BeeCon 2024 Program

Hosted by:

Centre for Bee Ecology, Evolution & Conservation

A Hybrid Event for 2024!

Virtual via Zoom Webinar: Thurs, Oct 17, 2024
In-person at York University or Virtual: Fri, Oct 18, 2024

www.yorku.ca/bees/beecon-2024

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BeeCon 2024 Program: Location, Schedule, Abstracts, and More

Welcome!

Welcome to #BeeCon 2024! BeeCon was originally the Southern Ontario Bee Researchers' Symposium, an event organized and hosted by York University researchers usually annually since 2011. The Centre for Bee Ecology, Evolution and Conservation at York University (BEEc) is now the host, and has helped grow BeeCon from a small, local symposium, aimed at sharing the recent findings of southern Ontario bee researchers, to an international one, connecting melittologists (bee biologists), industry professionals, and other researchers on a global scale!

In 2024, BeeCon returns to York University's campus as part of a two-day hybrid event. Thursday, October 17, 2024 will be a virtual-only event hosted on Zoom, while Friday, October 18, 2024 will be both virtual and in-person. We have over 40 presenters from 13 countries scheduled to participate, and we look forward to being able to network in-person over the breaks and the post-conference social!

We would like to give a big thank-you to our funders, the Faculty of Environmental and Urban Change and the Office of the VPRI, at York University. We would also like to thank the many volunteers who will help make the event run smoothly, from moderating sessions both virtually and in-person to handling the registration table and food for the in-person aspect of the event.

Are you on social media? We encourage you to share notable quotes, interesting findings, or general comments about the event with your followers, to help us achieve an even greater impact. Follow and tag us on Twitter @BeesYork or on Instagram @BeesAtYork. Use #BeeCon.

About BEEc

BEEc (pronounced bee-see) is an initiative that strives to advance research in the fields of bee ecology, evolution and conservation. The mission of BEEc is to foster interdisciplinary, innovative, collaborative, and cutting-edge research. This research is used for the advancement of knowledge and implementation of policy changes to help sustain pollinators globally. Ultimately, our goal is to apply our collaborative efforts to the development of policies and environmental management for the long-term sustainability of bees and the vital ecosystem services they provide.

Interested in joining us? There are numerous ways in which researchers, students and community members can be part of the work that we do. Visit https://www.yorku.ca/bees/about-us/membership/ for more information or to apply to become an Associate.

If you are not currently working or collaborating with someone in BEEc at York University, but want to stay informed on BEEc's research activities and events, you can also join our Global listserv. Send an email to LISTSERV@YORKU.CA with the following command in the body of the email:
SUBSCRIBE BEES YourFirstName YourLastName. Note you do not need a subject line and please do not include any other text in your message (e.g. signature line).

Check out our website at https://www.yorku.ca/bees/ for more information and resources, such as upcoming events, publications, and projects. Don't forget to follow our YouTube Channel at https://www.youtube.com/c/BeeEcologyEvolutionandConservation/, and engage with us on Twitter (aka X) @BeesYork or on Instagram @BeesAtYork.

Land acknowledgement

We recognize that many Indigenous nations have longstanding relationships with the territories upon which York University campuses are located that precede the establishment of York University. York University acknowledges its presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the Credit First Nation. This territory is subject of the Dish with One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.

This statement was written for the areas occupied by York University, in Toronto, Ontario. We encourage everyone to watch the following video that gives more background to this land acknowledgement, including a brief history of the traditional territory of the Indigenous Peoples who called this area home, the treaty involved, definitions and pronunciations, and suggestions on how to listen and reflect on what these teachings mean to you and how they can apply to your life and work. Associated article and video at https://yfile.news.yorku.ca/2019/01/14/new-video-explores-the-importance-of-understanding-the-land-acknowledgement/.

Not in Toronto? It is important for all of us, particularly those who are colonists/settlers, to understand our connections to the land we work and live on. To find out the Indigenous Peoples in your area of the world, visit www.native-land.ca.

Webinar Access Details – Thursday, October 17 and Friday, October 18

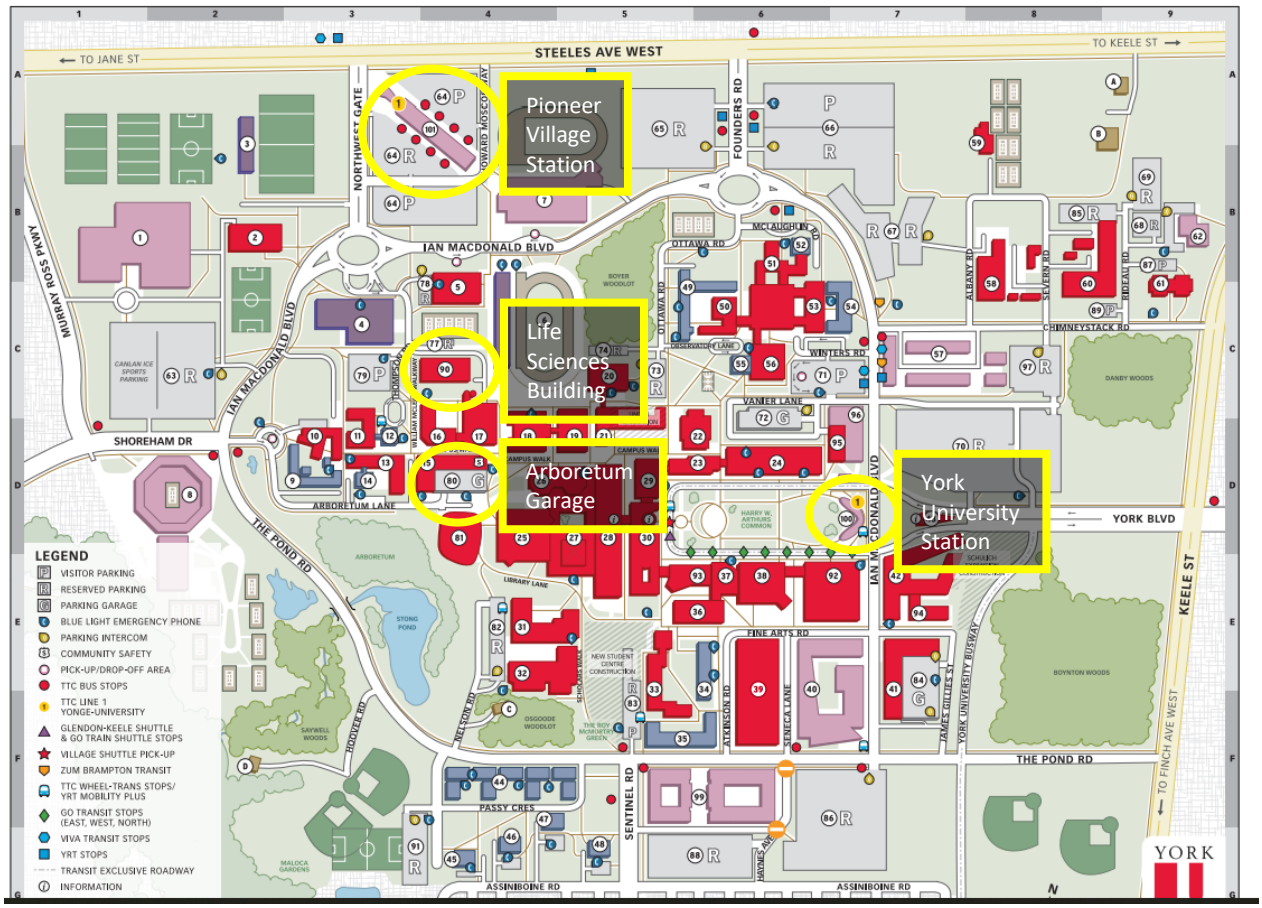
- Registered attendees should have already gotten the Zoom webinar link from beec@yorku.ca (will be sent October 11) It will also be sent out potentially at other times as well.
- By joining by Zoom as an attendee, you will NOT be able to turn on your video or microphone. However, you can use the Q&A function in Zoom to ask questions of the speakers.
- You can join by telephone to hear audio only, or by the Internet to see the presentation slides as well as the presenter. See the e-mail noted above for these connection details.

Directions to In-Person Venue at York University - Friday, October 13

- **Building & Room:** The in-person portion of BeeCon will be held in the Life Sciences Building at York University's Keele Campus (#90 on the map below). Specifically, the first-floor foyer and room 105 (LSB 105).
- **Public Transit directions** can be found online at https://maps.info.yorku.ca/transit-driving-directions/
    - For the majority of guests taking the Subway to York University Station (#100 on the map below) is the best option. TTC has two new subway stations at the Keele campus – York University (#100 on the map) and Pioneer Village Subway Stations (#101 on the map). All local TTC transit buses now service the Pioneer Village Station.
- **Driving directions** can be found at https://maps.info.yorku.ca/transit-driving-directions/ or use your favourite mapping app.
    - **Parking:** The Arboretum Parking Garage (#80 on the map below) would be the best lot to park in. From Pond Rd/Ian MacDonald Blvd, turn east onto Arboretum Lane. The parking garage will be on your left. Parking in this location is $2.50/half-hour ($20.00 max).
    - Note that you must pay using the app or in lot machine – there is no attendant on site.

- For other parking locations and information on campus visit http://www.yorku.ca/parking/ or see the interactive map linked below; prices vary.

- **Interactive Campus Map**
  - The online interactive map linked below can show you parking locations (including EV charging stations), building names/locations, and other campus locations. It also has a wayfinding option, where you can enter your start and end locations and it'll give you a walking route: https://map.concept3d.com/?id=1200#!ce/34557?s/?ct/29101,29093



BYOS! Bring your own Snacks on Friday

We will be providing a lunch for everyone who is registered for in person attendance on Friday, you will be able to enjoy lunch with your colleagues at the tables in the lobby of LSB or in the outdoor seating area. However, we will not be providing snacks during breaks this year, only coffee/tea at the beginning of the day.

BYOB! - Bring Your Own Bottle for Water and Coffee

- Please bring your own water bottle/coffee mug to help reduce waste.
- We will not be providing bottled water but there are water bottle refill stations in the building near the conference room.
- Paper cups will be provided for coffee but why not show off your favourite insect mug!

COVID Precautions

- York University has paused its vaccination, screening, and masking requirement BUT you are welcome to wear a mask personally if you desire. Food can be eaten outside if the weather permits.
- There are hand sanitizing stations and washrooms inside the building.
- If you are feeling unwell, please do not come to campus, and instead join us virtually.
- Visit https://www.yorku.ca/bettertogether/ for more information on COVID-19 at York University.

Free Wi-Fi Access on Campus

- There are three options for accessing wi-fi on campus, depending on your status: see https://www.yorku.ca/uit/faculty-staff-services/internet-access/wireless-access/
    - *YorkU Students/Staff/Faculty* – select the AirYorkPlus wireless network and login with your Passport York credentials
    - *Eduroam participating institutions* (e.g. Universities of Guelph, Toronto, Western, many others – see https://www.canarie.ca/identity/eduroam/): select the Eduoroam wireless network and log in with the credentials provided by your institution
    - *Anyone:* select the AirYorkGuest wireless network, complete the free registration form on the splash page, receive and confirm the verification message by e-mail, and then proceed with using the internet: https://www.yorku.ca/uit/faculty-staff-services/internet-access/wireless-access/airyork-guest/

Questions? Concerns? Feedback? Ideas for Future Events?

If you have any questions, concerns, feedback, or ideas for future BEEc events, please contact Laura at beec@yorku.ca. We hope that you'll enjoy BeeCon 2024 and join us again in the future.

Keep reading for the schedule and abstracts.

Schedule With Abstracts:

Day 1 – Thursday, October 17, 2023 (Virtual Presentations and Attendance Only)

Day 1 -#1: 8:30 AM. Introducing BEEc and BeeCon - Day 1
Laura Newburn (she/her), Coordinator, BEEc, Ontario, Canada
Twitter: @BeesYork Instagram: @BeesAtYork

Abstract: Welcome to day one of BeeCon 2024. I'll give a brief background to the Centre for Bee Ecology, Evolution and Ecology (BEEc) and the BeeCon conferences, thank our sponsors, and go over logistics for the day.

Day 1 - #2: 8:45 AM. Using bee hotels to assess fitness impacts of the European honey bee Apis mellifera on cavity nesting native bees.
Kit Prendergast (she/her), Postdoctoral fellow, Curtin University, School of Molecular & Life Sciences, and University of Southern Queensland, Centre for Sustainable Agricultural Systems, Western Australia, Australia.
Twitter: @BeeBabette Instagram: @bee.babette_performer
Co-Authors: Mark Murphy, Peter G. Kevan, Zong-Xin Ren, Lynne A. Milne.

Abstract: European honey bees *Apis mellifera* are an introduced species and may harm native bee fauna through competing with them for food resources. Field studies have revealed negative associations between honey bee and native bee abundance, but whether this translates to fitness costs for native bees is unclear. Here, using trap-nests, we evaluate whether honey bee abundance is associated with fitness parameters (number of nests, provisioned cells per nest, number of offspring, mortality rate, sex ratio, and body size) of cavity-nesting native bees over two years. We also conduct palynological analyses to measure pollen resource overlap and evaluate whether this impacts native bee fitness. Greater honey bee abundance was associated with a male-biased sex ratio in the native bee progeny across years, and increased mortality rate of native bee progeny in the first year. Most non-significant associations were also in the directions predicted from honey bees adversely impacting native bee fitness. In the first year, greater pollen morphospecies overlap was associated with fewer provisioned cells. In conclusion, we demonstrate that honey bees have the potential to have harmful consequences for native bee fitness.

Day 1 - #4: 9:15 AM. Monitoring phenological changes via the plant-pollinator interface.
Sydney Wizenberg (she/her), Post-Doctoral Fellow, Evolutionary Ecology, Naturalis Biodiversity Center, South Holland, The Netherlands.
Co-Authors: Sydney B. Wizenberg, Mateus Pepinelli, Bao Ngoc Do, Mashaba Moubony, Darya Tamashekan, Ida M. Conflitti, Barbara Gravendeel, Amro Zayed.

Abstract: Phenological reshuffling, changes to community-level patterns of developmental timing, is one of the largest expected impacts climate change will have on plant communities. Phenological timing is a strong determinant of the temporal aspect of plant-pollinator interactions, and thus reshuffling presents a potent evo-eco threat as it runs the risk of destabilizing crucially important pollination networks. Documenting these shifts and their impact on plant-pollinator interactions has been difficult in the past, requiring the development of new techniques to modernize this field. Here, we present a validated

approach for inferring the flowering phenology of plant communities through multi-locus metabarcoding of bee-collected pollen. Pollen collected by bees can accurately indicate the on-set of flowering in a wide variety of plant species, providing a new avenue for mapping phenological changes via the plant-pollinator interface.

Day 1 - #5: 9:30 AM. Foraging preferences, immune function, and ecological communities : The Factors Affecting the Spread of Viruses in Bee Communities in Central Israel.

Avi Eliyahu (He, Him), PhD researcher, Department of Entomology, Institute for Environmental Studies in the Robert H. Smith Faculty of Food Agriculture and Environment - The Hebrew University of Jerusalem, Israel, Israel.
Co-Authors: Sean T. Bresnahan, Christina Grozinger, Aviv Dombrovsky, Yael Mandelik, Asaf Sadeh.

Abstract: Viruses pose a threat to bees and other pollinators worldwide. Bee viruses are known to be transmitted between taxa in co-foraged flowers, but the interaction with other epidemiological factors remains unclear. To determine if sympatric bees' foraging patterns affect their virome and the viral sharing between them, we characterized the virome of honey bees (*Apis mellifera*) and three wild bee genera from central Israel—Eucera, Andrena, and Hylaeus. Virus sharing was found only between the honey bees and Eucera bees. Visitation network analysis demonstrated that the highest resource sharing was between these two genera. This result, together with a phylogenetic analysis of the viral sequences obtained from the infected bees, provides strong support for the idea that bees co-foraging on the same plant species are more likely to share viruses. However, we found a virus which is typical to crucifers shared across all taxa regardless of their visitation rate on cruciferous flower. Additionally, we hypothesized that the different genera's anti-viral immune defenses also influence their likelihood of acquiring or transmitting viruses. To evaluate this, we sequenced the collected bees' virus-targeting siRNA and found significant differences in siRNA profiles among these bees, suggesting significant differences in immune function.

Day 1 - #6: 9:45 AM. Assessing Climate Change Impacts on Pollinators and Forage Plants in Mediterranean shrublands.

Arielle Lofchick (she/her), PhD student, Department of Entomology, The Hebrew University of Jerusalem, Rehovot, Israel.
Co-Authors: Marcelo Sternbergl, Yael Mandelik.

Abstract: Climate change is a major threat to biodiversity and ecosystem services, especially in Mediterranean regions, where its impacts are anticipated to be severe. This study focuses on the effects of climate change, specifically reduced overall amount and altered rainfall patterns, on pollinator communities and their forage plants in a Mediterranean ecosystem, in central Israel. Using a unique setup of rainout shelters we mimic conditions of severe drought (66% reduction in water availability) combined with low vs high rainfall frequency (3 vs 9 events, respectively), as well as natural frequency. In a preliminary survey, we monitored the effects of these rainfall manipulations on flowering amount and phenology, and on nectar production, in key forage plants, as well as the foraging preferences of wild pollinators. We found significant effects of the different treatments on flowering plants and their insect visitors, mostly decreasing abundances and altering phenology. These initial results support a further study to explore the possible effects of altered rainfall regimes in Mediterranean ecosystems.

Day 1 - #7: 10:00 AM. Break.
We will take a short break and return at 10:30am.

Day 1 - #8: 10:30 AM. New pollen substitutes for honey bees (Apis mellifera) with edible insect flour.
Ratko Pavlovic, PhD Student, Faculty of Chemistry, Department of Biochemistry, University of Belgrade, Belgrade, Serbia.
Co-Authors: Ratko Pavlovic, Biljana Dojnov, Marinela Sokarda Slavic, Marina Ristovic, Nenad M. Zaric, Ljubisa Stanisavljevic, Zoran Vujcic.

Abstract: True substitutes for pollen have not yet been developed, although various dietary combinations have been explored. We attempted a novel approach by exploiting honey bees' natural cannibalistic behavior to address nutritional deficiencies. In controlled cage experiments, we monitored bee mortality, food consumption, and changes in body weights, finding that flour derived from dried yellow mealworm larvae holds great potential as a pollen substitute. Bees fed with the new mealworm patties showed the best overall results compared to those fed sugar, yeast or pollen patties. Moreover, insect-based nutrition could be particularly advantageous when processed capped drone brood flour is used instead of yellow mealworm flour. This substitution not only enhances the nutritional quality of the bees' diet but also aids in controlling Varroa (*V. destructor*) mites, offering a dual benefit. The affordability of this method is notable, as beekeepers can easily find the necessary equipment for processing drone brood into flour within most households. This innovative approach shows considerable promise for developing a cost-effective and sustainable alternative to traditional pollen substitutes in apiculture, thereby contributing to the long-term resilience of beekeeping practices in the face of ongoing environmental challenges.

Day 1 - #9: 10:45 AM. The effect of flower shape and constancy on pollen foraging efficiency.
Natacha Rossi (she/her), Research Fellow, University of Sussex, Sussex, UK.
Twitter: @rossi_natacha
Co-Authors: Becca Gorham, Lucy Unwin, Beth Nicholls.

Abstract: By 2050, we must feed 9.3 billion people, but 76% of crops could face production loss due to pollinator limitations, according to the FAO. Understanding the factors that influence bees' foraging decisions is crucial to enhancing crop pollination. Bees exhibit "flower constancy," focusing on one plant species even when other options are available. This benefits plants by ensuring species-specific pollen transfer and may increase bees' foraging efficiency by improving search images or reducing handling costs. While nectar foraging constancy is influenced by nectar volume, concentration and flow rate, it is unclear if the same applies to pollen foraging, which has significant implications for plant-pollinator networks. We investigated whether flower shape and constancy affect pollen foraging efficiency in bumblebees, using flower orientation as a proxy for shape to manipulate foraging costs. Our findings show that flower-naïve bees have no orientation preference, constant bees collect more pollen but are less time-efficient than bees that were forced to switch flower orientation between foraging bouts, and bees do not change preferences based on training. These results suggest bumblebees have high learning flexibility, possibly due to their polylectic diet. Future research will explore similar capacities in oligolectic bees, which may rely more on innate preferences.

Day 1 - #10: 11:00 AM. Standardizing sampling for large-scale bee monitoring programs.

André Krahner (he/him), Research Fellow, Julius Kühn Institute (JKI) - Federal Research Centre for Cultivated Plants, Institute for Bee Protection, Lower Saxony, Germany.
Co-Authors: Anke C. Dietzsch, Felix Klaus, Tobias Jütte, Jeroen Everaars, Severin Polreich, Oleg Lewkowski, Wiebke Kämper, Jens Pistorius.

Abstract: Pan traps allow simultaneous bee sampling of many sites, and several methodological studies and conceptual frameworks offer guidance on its standardization. So far, it is unclear if bee studies apply these standards consistently so that results among studies are comparable.
We systematically searched for peer-reviewed studies which used pan trapping for bee collection. We extracted details on trap characteristics and on the methodology used to sample flower abundance and diversity around traps. Moreover, we experimentally investigated the effects of key pan trapping methodology aspects (trap size, exposure time, and floral context) on sampled bee communities.
Our systematic review revealed that methodologies varied considerably among studies for some aspects (e.g., sampling duration). Few studies used floral abundance and/or diversity as an explanatory variable in their analyses. Using larger pan traps for sampling bees increases trap efficacy (absolute numbers of sampled individuals and species) and efficiency (sampled species per sampled individuals), but larger traps also capture more bycatch biomass than smaller traps. The gain in additional bee OTUs appears to level off after 48h of exposure. Flower cover, interacting with bee taxon, affected detection probability per trap as well as the number of sampled bee individuals per trap.

Day 1 - #11: 11:15 AM. An Insightful View: In-Hive Flatbed Scanners for Non-invasive Long- Term Behavior and Disease Monitoring of Honey Bee Hive Combs.

Parzival Borlinghaus (he/him), PhD Student, Karlsruhe Institute of Technology, Baden-Württemberg, Germany.
Co-Authors: Jörg Marvin Gülzow, Richard Odemer.

Abstract: Honey bee colonies face significant threats from pathogens and pests, including chalkbrood disease caused by *Ascosphaera apis* and *Varroa destructor* mites. Traditional monitoring methods for these issues are often invasive and disruptive, hindering continuous and detailed observations. This study introduces a novel, non-invasive monitoring technique using a modified flatbed scanner integrated into a honey bee brood frame. The scanner, housed within a Dadant frame and connected to a Raspberry Pi, captures high-resolution images of the brood cells at regular intervals. This approach facilitates real-time observation of the brood lifecycle, including egg laying, larval development, and the presence of pathogens and mites.
Over a three-month pilot study, the scanner successfully monitored 419 cells, capturing 2819 images of each cell and documenting critical events such as Varroa infestations and chalkbrood development. The method demonstrated high-resolution imaging capabilities, enabling detailed analysis of pathogen dynamics and hygienic behaviors like Varroa-sensitive hygiene (VSH) without disturbing the colony.

Day 1 - #12: 11:30 AM. New taxonomic insights into long-legged oil bees: Exploring the Great Escarpment of South Africa.

Annalie Melin (she/her), Postdoctoral fellow, Compton Herbarium, South African National Biodiversity Institute, South Africa and African Centre for Coastal Palaeoscience, Nelson Mandela University, South Africa., Western Cape, South Africa.
Instagram: @annaliemelin
Co-Authors: John C. Manning, Jonathan F. Colville.

Abstract: *Rediviva neliana Cockerell 1931* has been widely distributed along the Great Escarpment of South Africa and Lesotho, exhibiting high variation in foreleg length across populations. The allometric relationship between foreleg length and body size for the oil-collecting species of Rediviva revealed that *R. neliana* is a distinct 'outlier', suggesting that it may represent a group of species. This hypothesis prompts a comprehensive review of the taxonomy of *R. neliana*. We examined historical (n = 1228) and recently collected specimens from 23 different sites across the Great Escarpment, including the resurveying of type localities. This study presents morphological evidence, particularly the shape of the galea and male genitalia, supporting the description of a new species, along with revisions, and re-descriptions of three species. We conclude that the *R. neliana* group comprises four species. Resolving the taxonomy for this specialized and biologically unique group of bees has broad significance for both pollination studies and uncovering their hidden diversity.

Day 1 - #13: 11:45 AM. BEEtopia a Center for the Conservation of Bees through Research and Education in Tanzania.

Kathrin Krausa (she/her), Visiting Scientist, Aga Khan University, Beegreen Ltd., Aruhsa, Tanzania.
Instagram: @beetopia_tz
Co-Authors: Warren Steyn, Beegreen Ltd.

Abstract: Karibu and warmly welcome to Tanzania's first center for the conservation of bees. At BEEtopia, we are dedicated to tackling the conservation of bees through research and education, primarily focusing on non-Apis bees. Tanzania is home to hundreds of different bee species, all providing essential services to ecosystems and humanity. Most of them are neglected and underrepresented in research – amongst them stingless bees.
Bringing together diverse stakeholders, BEEtopia's mission is fourfold:
1) Sustainable Stingless Beekeeping: We offer training to local communities in sustainable stingless beekeeping practices and pollinator friendly farming
(2) Educational Outreach: Schools are invited to use BEEtopia as an outdoor classroom, enriching their students' learning experiences.
(3) Scientific Collaboration: We welcome scientists from near and far to contribute to expand our knowledge of bees and their ecology.
(4) Melitourism: Bee enthusiasts can gain deeper insights and firsthand information from our visiting scientists through our Melitourism program.
Our goal is to be the conduit connecting researchers, beekeepers, and bee-lovers. In our presentation, we will introduce BEEtopia as the ideal place to research bees and other pollinators in Tanzania. We offer excellent infrastructure, local research assistance, and a network of farmers and beekeepers, along with guidance through bureaucratic processes.

Day 1 - #14: 12:00 PM. Lunch
We'll take a break for lunch and return at 1:00 PM.

Day 1 - #15: 1:00 PM. Gustatory sensitivity to amino acids in bumblebees.

Sergio Rossoni (He/him), Postdoctoral research fellow, University of Sussex, England, United Kingdom.
Twitter: @rossoni_sergio
Co-Authors: Jeremy E Niven, Elizabeth Nicholls.

Abstract: Pollinators can gather two types of food rewards from flowering plants: nectar, a sugar-rich solution, and pollen, tiny grains rich in protein and fat. Bees and other insects have taste organs on their mouthparts and antennae, which they use while visiting flowers to gather information about the nutritional contents of the food they are collecting. While it is known that bees can use the sugar concentration of nectar to inform foraging decisions, the role of taste in assessing pollen rewards is poorly understood.
To tackle this question, we recorded the extracellular activity of the four taste receptors within individual gustatory sensillae on the mouthparts of the buff-tailed bumblebee, *Bombus terrestris*. Each sensilla was exposed to aqueous solutions with increasing concentrations of either sucrose or one of four of amino acids (two essential, lysine and valine, and two non-essential, asparagine and glutamate). We quantified the concentration-dependent responses for the different substances tested and compared the responses between sucrose and amino acids, and between the different amino acids themselves. These experiments revealed that bumblebees have concentration-dependent responses to some of these amino acids and that their amino acid sensitivity is comparable to their response to sucrose.
These results provide important insights into the complexities of how bumblebees' gustatory sensillae respond to different tastants, with implications for the foraging tactics of bees. Our experiments show that bees are indeed capable of assessing the nutrients contained in both nectar and pollen, meaning they can, in principle, use taste to meet food demands when foraging. This can in turn help us understand how they select which flowers to forage from and which ones to ignore, a seemingly small choice which can however determine the reproductive success of both pollinators and flowering plants, including many important food crops.

Day 1 - #16: 1:15 PM. Enhancing the reliable and effective long-term monitoring of bee diversity in agricultural landscapes through DNA-metabarcoding.

Oleg Lewkowski (he/him), Research Fellow, Julius Kühn Institute (JKI) - Federal Research Centre for Cultivated Plants, Institute for Bee Protection, Lower Saxony, Germany.
Co-Authors: Severin Polreich, André Krahner, Wiebke Kämper, Jens Pistorius.

Abstract: A long-term monitoring of biodiversity within agricultural landscapes, the collaborative initiative MonVIA was launched in 2019. Within this framework, we recorded bee diversity at 54 determined monitoring spots in northeastern Germany, spread across 5 federal states. For data collection we used a standardized pan-trap approach (April-May 2023, 154 pan traps sets). We submitted samples to DNA-metabarcoding for taxonomic analysis. DNA-sequences were clustered by OTUs and aligned with three open access databases. Matches were validated through a consensus analysis and established species identification procedures.
The BLAST search generated 1288 matches from 6956 Apiformes in total. The consensus resulted in 88 taxon matches at family, 82 at genera and 48 at species level. The presented approach shows some uncertainties, as a large number of OTUs cannot be linked to particular species. We explored the accuracy of species and genus identification by matching identification rates of previously determined *Apis mellifera* and Bombus counts. Our preliminary results indicate that the metabarcoding approach may provide a valid reference for bee diversity monitoring under changing agro-ecological conditions.
The presented study was financed by Julius Kühn Institute funds being part of ‘Farmland biodiversity Monitoring’ (MonVIA), which is funded by the German Federal Ministry of Food and Agriculture.

Day 1 - #17: 1:30 PM. Tracing and Scaling the Value of Native Pollination for a More Feasible Future.
Nicolas Picat Saridaki, Researcher, Professor, Ministère de l'Éducation Nationale Française; President, Global Portal Institute, Ministère de l'Éducation Nationale Française; Global Portal Institute, São Paulo; Athens, Brazil; Greece.
Co-Authors: Lucy Xu, The Port Global.

Abstract: 20 years of fieldwork with communities and governments across the Amazon Basin and the most remote regions on the planet highlight a recurring theme: the urgent need to scale environmental benefits and facilitate critical knowledge transfer to combat global threats to our biomes.
New integral biological corridor models are emerging, enabled by stingless bee pollination, the most federative element in the planet's biodiversity-rich regions encompassing climate goals, conservation and recovery, and making tangible the possibility of investing in alternative livelihoods.
A network of interconnected hives — spanning 6 continents, 30 countries, 12 remote autochthonous communities, 319,000 pupils, and 1.1 million pollinators — is being installed across the planet's tropical belt to safeguard and regenerate ecosystems.
This "Nest-Work" between people and pollinators, public and private institutions, researchers, communities, students, and native ambassadors introduces dynamic environmental exchange data and co-develops equitable, impactful biodiversity measures through pollination supply and remediation.
The intensive efforts and collaborative initiatives – integrating native pollination frameworks into daily lifestyles/conducts and the greater economy – generate more wealth for the spaces to be emergently preserved, and reveal how the native bee is distinctively making ecology economically sustainable through co-adapted a scientific and social infrastructure reinforcing our wiser resource transformation.

Day 1 - #18: 1:45 PM. Medicinal plants for bees.
Bandele Sharma Morrison, York University, Ontario, Canada.
Co-Authors: Gordon Fitch, Laura R. Newburn.

Abstract: Plant-pollinator interactions have intrigued scientists for over 200 years. Bees use plants products for their nutrition and in the case of honeybees, for propolis production. Furthermore, plant products contain phytochemicals that affect pollinator behaviour and health. Unfortunately, disease and pathogen spill-over are increasingly understood to be major contributors to bee decline. Therefore, developing strategies to mitigate the effects of disease may help reverse the decline in both managed and wild bee populations. This presentation discusses the phytochemicals and plants with demonstrated and potential health benefits for bumblebees and honeybees. In particular, it proposes plants whose pollen, nectar or resin directly provide health benefits or contain phytochemicals with demonstrated benefits. The specific health benefits of the featured plants and phytochemicals are given, i.e. longevity, immune function, defense against disease agents and detoxification of pesticides. These four classes of health were chosen due to their effects on individual and colony level success. Overall, the phytochemical content and direct effects of products from Asteraceae plants appear to be the most beneficial for bees, especially in terms of their anti-parasitic effects against Crithidia. As most of the plants proposed in this review were featured due to the phytochemical content, we recommend additional research in qualifying and quantifying plant product phytochemicals; investigating the effects of products from plants with potential medicinal benefits on bee disease and pesticide exposure; and exploring self-medication behaviour in bees.

Day 1 - #19: 2:00 PM. Ecological and evolutionarily consequences of buzz pollination.

Avery Russell (he/him), Assistant Professor, Missouri State University, Missouri, USA.
Twitter: @draverbee

Abstract: Buzz pollination, a type of interaction between bees that can vibrate flowers to collect pollen and flowers that conceal pollen within tube-like (poricidal) morphology, involves more than half of all bee species and 10 percent of all angiosperm species. In fact, the evolution and diversification of buzzing bees and buzz pollinated plant species is thought to be strongly affected by this ancient interaction. Yet despite 120 years of research on buzz pollination, much work remains to understand the broad ecological and evolutionary consequences. We discuss our work on the evolution of buzzing behavior and drivers of the global distribution of buzzing bee taxa, and the evolution and distributional patterns of buzz pollinated flowers. Overall, we find that buzzing has been lost and gained repeatedly and may be a key driver of bee diversification. Drivers of buzzing bee biogeography also differ from those of non-buzzing taxa and are closely associated with poricidal plant biogeography. We also find that buzz pollination occurs across 87 plant families and more than 635 genera, with on average 200 independent gains and 150 independent losses, but is generally not associated with increased plant diversification. Finally, we present alternative hypotheses for the functional significance of poricidal flowers.

Day 1 - #20: 2:15 PM. Pollination biology of the federally threatened Texas endemic *Hibiscus dasycalyx* (Malvaceae).

John Pascarella (he/him), Professor, Department of Biological Sciences, Sam Houston State University, Texas, United States.
Co-Authors: Haley Posey, Gabrielle Almaraz.

Abstract: The reproductive biology of the federally threatened Texas endemic *Hibiscus dasycalyx* was studied at one of three remaining natural populations in Houston County, Texas and at an experimental population in Walker County, Texas. Breeding systems were characterized at the experimental population through self-pollination, cross-pollination, bagged, and open-pollinated treatments. Floral phenology and pollinator observations were made at both the natural and experimental populations. Breeding system experiments found that the plant is not autogamous but is self-compatible. Selfed and Crossed flowers had similar seed set and seed weight but differed in fruit set. No bagged flowers set fruit while open pollinated flowers at the experimental site lacked pollinators and had low fruit set. Flowering phenology at both sites found the greatest flowering in June with the natural site extending into July and very limited flowering in August. The principal flower visitor at the natural site was the Apid bee *Ptilothrix bombiformis*, which comprised over 90% of all visits. Additional flower visitors included *Bombus pennsylvanicus*, *Xylocopa micans*, *Apis mellifera*, and *Melissodes bimaculata* along with several *Lepidoptera* and various beetles. While an abundant and highly effective pollinator, *Ptilothrix bombiformis* also visits other native Hibiscus (*H. moscheutos and H. laevis*), with potential hybridization.

Day 1 - #21: 2:30 PM. Foraging Behavior of Bees on Centipedegrass Spikelets.

Daniel Ibiyemi (He/Him), Ph.D. Candidate (Graduate Research Assistant), Entomology Dept. University of Georgia, Griffin., Georgia, United States of America.
Co-Authors: Karen Harris-Shultz, David Jespersen, Shimat Joseph.

Abstract: Centipedegrass spikelets can provide additional important pollen resources for bees during the late summer and fall when pollen resources decline in the landscapes. Although bees forage on centipedegrass spikelets, how various types of bees; bumblebees, honeybees, and sweat bees interact

with spikelets is poorly understood. Thus, the aim of this study was to analyze how bees interact with spikelets through videos of bumblebees, honeybees, and sweat bees, foraging on centipedegrass spikelets. Data show that bumblebees and honeybees attach to centipedegrass anthers and traversing the inflorescence to gather pollen efficiently. Bumblebees and honeybees spent relatively less time on pollen collection compared to sweat bees. Sweat bees were often seen dangling upside down from anthers, using their middle legs to dislodge pollen onto the underside of their abdomen after vigorous movements. The study reveals foraging behaviors among bee groups on centipedegrass spikelets.

Day 1 - #22: 2:45 PM. Break
We will take a break and return at 3:15 PM.

Day 1 - #23: 3:15 PM. Automating bumble bee tracking to study sublethal impacts of pesticides on behavior.
Anupreksha Jain (She/her), PhD student, UW-Madison, Wisconsin, USA.
Co-Authors: James Crall.

Abstract: Intensive use of insecticides in conventional agriculture has been shown to adversely affect non-target organisms at even trace but field-relavant concentrations. However, there are significant knowledge gaps in our understanding of simultaneous effects on different types of behaviors in a realistic plant community context. Here we used a combination of low-cost high-throughput computer vision and machine learning powered tools and individual tag tracking to investigate the sublethal effects of imidacloprid, a neonicotinoid, and flupyradifurone, a novel butanolide insecticide, on *Bombus impatiens* nesting, foraging activity, and flower visitation in a semi-field environment. Microcolonies of 20 individually-tagged workers, provided insecticide exposure through their nectar reservoir, were released one at a time in a hoophouse containing a randomized array of 45 potted plants, 15 each of cucumber, borage, and zinnia. We monitored nesting behavior using an overhead camera set up to record 10-second videos every 5 minutes, foraging activity using a motion-triggered camera at nest entrance, and flower visitation using a camera trap system running an insect detection model in real time, all operated by Raspberry Pi microcomputers. Tag tracking was run post-hoc on recorded images and videos. This protocol can be powerful and effective for comprehensively studying multi-modal effects of various stressors on bumble bee behavior.

Day 1 - #24: 3:30 PM. Habitat Assessments for Bumble Bees in Minnesota Restored and Remnant Prairie.
Julia Leone (she/her), Pollinator Biologist, Friends of the Mississippi River, Minnesota, USA.
Instagram: @friendsmissriv
Co-Authors: Alex Roth.

Abstract: Organizations spend millions of dollars on land protection and habitat restoration each year, with a common goal of providing habitat for pollinators. At the same time, native pollinators are still experiencing population declines. Currently, not enough is known about specific prairie restoration techniques or plant diversity levels needed to provide suitable habitat and encourage the greatest diversity of bumble bees. Moreover, it is unclear whether restorations differ from remnant prairie communities in their ability to provide habitat for these species. We used the Xerces Society's habitat assessment tool to compare sites seeded with different techniques and seed mix diversity levels and

also compared remnants versus restorations in terms of their potential to provide bumble bee habitat. We also conducted non-lethal meander surveys to record bumble bee diversity and abundance throughout the growing season to document how realized diversity and abundance at these sites compared to their assessment scores. We present preliminary results from the first of two planned field seasons. Results will provide land managers with information about seeding techniques, seed mix composition, and seed mix diversity levels that can lead to the best results for bumble bees. Results will also inform prioritization for protection and conservation.

Day 1 - #25: 3:45 PM. Leveraging community science for large-scale monitoring of insect pollinators: insights from Abeilles citoyennes.
Frédéric McCune (He/him), Research associate, Université Laval, Quebec, Canada.
Co-Authors: Anne Leboeuf, Amélie Gervais, Sabrina Rondeau, Valérie Fournier.

Abstract: Pinpointing at-risk pollinator communities remains challenging due to the significant time, cost, and expertise needed for the collection and identification of wild insect pollinators, notably bees. These challenges are especially significant over multiple years and across extensive geographic areas. The Abeilles citoyennes (abeillescitoyennes.ca) project, a pollinator monitoring initiative, was launched in Quebec in 2019 to monitor the diversity of wild bees and hover flies within Quebec over time. Specifically, volunteers are provided with a kit containing materials for sampling pollinators, as well as preserving the samples and sending them to the lab. The sorting, processing, and identification of pollinators are carried out by the university team. From 2019 to 2021, 131 volunteers collected insects at 161 sites across the province. A total of 13,558 bees and 2,486 hover flies were collected and identified to species. In 2023, we received samples from 61 volunteers and 112 sites, while we have 105 volunteers and 139 sites registered for 2024. In this presentation, we use it as a case study leveraging the complementarity of community science and taxonomist expertise for large-scale monitoring of insect pollinators. We will discuss the benefits and challenges of the Abeilles citoyennes approach and opportunities for improvement.

Day 1 - #26: 4:00 PM. Exploring Mexico's Stingless Bees: A Photographer's Perspective.
Craig Symonds, Photographer, Craig Symonds Photography, Ontario, Canada.
Instagram: @symstrider

Abstract: Venturing to the south Pacific coast of Mexico my goal was to locate and document the stingless bees native to Oaxaca state. This presentation will explore my journey, the insights I gained, and the critical role these bees could possibly play in addressing future climate issues, such the looming threat of water scarcity. Through my lens as a photographer, I aim to highlight the beauty and ecological significance of these seemingly overlooked bees.

Day 1 - #27: 4:15 PM. *Andrena nimigracilis*, a New Species (Hymenoptera: Andrenidae) from México.
Wyatt Zabinski, PhD Student, University of Kansas, Kansas, United States.

Abstract: *Andrena nimigracilis*, new species is described from a single male specimen from the state of Michoacán in México. It can be distinguished from males of all other species of North American Andrena by the following combination of characters: metasoma extremely narrow, humeral angle extremely weak, propodeum declivitous, genal area small, compound eye wide compared to its length, pretarsal claws with tooth, vertex 1.5 or slightly less than one lateral ocellar diameter, and wings hyaline. Due to

this unique morphology, this species currently cannot be placed into any Andrena subgenus, therefore placed as subgenus incertae sedis. Nothing is known about the biology of this species and it is hoped that more specimens and the female of this species will be discovered in the future.

Day 1 - #29: 4:45 PM. Rise and fall of bumble bees in Alberta.
Robin Owen (he/him), Professor, Dept. of Biology, Mount Royal University, Alberta, Canada.
Twitter: Instagram:
Co-Authors: None.

Abstract: Bombus cryptarum occurs in the northern and western regions of North America and reaches its southern limit in Alberta. In 1915, the southernmost record was Banff; by 1987, it had appeared in Kananaskis Country, 40 km southeast of Banff, and by 2010, it had become established in Calgary, where it had never been previously recorded. During the same time period, another two sympatric species, B. occidentalis and B. terricola have been in decline. Here I will: (1) summarize the taxonomic history of the three species, (2) give an update on their current distribution and abundance, and (3) speculate on the causes of the changes in their distribution and abundance over the last 35 years. The exact causes of this concurrent rise and fall of these species is unclear, the degree of parasitism (e.g. Nosema), levels of fluctuating asymmetry, etc. do not differ among the species. Moreover, all species are closely related, being in the same subgenus, Bombus sensu stricto. Here I speculate that we are seeing the process described by Darwin (1859) in On the Origin, that some lineages are more successful in replacing others simply due to their intrinsic features, making them more competitive.

Day 1 - #30: 4:45 PM. Day 1 - #30: 5:00 PM. Concluding Remarks.
Laura Newburn (she/her), Coordinator, BEEc, Ontario, Canada
Twitter: @BeesYork Instagram: @BeesAtYork

Abstract: Thanks for attending day one of BeeCon 2024. Reminders will be and sponsors and organizers thanked.

Day 2 – Friday, October 18, 2024 (In-Person Presentations, In-Person or Virtual Attendance)

Day 2 - #31: 8:30 AM. Introducing BEEc and BeeCon - Day 2
Laura Newburn (she/her), Coordinator, BEEc, Ontario, Canada
Twitter: @BeesYork Instagram: @BeesAtYork

Abstract: Welcome to day two of BeeCon 2024. I'll give a brief background to the Centre for Bee Ecology, Evolution and Ecology (BEEc) and the BeeCon conferences, thank our sponsors, and go over logistics for the day.

Day 2 - #32: 8:45 AM. Effects of air pollutants on honey bee cognition, behavior, and gene expression..
Mariana Rodriguez Lopez (She/her), PhD student, York University, Faculty of Science, Ontario, Canada.
Twitter: @MarianaRaccoon
Co-Authors: Judy Saka-Amini, Amro Zayed.

Abstract: Cities around the world are growing at an accelerated rate and so is the interest in urban beekeeping and projects that allow the inclusion of native bees in these urban spaces. However, adaptation to an urban environment presents several challenges such as being exposed to pollution. Air pollutants are known to be a major health and life quality problem for humans, but little is known about how they might be affecting bees.
Therefore, this project aims to use honeybees (*Apis mellifera*) as a model to characterize the impact of ozone, a common but harmful air pollutant in cities, on honeybees from a molecular to a behavioral perspective, giving us insight into urban bee conservation projects.
To achieve this, I will expose honeybees to different concentrations of ozone and different exposure times. Afterward, I will assess cognitive effects on learning and memory with gene expression changes via RNA sequencing, flight-foraging abilities using radio frequency identification (RFID) tracking, and foraging preference changes through pollen metabarcoding. This study will characterize effects on nurse bees and later on whole colonies.

Day 2 - #33: 9:00 AM. Diversity and pesticide exposures of pollen collected from honeybees and small carpenter bees from different agricultural landscapes.
Hongmei Li-Byarlay (she/her), Associate Professor, Central State University, Ohio, United States.
Twitter: @insect_sciences Instagram: @hmlibee
Co-Authors: Zhaorigetu Hubhachen, Sandra Rehan, Reed Johnson.

Abstract: Bees are critical for crop pollination. Pesticide exposure to pollen collected by bees has been a great concern for researchers in recent years. However, there is limited information on pesticide exposure to pollen in different agricultural landscapes such as conventional and organic farms. Therefore, we analyzed pesticide residues in pollen collected by Apis mellifera and Ceratina calcarata from organic farms, conventional farms, and roadside sites as a control landscape in Ohio during the growing season between 2021 and 2023. We identified 36 different pollens from 27 samples collected by A. mellifera whereas 35 different pollens from 22 samples collected by C. calcarata from three different landscapes in 2021. Furthermore, we identified 16 pesticide residues in the pollen from conventional farms and 14 pesticides residues in the pollen from organic farms. Nine different pesticide residues were identified in the pollen from both farms. Our preliminary data show that it might be one of the main factors affecting bee health.

Day 2 - #34: 9:15 AM. Unveiling critical habitat: behavioural insights into overwintering and nesting requirements of bumble bees using radio telemetry.
Amanda Liczner (she/her), Postdoctoral Research Fellow, University of Guelph, Ontario, Canada.
Instagram: @bumblebeehaviour
Co-Authors: Elizabeth L. Franklin, Nigel E. Raine..

Abstract: Bumble bees (*Bombus spp.*) face severe threats from habitat loss, pathogen spillover, climate change, and pesticides, making their conservation a priority. However, current understanding about what represents high-quality bumble bee habitat remains limited, especially concerning their overwintering and nesting requirements. Given the challenges of observing bumble bees, particularly underground overwintering queens, our research aimed to identify these crucial habitat needs. Employing a 43-tower autonomous radio-tracking array, we monitored the movement behaviour of radio-tagged bumble bee queens to determine overwintering and nesting habitats. Prior to overwintering, queens exhibited reduced activity in late summer/ early fall, concentrating in areas of abundant floral resources, and overwintering sites included locations adjacent to nesting sites, gardens, and grassy hillsides. In contrast, spring queens displayed heightened activity during nest searches, exploring diverse habitats over large areas. Our findings contribute vital insights into bumble bee habitat requirements, enhancing conservation and recovery initiatives for these crucial insect pollinators.

Day 2 - #35: 9:30 AM. Effects of Invasive Plant Removal on an Urban Plant-Bee Community.
Pascale Bider (she/her), MSc Student, University of Toronto, ON, Canada.
Co-Authors: Scott MacIvor.

Abstract: In the emergent field of urban ecosystem naturalization, there is a need to better understand how invasive plant removal practices alter plant-bee relationships. Though non-native plants have been linked to lowered pollinator abundance and diversity in some settings, they often make up a large proportion of food resources available to bees in urban environments. To address this knowledge gap, a project was designed in partnership with the Toronto and Region Conservation Authority (TRCA) at their Meadoway site in Scarborough, ON. Here, the plant-bee community was monitored over one growing season at plots where the invasive *Cirsium arvense (L.) Scop*. (Asteraceae) was either removed or left to flower. Metrics of plant community alpha diversity, bee community alpha diversity, and plant-bee network structure were analyzed. Of these, only bee abundance and network modularity were affected. Bee abundance was marginally higher at non-removal plots during peak *C. arvense* flowering, and communities at these plots were more modular during this period. These findings suggest that sites at which the invasive *C. arvense* is removed can support equally rich and diverse if slightly less abundant and differently structured bee communities.

Day 2 - #36: 9:45 AM. Finding the missing honey bee proteins; a meta analysis.
Nadejda Tsvetkov, Postdoctoral Fellow, University of British Columbia, ON, Canada.
Twitter: @NadiaTsvet
Co-Authors: Leonard J. Foster.

Abstract: The honey bee (*Apis mellifera*) is a model organism for insect learning, pesticide tolerance, and the evolution of eusociality. Many studies have been published exploring these questions and others

using genomic and proteomic techniques. This wide spread use of proteomics revealed that we detect fewer proteins in the honey bee than in other model organisms. We do not know if there is a group of proteins that is consistently missed and whether the missing proteins are the same across tissues, life stages, and preparation techniques. In this meta-analysis, we analyzed publicly available proteomic databases and found a set of proteins that are never detected. An ontology analysis revealed an enrichment for zinc-finger proteins and odorant binding proteins.

Day 2 - #37: 10:00 AM. Break
We will take a break and return at 10:30 AM.

Day 2 - #38: 10:30 AM. Understanding honeybee-virus interactions through molecular analysis.
Philippine Granger Joly de Boissel (She/her), Post-doc Fellow, York University, Ontario, Canada.
Twitter: @BeeCSI ; @philou_Sap Instagram:
Co-Authors: Aidan Jamieson, Laura R. Newburn, Mateus Pepinelli, Ida M. Conflitti, Leonard J. Foster, Amro Zayed, the BeeCSI Consortium.

Abstract: Honeybees (*Apis mellifera*) play a crucial role in pollination and agricultural productivity contributing significantly to the economy and biodiversity. However, their population is declining due to various human activities including pesticide use, habitat destruction, and the introduction of pathogens, making it imperative to understand and mitigate the effects of these stressors on the honeybees' health. Understanding the molecular responses of honeybees to common viral infections is crucial for developing strategies to protect these essential pollinators. This study performed RNA-sequencing on three tissues - head, abdomen, and gut - from honeybees exposed to three viruses (IAPV, DWVA and VDV). Differential gene expression analysis revealed that all viral conditions were capable of modulating gene expression, but no differentially expressed genes were found to be common across tissues or viral conditions. Gene co-expression analysis indicated that co-expression networks varied based on viral treatment. These findings suggest that honeybees' responses to viral infections are highly specific to the viral condition providing new insights into the complexity of honeybee-virus interactions and implement best practices to monitor infections.

Day 2 - #39: 10:45 AM. Impacts of urban warming on cavity-nesting bees across spatial scales
Lydia Wong (she/her/hers), PhD Student, University of Ottawa (Forrest Lab), Ontario, Canada.
Twitter: @Ldia_wong Instagram: @little.lyd.wong
Co-Authors: Jessica Forrest.

Abstract: Although cities are generally characterized by higher temperatures relative to naturalised areas, temperatures within a city can be variable, depending on the spatial scale of interest. Differences in land-use may generate thermal heterogeneity, with commercial and industrial areas being warmer than parks and older residential neighbourhoods. Thermal heterogeneity within a city can be considered at even smaller spatial scales. For example, vegetation may have a cooling effect on the few metres directly around it, even if it is in an otherwise hot region of the city. Considering thermal heterogeneity at different spatial-scales may be important for holometabolous insects such as bees, since different life-stages likely vary in the scales at which they are sensitive to temperature. We asked how total brood cell production and juvenile body size in cavity-nesting bees are influenced by landscape-scale and microhabitat-scale temperature in Ottawa and Toronto (Ontario, Canada). Nesting structures were

established at 31 sites distributed between the two cities. We recorded temperatures within trap-nests as well as air temperatures to characterize conditions experienced by juvenile bees and by foraging females respectively. Preliminary work suggests that brood cell production and juvenile size (mass) generally decreased with increasing temperature though this pattern varies across taxa.

Day 2 - #40: 11:00 AM. The change in bumble bee abundance, diversity and floral use over time in southern Ontario.

Taylor Kerekes (She/Her), Biology, York University/Wildlife Preservation Canada (WPC), ON, Canada.
Twitter: Instagram:
Co-Authors: Sheila Colla, Cole Blair, Sarah MacKell, Tiffani Harrison.

Abstract: Bumble bees have been documented to be in decline in many temperate regions including Canada. Multiple stressors working in tandem are thought to be contributing to these declines including habitat loss and urbanization, pathogen spillover and disease, climate change, and pesticides. In this study, surveys were done in 2021-2023 in southern Ontario and were compared to historical surveys done in 1971-1973 and 2004-2006. This study works to compare changes over time in the bumble bee community including abundance, diversity, and floral use. we illustrate a persistent absence and decline of some species over the past 50 years along with a continual decline of diversity. Changes in floral use over time can help to explain community variations such as an overall decrease in bumble bee dietary breadth. Although multiple species are experiencing declines, some species are seeing large increases in abundance and floral resource use showing a decrease in diversity by having a few species dominating the community. Continued monitoring in southern Ontario is integral to further documenting future bumble bee community changes allowing us to better understand conservation requirements.

Day 2 - #42: 11:15 AM. The impact of land use and social environment on bee development and their microbiomes.

Katherine Chau, PDF, York University, Ontario, Canada.
Twitter: @evolkate
Co-Authors: Mariam Shamekh, Jesse Huisken, Farida Samad-zada, Evan P. Kelemen, Sandra M. Rehan.

Abstract: Bee microbiomes greatly influence the health and development of bees, which becomes more crucial with land use change and anthropogenic stressors. In subsocial bees, the microbiome is influenced by both the presence of mothers and the environment. Maternal care acts as a strong social environmental stimulus that alters gene expression patterns in developing larvae, pupae, and callows. Furthermore, subsocial bee mothers play an important role in nest cleaning which impacts the type of microbes developing larvae interact with and has been found to be most impactful during early larval developmental stages. In addition to maternal care, land use change greatly influences the microbes and pathogens urban bees interact with. To assess how subsocial bee microbiomes are affected by land use and social environment, we employed metatranscriptomic and metagenomic techniques on the small carpenter bee, *Ceratina calcarata*. We overview how its microbiome changes through development (larval-callow stages) in the presence and absence of maternal care, as well as how it changes across an urban gradient. Similar to other solitary and social bee studies, larvae reared without mothers were more exposed to fungal plant pathogens such as Aspergillus, a fungus that is known to cause stonebrood disease in bees. Using metatranscriptomics we also show an increased expression for transcription factors involved with immune response in bees exposed to these fungal pathogens. We also found that areas of high urban intensity had increased pathogen load and increased overall microbial alpha diversity. Our findings show that subsocial bee microbiomes are markedly susceptible to environmental

stressors, and that lack of maternal care or urbanization increases the risk of pathogenic exposure and altered microbiomes.

Day 2 - #43: 11:30 AM. Which bee families use Canadian goldenrod (Solidago Canadensis) on revegetated mine sites in Québec?.

Shawna O'Flaherty (she/her/elle), MSc Student, Ecology and Forestry Ecosystem Management, Université du Québec en Abitibi-Témiscamingue (UQAT), Research Institute on Mines and Environment (RIME), Ontario, Canada.
Twitter: @hoboshutterbug Instagram: @hoboshutterbug
Co-Authors: Shawna O'Flaherty, Marie Guittonny, Julia Mlynarek.

Abstract: Revegetation of mining sites is a legal requirement in many Canadian provinces and American states; the goal is that a mining site may return to a satisfactory state after reclamation efforts. Previous objectives in revegetation practices consisted of greening the space and limiting erosion. More recent efforts have focused on the capacity for anthropogenic soils, including revegetated mines, to provide additional ecosystem services. This project focused on ecosystem services by creating suitable habitats for communities of indigenous pollinator insects by using *Solidago canadensis* (Canadian goldenrod), a polyvalent pioneer forb, in mine site revegetation.
An experimental setting was installed on two mine sites and four control sites located in urban or roadside areas in the context of the boreal forest ecosystem in Abitibi-Témiscamingue in western Québec. To compare feeding habitat quality between mining sites and roadside control sites, native bee family abundance and diversity was investigated on 4-years-old planted goldenrods. The results showed that the abundance and diversity of native bees in the Halictidae and Apidae families, along with one fly family (Syrphidae) was important on mine sites revegetated with Canadian goldenrod, with a greater abundance on mine sites compared to the control sites.

Day 2 - #44: 11:45 AM. Lunch

We will take a break for lunch and return at 1:00 PM.

Day 2 - #45: 1:00 PM. Stay Cool: How bees balance social and ecological information to manage a changing world. *KEYNOTE PRESENTATION*

Chelsea N. Cook (she/her), Assistant Professor, Marquette University, Milwaukee, Wisconsin.
Twitter: @phdbee Bluesky: @phdbee

Abstract: Animals must be able to navigate a changing environment, whether that is daily temperature fluctuations or long-term climate change. Social animals are hypothesized to manage a changing environment more effectively. In this talk, I discuss how my lab is testing this hypothesis by studying how social insects sense, integrate, communicate, and collectively behave to manage a changing world.

Day 2 - #46: 2:00 PM. Is there a genetic toolkit for the evolution of bee sociality or are other genomic hypotheses more helpful?.

Clement Kent (he/him), Adjunct Prof., York University, Dept of Biology. BEEc member, Ontario, Canada.

Abstract: Since the sequencing of the honey bee genome, hypotheses about which genetic features contribute the most to the evolution of eusociality have multiplied almost as fast as the number of bee genomes. Prominent authors like Grozinger, Kapheim, Keller, Rehan, Robinson, Sumner, Toth, and Zayed have pointed to a regulatory toolkit, or novel genes, or greenbeard genes and inversions, or preexisting traits of foraging non-social insects. In 2012-2014, Kent, Harpur, and Zayed described sets of Apis mellifera genes with possible connections to eusociality. Since then, Wallberg and Webster have challenged some of these connections.
My talk presents new analyses of ~550 metazoan genomes. I find that certain genes having specific functional roles have conserved features far beyond the social insects. I will touch upon some recent explanations of these features that have nothing to do with insects or sociality, but which may be helpful in understand the evolution of eusociality.

Day 2 - #47: 2:15 PM. Applications of Ultraconserved Element Phylogenetics in Apid Bees.
Trevor Sless (he/him), Postdoctoral Researcher, York University, Ontario, Canada.
Co-Authors: Sandra Rehan.

Abstract: Recent advances in molecular and computational techniques have streamlined the production of high-quality phylogenetic trees. Our research used ultraconserved elements (UCEs) for the cost-effective generation of large DNA alignments, allowing exploration of evolutionary questions pertaining to multiple groups of bees in the family Apidae.
First, we updated the phylogeny of subfamily Nomadinae, the largest group of parasitic bees. Integrating new UCE data with previously published sequences created the most complete tree for this group to date, including ~ 25% of all species. We further studied the unique evolutionary history of this group through phylogenetic dating.
Our second study focused on subfamily Xylocopinae, consisting of carpenter bees and their relatives, which shows a spectrum of behaviours ranging from solitary to eusocial. Our analyses support solitary origins for the Xylocopinae followed by multiple independent transitions to sociality.
Lastly, we focused on small carpenter bees (*Ceratina*), a cosmopolitan genus within Xylocopinae. Our resulting phylogeny included better taxonomic sampling than any previous study, with nearly all subgenera represented, and further provided a framework to explore the evolution of *Ceratina* across time and space by reconstructing their biogeographic history.
These studies highlight recent advances in phylogenetic research and the diversity of applications enabled by these methods.

Day 2 - #48: 2:30 PM. Break
We will take a break and return at 3:00 PM.

Day 2 - #49: 3:00 PM. Management Methods To Optimize Commercial Bumblebee (*Bombus impatiens*) Colonies' Performance During The Lowbush Blueberry (*Vaccinium angustifolium*) Pollination.
Anne-Charlie Robert (she/her), MSc Student, Laval University, Quebec, Canada.
Co-Authors: Valérie Fournier, Pierre Giovenazzo.

Abstract: *Bombus impatiens*, the most economically significant commercial bumble bee in North America, efficiently pollinates lowbush blueberries (*Vaccinium angustifolium*). Thousands of managed colonies are used each year to increase production, but their management methods are not well known

and must be explored to maximize their performances during blueberry pollination. This study aims to test methods to increase foraging activity and sustain strong, healthy colonies. We hypothesized that colony preparation, timing of their arrival in blueberry fields, and protection from direct sunlight will affect foraging activity, and colony strength and health. Six groups of *B. impatiens* colonies, some previously placed in a farm field to promote colony growth, were placed in blueberry fields during peak flowering. They arrived at two different times and were either protected from direct sunlight or not. We recorded the number of workers entering and exiting colonies, the pollen retrieved, the composition of the colonies, and the presence of pathogens to assess foraging activity and colony strength and health. Results showing how these methods influence the workers' foraging activity, and colonies' growth and health will be presented. Our work will help optimize the management of commercial bumble bee colonies during pollination services, thereby improving lowbush blueberry yields.

Day 2 - #50: 3:15 PM. Airborne eDNA to track honey bee foraging and health.
Mateus Pepinelli (he/him), Assistant Professor, School of Natural Sciences, Laurentian University, Sudbury, Ontario, Canada.
Co-Authors: Alejandro Biganzoli Rangel, Katherine Lunn, Patrick Arteaga, Amro Zayed, Daniel Borges, Elizabeth L. Clare.

Abstract: Environmental DNA (eDNA) refers to genetic material collected from the environment rather than directly from an organism. One of the latest advancements is the collection of eDNA from air, which relies on airborne genetic material to monitor biodiversity. In this study, we tested whether airborne eDNA from honey bee colonies could be used to evaluate recent foraging behaviour and colony health. We used custom "bee-safe" air filters running for 5-6 hours per colony over three weeks, totalling 17 samples. Following DNA extraction, PCR, and sequencing, we obtained 297,566 reads for the 16S marker (microbes) and 186,867 reads for the ITS marker (plants and fungi), identifying 4,129 Amplicon Sequence Variants for 16S and 596 for ITS. These were classified to genera, and beta diversity was calculated to assess the effects of apiary sites and sampling dates on microbial and plant/fungal composition. We detected all bacterial species from the honey bee core microbiome, demonstrating the potential of airborne eDNA for assessing colony health. Additionally, we identified a wide variety of local plants visited by the bees. Sampling date explained the most data variation, indicating that airborne eDNA can track foraging behavior on a very recent time scale.

Day 2 - #51: 3:30 PM. Social networks and social environment in a facultatively social bee.
Jesse Huisken (he/him), PhD Candidate, York University, Ontario, Canada.
Twitter: @JesseHuisken
Co-Authors: Sandra Rehan.

Abstract: The eastern small carpenter bee *Ceratina calcarata* is a facultatively social bee. In social nests mothers frequently produce a small under-provisioned daughter who forages on behalf of her regular siblings to prepare them for overwintering, which this worker-daughter does not herself survive. To understand how this simple division of labour, between mothers, worker-like daughters, and regular daughters, is determined we studied social networks within colonies of differing social composition. Observation nests were constructed from wild established nests, with control nests possessing mothers and worker-like daughters, and two treatments manipulating social environment were applied, 1) removing mothers, and 2) removing mothers and worker-like daughters. Behaviours were scored from video and pairwise interactions were analyzed using social interaction networks. Within observation

nests it is expected that nests possessing worker-like daughters will exhibit interaction networks of low connectivity, with mothers, worker-like daughters or foraging regular daughters being hub individuals, as they provision nest mates. In colonies lacking mothers and worker-like daughters, thus lacking size-based hierarchy, it is expected that interaction networks will be highly connected, and repeated aggressive encounters will establish hierarchy and food sharing roles in the nest. Insights into such simple social systems advance our understanding of sibling cooperation and competition, as well as maternal care. Understanding such dynamic cooperative behaviours may also suggest plausible scenarios by which both differences in physiology and behaviour in otherwise solitary species may have set the stage for advanced eusociality.

Day 2 - #52: 3:45 PM. Concluding Remarks.
Laura Newburn (she/her), Coordinator, BEEc, Ontario, Canada
Twitter: @BeesYork Instagram: @BeesAtYork

Abstract: Thanks for attending day two of BeeCon 2024. Reminders will be given and sponsors and organizers thanked.

That's It For BeeCon 2024!
If you have any feedback on this event, please contact the BEEc Coordinator at beec@yorku.ca. We hope that you enjoyed BeeCon 2024 and will join us again in the future. Visit us online at https://www.yorku.ca/bees/.

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