BeeCon 2022 Program

Hosted by:

Centre for Bee Ecology, Evolution & Conservation

BeeCon

A Hybrid Event for 2022!

Virtual via Zoom Webinar: Thurs, Oct 13,2022

In-person at York University or Virtual: Fri, Oct 14, 2022

www.yorku.ca/bees/beecon-2022

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#BeeCon

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BeeCon 2022 Program: Location, Schedule, Abstracts, and More

Welcome!

Welcome to #BeeCon 2022! 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 2022, BeeCon is returning to York University's campus as part of a two-day hybrid event. Thursday, October 13, 2022 will be a virtual-only event hosted on Zoom, while Friday, October 14, 2022 will be both virtual and in-person. With the easing of COVID restrictions, we look forward to being able to network in-person again over the breaks and the afternoon social!

We would like to give a big thank-you to our funders, the Faculties of Science and 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 @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.

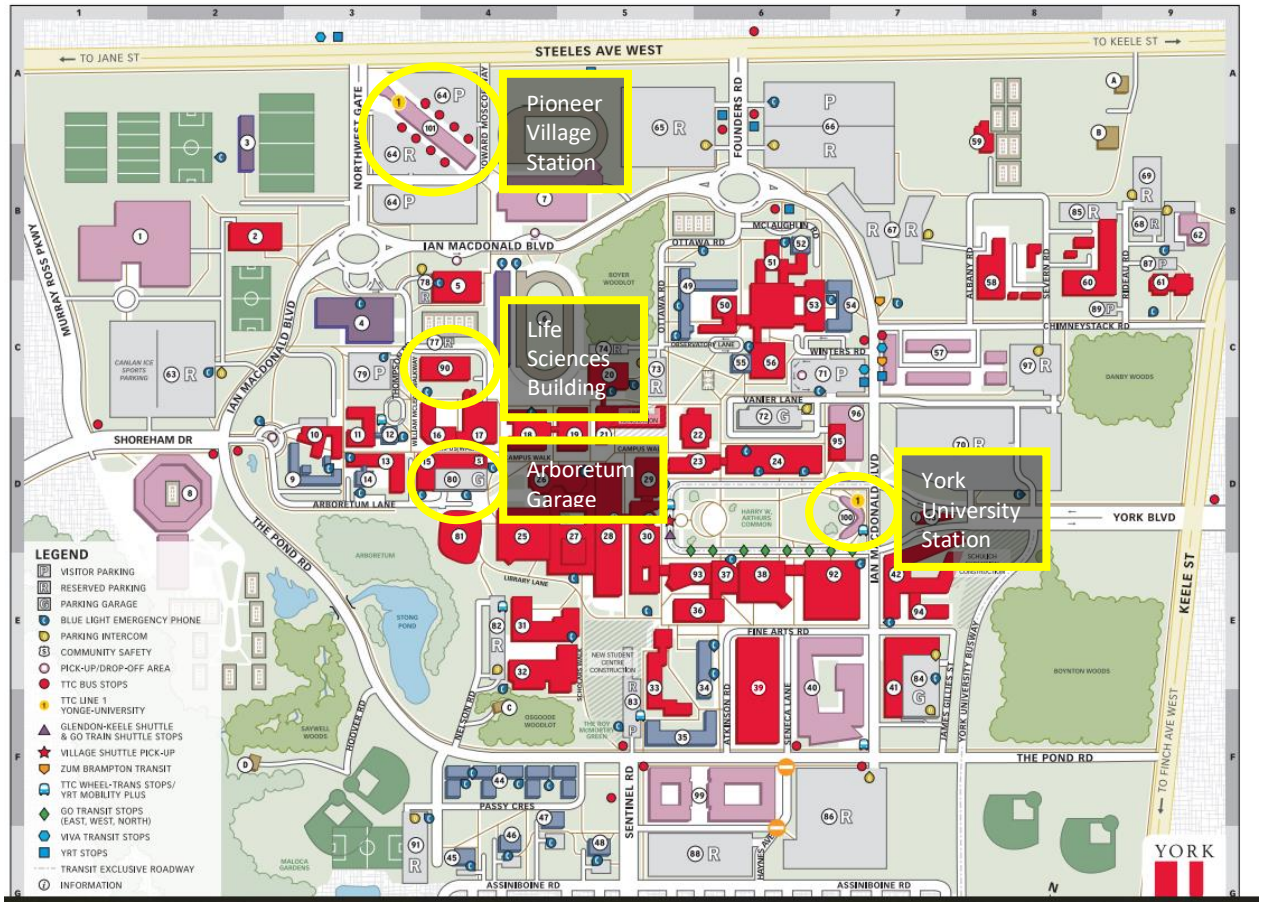
Webinar Access Details – Thursday, October 13 and Friday, October 14

- Registered attendees should have already gotten the Zoom webinar link from beec@yorku.ca (sent October 4, subject line "Important information for BeeCon 2022 attendees: Oct 13-14"). It will also be sent out the morning of October 12 and 13 and 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.
- Virtual presenters and moderators should NOT use the general attendee link for the day they present/moderate, but the unique panelist zoom link that will come from no-reply@zoom.us, with the name "The Centre for Bee Ecology, Evolution and Conservation" (i.e. NOT the one from the beec@yorku.ca email).

Directions to In-Person Venue at York University - Friday, October 14

- **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)
    - 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



COVID Precautions

- York University has paused its vaccination, screening, and masking requirement BUT **to respect the needs of those with health concerns, please wear a mask at all times when inside the lecture hall and in the foyer, particularly around the registration and food tables**. Masks are not required when you are actively eating in the foyer. Food can be eaten outside if the weather permits.
- Level 3 medical masks will be provided free of charge at the door for those who need one.
- Hand sanitizer will be provided at the registration and food tables. There are also hand sanitizing stations inside the building itself.
- 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/

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!

Questions? Concerns? Feedback? Ideas for Future Events?

If you have any questions, concerns, feedback, or ideas for future BEEc events, please contact Victoria at beec@yorku.ca. We hope that you'll enjoy BeeCon 2022 and join us again in the future.

Schedule With Abstracts

Recording Status Key:
Yes: Recording will be made public on BEEc's YouTube Channel after the event
No: No recording will not be shared publicly
Private: shared by email upon explicit request to beec@yorku.ca by a YorkU BEEc Associate

Day 1 – Thursday, October 13, 2022 (Virtual Only)
(all times Eastern, i.e. Toronto/New York)

8:00 AM Welcome to BeeCon 2022!
Victoria MacPhail (she/her), Coordinator, Centre for Bee Ecology, Evolution and Conservation, York University
Twitter: @BeesYork Instagram: @BeesAtYork Recording Status: Yes
Co-Authors: n/a

8:15 AM Species Diversity of the Apidae Family (Apoidea: Hymenoptera) in District Dehradun, Uttarakhand, India
Shivani Sharma (she/her), Senior Research Fellow, Zoological Survey of India, Northern Regional Centre, and Department of Environmental Sciences, Kanya Gurukula Campus, Gurukula Kangri, India
Twitter: n/a Instagram: n/a Recording Status: No
Co-Authors: Gaurav Sharma and Namita Joshi

Abstract: Twenty-one species of Apidae belonging to six genera were reported from the Dehradun district of Uttarakhand, India during 2020-22. The study area lies between longitude 30.3165°N and

latitude 78.0322°E in the Western Himalayan Biogeographic Province (2B) of India. This family is the most largest and diverse family of superfamily Apoidea and holds a key role as pollinators. Bees of this family were highly activated during the day (sun hours), the activities of *Bombus haemorrhoidalis* were also reported during the dawn and dusk hours. The *Apis* spp. and *Xylocopa* spp. activities were also observed at the night. They pollinate wild as well as domestic plants like *Tagetes erecta, Mesosphaerum suaveolens, Vitex negundo, Ocimum tenuiflorum, Cajanus cajan, Calotropis procera, Cucumis sativus, Cucurbita maxima* and *Lantana camara* etc. The maximum diversity of this family has been reported in the post-monsoon (September-October) period and least in the winters (as they hibernated in winters).

8:30 AM A comparison of collection methods for evaluating Canadian bumble bee diversity
Jocelyn Armistead (pronouns not provided), MSc Student, Brock University
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Cory Sheffield (Royal Saskatchewan Museum), Carolyn Parsons (Agriculture and Agri-Food Canada), and Miriam Richards (Brock University)

Abstract: Bumble bee (*Bombus*) populations across Canada are experiencing increases and decreases in abundance. Surveys are conducted to monitor these changes, but currently many different collection methods are used. The objective of my study is to evaluate three collection methods to determine if they provide the information needed to assess bumble bee abundance and diversity, and to examine whether there are regional differences in their efficacy. In 2021 bumble bees were collected by researchers in regions of Ontario, Saskatchewan, and Newfoundland and Labrador. In all regions, bumble bees were collected using blue vane traps (BVTs), netting, and photographs. Generally, BVTs were set for 1 week at a time, while multiple 30-minute netting and photographic surveys were conducted during the week. In Ontario and Saskatchewan, BVTs collected the most species, but in Newfoundland and Labrador, netting did. Comparisons within regions revealed differences in community composition and diversity depending on collection method used. These differences suggest that multiple complementary methods should be used to provide a complete understanding of the bumble bee community. These results will help Canadian bumble bee researchers make informed decisions about which methods would work well for their study purpose and region.

8:45 AM 'Every third mouthful...'
Pamela Martin (we/us), Artists, Chatwin : Martin
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Peter Chatwin

Abstract: Since 2002 we have been undertaking an art/science research project collaborating with international entomologists specialising in solitary bees and pollination. That year Christopher O'Toole asked us if we would like to accompany him 'in the field', and see where our curiosity would lead us. Arts Council England and university grants (Peter was a senior researcher at Manchester Metropolitan University) allowed us to visit southern Italy, Israel and the Californian Central Valley with Chris. Chris also shared with us his extensive genitalia drawings. Bees' genitalia, I hasten to add, as he had devised a way to extend the endophallus had also introduced us to his colleague, Dr. Stephen Buchmann in Tucson, AZ, from whose book, 'The Forgotten Pollinators', the title of our project was taken.
With Steve we explored the bee hotspot of the Sonoran Desert, and spent a week in his laboratory looking down microscopes at bees' heads. On an International Art Scholarship in Lahore, Pakistan we discovered Dr. Nasreen Muzzaffar, who showed us the neir reed that took us back the following year to conduct a scientific project using the reed on a farm with the backing of the WWF Pakistan.

During the past twenty years we have had three touring exhibitions, the latest of which features a large-scale, illustrated, graffitied and illuminated, hand-written manuscript, all about bees and the exploits that have happened to the entomologists and ourselves during the intervening years - Peter nearly being kidnapped in Pakistan; Chris threatened with being shot - all in the name of bees.
Over the years our work has become increasingly more political. But then we live in exacting times...

9:00 AM Seasonal impact of landscape complexity, nesting substrate, and nest orientation on cavity-nesting solitary bees in southern Punjab, Pakistan
Mudssar Ali (pronouns not provided), Assistant Professor Entomology, MNS University of Agriculture, Multan, Pakistan
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Fawad Z. A. Khan, Danyal Haider Khan

Abstract: Solitary bees are facing constant decline due to climate change, pesticide toxicity, and habitat loss. Providing artificial nesting sites for solitary bees is the best conservation strategy. Many biotic and abiotic factors influence the nesting ability of bees, like parasitism, the orientation of the nesting entrance, type and diameter of the nesting substrate. This study investigated the role of nesting substrate, cavity diameter, and orientation of nest entrance on solitary bee preference for nesting. Furthermore, this research also studied the impact of landscape type and seasonality on the nesting efficiency of bees. Trap nests were deployed at 8 locations representing five landscapes (forest, desert, agriculture, peri-urban and urban). These trap nests were equipped with 5 different nesting substrates (Bamboo reeds, wooden blocks, wooden logs, mud blocks, and paper tube). At every location, 4 traps were installed in every direction. The results indicated that maximum cavity occupation occurred in the nest facing the south direction. The peri-urban landscapes were most favored for nesting, followed by forest landscapes. Solitary bees preferred mostly bamboo reeds for making nests, and April-June showed peak nest occupation. Bees mostly preferred cavities with an entrance diameter of 6 and 8 mm while wasps occupied cavities with diameters lower than 5 mm. For future studies, the number of the brood chamber and species-specific preference of bees for nesting aids should be studied, along with the impact of cavity microclimate on bee growth.

9:15 AM Wild bee utilization of engineered pollinator habitats in eastern Nebraska agroecosystems
Shianne Lindsay (she/her), MSc Student, University of Nebraska-Lincoln (UNL), Department of Entomology
Twitter: @the_beecologist Instagram: @the_beecologist Recording Status: Yes
Co-Authors: Autumn Smart, Judy Wu-Smart, Dave Wedin (UNL Dept. Natural Resources), Chris Helzer (The Nature Conservancy)

Abstract: Habitat loss is a leading cause of biodiversity decline globally. Further, natural habitat loss is a major factor contributing to declines in native pollinator populations. Among intensive agroecosystems in the Midwestern U.S., corn, soy, and small grain fields dominate the landscape and leave little space available for forb-rich pollinator habitat. There are numerous barriers and challenges to integrating pollinator habitat into such agroecosystems and quantitative assessments for pollinator communities are largely lacking. The establishment of high-quality pollinator habitat can provide both high flower abundance and species richness throughout the growing season to support local bee communities. This project examines plant-bee interaction networks and flower preferences occurring in pollinator habitats in eastern Nebraska. These data will serve as baseline wild bee abundance and richness estimates for the region and to examine cost-effectiveness of seed mixes used design in pollinator habitat plantings.

9:30 AM Effectiveness of bee pollination on the yield components of broad bean, *Vicia faba* L. in Ismailia, Egypt

Mohamed Shebl (pronouns not provided), Professor, Department of Plant Protection, Faculty of Agriculture, Suez Canal University, Egypt
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Noha M. Ghareb, Kariman M. Mohamed, Soliman M. Kamel

Abstract: Broad bean (*Vicia faba* L.) is one of the important crops in the world being incredible complete crop food because of its nutritional and medicinal use. Globally, it is the third most important feed grain legume and it is considered one of the major cultivated crops in the country. This study aims to examine the important and effectiveness of the bees on the yield components of the crop. Experiments were conducted at the experimental research farm of Faculty of Agriculture, Suez Canal University during blooming seasons of broad bean for two successive years. Bee numbers and yield parameters in open and closed pollinated plants were measured and compared. Generally the most abundant bee pollinators were long tongue bees of *Anthphorini* and *Chalicodoma siculum* in Egypt. The study revealed that honey bee, *Apis mellifera* L. was the most abundant species comparing to the other solitary bee species, *Chalicodoma siculum* (Rossi), *Colletes lacunatus* Dours, 1872 and *Andrena ovatula* (Kirby, 1802). Malaise trap method was also evaluated as a tool for collecting bees in addition to sweeping for two seasons. The enotomofuna was divided into three major groups pests, pollinators and natural enemies, three major orders were collected were Dipteran, Hymenopteran and Coleopteran. Obtained data concluded that the Malaise trap is not recommended for collecting bees especially large size bees, it is very good for collecting Dipteran and Coleopteran insects. The open pollination plants were higher than closed pollination plants in all studied parameters such as pod length and numbers, weight of pods and green and dry seeds weigh.

9:45 AM Pollination studies in Shea Parklanda in Northern Ghana.

Peter Kwapong (pronouns not provided), Professor, University of Cape Coast, International Stingless Bee Center
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Latif Abdlaih Nasera and Jane Stout

Abstract: Bee pollination studies were carried out within shea parkland in Nothern Ghana. Both *Apis mellifera* and Stingless bees were the most significant pollinators of shea butter flowers leading to quality and quantity fruit set. Incorporating apiaries in shea parklands could enhance fruit yields and increase livelihoods of parkland dwellers.

10:00 AM Morning Break (Virtual)

10:30 AM Announcing Big-Bee: An initiative to promote understanding of bees through image and trait digitization

Madeleine Ostwald (she/her), Postdoctoral Scholar, University of California, Santa Barbara
Twitter: @MaddieOstwald Instagram: n/a Recording Status: Yes
Co-Authors: Katja C. Seltmann, Julie Allen, Brian V. Brown, Adrian Carper, Taro Eldredge, Michael S. Engel, Nico Franz, Edward Gilbert, Chris Grinter, Victor H. Gonzalez, Pam Horsley, Giar Ann Kung, Sangmi Lee, Crystal Maier, Istvan Miko, Paul Morris, Peter Oboyski,

Abstract: While bees are critical to sustaining ecosystem health globally, they are decreasing in both numbers and diversity. Our understanding of the factors driving these declines is limited, in part,

because we lack sufficient data on the distribution of bee species to predict changes in their geographic range under climate change scenarios. Additionally lacking is adequate data on the behavioral and anatomical traits that make bees either vulnerable or resilient to environmental change. Fortunately, a wealth of attributes can be extracted from the specimens deposited in natural history collections for over 100 years. Extending Anthophila Research Through Image and Trait Digitization (Big-Bee) is a newly funded NSF project encompassing a network of 13 US institutions and partnerships with US government agencies. Over three years, we will create over one million high-resolution 2D and 3D images of bee specimens, representing over 5,000 worldwide bee species. We will also develop tools to measure bee traits from images and generate comprehensive bee trait datasets to measure changes through time. We will develop novel mechanisms for sharing image and trait datasets that will be available through an open data portal called the Bee Library, greatly extending opportunities for bee research from existing specimen data.

10:45 AM Evidence for lack of bilateral transfer of olfactory learned information in *Apis dorsata* and *Apis mellifera*

Meenakshi Vengarai (she/her), Postdoctoral, Case Western Reserve University
Twitter: @meenakshicharu Instagram: @meeks_vk Recording Status: Yes
Co-Authors: Sandhya Mogily, Joby Joseph, Aparna Dutta Gupta

Abstract: Capacity and condition under which the lateral transfer of olfactory memory is possible in insects is still debated. Here, we present evidence in two species of honeybees *Apis mellifera* and *Apis dorsata*, consistent with lack of ability to transfer olfactory associative memory, in a PER associative conditioning paradigm, where the untrained antenna is blocked by an insulating coat. We show that the olfactory system on each side of the bee can learn and retrieve information independently and the retrieval using the antenna on the side contralateral to the trained one is not affected by the training. Upon recreating the setup using which the memory on the contralateral side has been reported at three hours after training, we see that, the memory is available on the contralateral side immediately after training. In the same setup coating the antenna with an insulator on the training side does not prevent learning, pointing to a possible insufficiency of block of odor stimuli in this setup. Moreover the behaviour of the bee as a whole can be predicted if the sides are assumed to learn and store independently and the organism as a whole is able to retrieve the memory if either of the sides have the memory.

11:00 AM Pollination biology and pollinator communities of the endangered Willamette Daisy in Oregon Prairies

Scott Harris (he/him), Director of Conservation Research, Institute for Applied Ecology
Twitter: @harrisecology Instagram: n/a Recording Status: Yes
Co-Authors: Tom Kaye, Christina Mitchell, David Cappeart, Susan Waters

Abstract: Willamette daisy (*Erigeron decumbens*) is an endangered plant endemic to prairies in the Willamette Valley of Oregon. Little is known about the species' pollination biology. In 2019-2022 we conducted experiments and field observations to understand the role of pollinators in seed production of the species. We found that it relies on insect visitors for seed set in the field. Pollen supplementation treatments showed that pollinator service to Willamette daisy flowers is below optimal, with an average increase in seed set of 6% to 15%. Controlled crosses between wild plants in the field show that the species is highly self-incompatible, with <5% seed set for selfed and unpollinated plants. Controlled outrosses within and between populations resulted in an average of ~50% seed set. Insects visiting the flowers of Willamette daisy included several species of Hymenoptera (mostly Halictidae) and Diptera

(mostly Syrphidae). Pollinator communities differed significantly from site to site and year to year, and reveal that insects visiting Willamette daisy are members of networks that rely on a wide range of co-occurring plants. Conservation of Willamette daisy populations hinges on supporting a thriving and diverse network of insect pollinators and flowering plants in the prairie ecosystem.

11:15 AM Prescribed fire in grassland restoration is associated with increased plant-pollinator community resilience to plant species losses

Susan Waters (she/her), Research Ecologist, Quamash EcoResearch
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Rachel Mitchell, University of Arizona

Abstract: Restoration of grasslands often includes returning fire to the landscape via prescribed burns. Though burning can increase native floral diversity and reorganize an interacting community of pollinators, few studies have examined how this restructuring can affect community resilience to future plant species losses via management or stochastic events. We assessed plant-pollinator community responses to prescribed fire in western Washington prairies, then simulated plant species losses from the resulting networks. Specifically, we followed six prairie sites (0-12 years of restoration) for four years, documenting plant-pollinator interactions and prescribed fire history. We 1) built plant-pollinator networks, 2) assessed the relationship between network structure and fire history, 3) simulated several management-relevant plant species loss scenarios, and 4) measured the number of predicted secondary species losses in less-burned and more-burned prairies. Prescribed fire, in combination with native reseeding, systematically increased floral resource abundance and diversity. Pollinator community composition and plant-pollinator interaction network structure changed in response. In addition, burning diminished the secondary extinction cascade impact of removing a plant species. This pattern was consistent across all plant removal scenarios, but was especially strong when a rare native forb was removed. Our work suggests that some rare native plants may play an outsized role in sustaining plant-pollinator networks.

11:30 AM Consequences of microsporidian prior exposure for virus infection outcomes and bumble bee host health

Elyse McCormick (she/her), Ph.D. Student, University of Massachusetts, Amherst
Twitter: @elysecmccormick Instagram: n/a Recording Status: Yes
Co-Authors: Olivia R. Cohen (Illinois State University), Adam G. Dolezal (University of Illinois at Urbana-Champaign), Ben M. Sadd (Illinois State University)

Abstract: Host-parasite interactions do not occur in a vacuum, but in connected multi-parasite networks. Resulting co-exposures and coinfections during an individual host's lifetime can affect host health and infectious disease ecology, including disease outbreaks. However, many host-parasite studies examine pairwise interactions, meaning we still lack a general understanding of the influence of co-exposures and coinfections. Using the bumble bee *Bombus impatiens*, we study the effects of larval exposure to a microsporidian *Nosema bombi*, implicated in bumble bee declines, and adult exposure to Israeli Acute Paralysis Virus (IAPV), an emerging infectious disease from honey bee parasite spillover. We hypothesize that infection outcomes will be modified by co-exposure or coinfection depending on relevant temporal interactions, due to changes in host immune allocation or condition. *Nosema bombi* is a potentially severe, larval-infecting parasite, and we predict that prior exposure will result in decreased host resistance to adult IAPV infection. We predict a double exposure will also reduce host tolerance, as measured by host survival. Although our larval *Nosema* exposure mostly did not result in viable infections, it reduced resistance to adult IAPV infection. Exposure to *Nosema* also negatively affected

survival, potentially due to a cost of immunity in resisting the exposure. There was also a significant negative effect of IAPV exposure on survivorship, but in contrast to resistance, prior *Nosema* exposure did not alter this survival outcome. These results again demonstrate that infection outcomes within multi-parasite host networks can be non-independent, even when exposure to one parasite does not result in a substantial infection.

11:45 AM Variations in bee responses to thermal stress
Victor Gonzalez (pronouns not provided), Assistant Teaching Professor, University of Kansas
Twitter: @vhgonzab Instagram: @vhgonzab Recording Status: Yes
Co-Authors: Kennan Oyen

Abstract: Interest in assessing the thermal tolerance of bees to predict their potential response to climate change is rapidly increasing. I provide an overview of bees' critical thermal limits, physiological traits measured under laboratory conditions that are useful to estimate species' vulnerability to climate change and to predict their response to thermal stress. Based on on-going studies and literature review, we discuss the biotic (body size, sex, nutrition) and abiotic (pesticides, spatial and temporal gradients) factors that influence bees' critical thermal limits. To date, only few studies have assessed bees' thermal limits, most are from North America and are focused on understanding changes in heat tolerance in the context of landscape alteration. However, some studies have addressed thermal tolerance in relation to bees' invasiveness potential and foraging patterns. Bees appear to display a stronger response in cold tolerance than in heat tolerance, except to acute exposures to sublethal doses of pesticides, which increases bees' heat tolerance. Despite the small number of studies on bees' critical thermal limits, these differ in methodology, which likely affects estimates of bees' heat tolerance and thus potentially limit comparisons across taxa and regions.

12:00 PM Lunch Break (Virtual)

1:00 PM The Ontogeny of Sociality in Bumble Bee Queens – KEYNOTE PRESENTATION
Hollis Woodard (pronouns not provided), Associate Professor; Lead PI, University of California, Riverside; US National Native Bee Monitoring Network RCN
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: n/a

Abstract: Bumble bee queens, like queens in many social insect lineages, found nests independently and only transition to living a eusocial lifestyle when the first workers emerge and remain in the nest. This aspect of their life history makes studies of bumble bee queens and their incipient nests a rich system for exploring fundamental questions about social organization and evolution. Moreover, bumble bee queens typically found nests during early spring, at a time when food resource availability can be more limited. Thus, independent founding can also be examined for its relationship to population dynamics, including decline.

2:00 PM Ultrastructural and histological characterisation of the hairiness involved in electrostatic pollination phenomena in species of the genus *Bombus* from urban and peri-urban areas of Bogotá D.C., Colombia.
Fabián David Rosas Dávila (he/him), Biologist, Pontifical Xaverian University of Colombia
Twitter: n/a Instagram: @fadaroda16 Recording Status: No

Co-Authors: Daniel Andrés Chirivi - Pontifica Xaverian University of Colombia; Juliana Durán Prieto - Botanical Garden of Bogotá , José Celestino Mutis; Giovanny Fagua Gonzáles - Pontifical Xaverian University of Colombia

Abstract: In pollination, the electrical phenomena surrounding plant-pollinator relationships are well known. One of the peculiarities of this phenomenon is the recognition and discrimination of rewards from the perception of floral electrical fields by bumblebees, however, the information available on the mechanisms and structures involved, as well as electrical perception in Colombian bees is small. In this research, through observation of 7 sections of the head of three species of the genus *Bombus* in a stereoscope, microscope and analysis of images in scanning electron microscopy (SEM), 5 types of hairs/setae that make up the head´s hairiness of the of *B. pauloensis, B. hortulanus* and *B. rubicundus*. According to the differences in these hairiness types, the ultrastructure and histology of target hairs were analyzed; evidencing a variable distribution, structure and morphology of at least 2 types of hairs/setae with potential sensoriality. The histological composition shows tissues associated with mechano and chemoreceptor relationships in sections of the head of *B. pauloensis*, which agree with the location of the hairs involved in electrostatic pollination phenomena. Subsequently, similarity relationships were established between these species, according to their interactions with plant species in the city of Bogotá and its surroundings; finding a greater similarity between *B. hortulanus* and *B. rubicundus* due to their presence in peri-urban environments; Consequently, *B. pauloensis* is positioned as a generalist species in the city of Bogotá due to its presence in the urban environment. This work addresses the microscopic observation of the head´s hairiness of native bumblebees as a source of evidence of their chemo- and mechanosensory interactions. It also proposes a detailed description of key structures in the pollination phenomena of species of the genus *Bombus* found in Bogotá.

2:15 PM Decreases in *Centris pallida* male head widths across five decades (Hymenoptera: Apidae)
Meghan Barrett (she/her), Postdoctoral fellow, California State University Dominguez Hills
Twitter: @Bee_Bytes Instagram: n/a Recording Status: Private link
Co-Authors: Meredith Johnson, Arizona State University

Abstract: Historical data suggest that many bee species have declined in body size. Larger-bodied bees with narrow phenological and dietary breadth are most prone to declines in body size. This may be especially true in solitary, desert-adapted species that are vulnerable to climate change. In addition, body size changes in species with size-linked behaviors could threaten the prevalence of certain behavioral phenotypes long-term. Sonoran Desert *C. pallida* solitary bee males use alternative reproductive tactics (ARTs) and are dimorphic in both morphology and behavior. *C. pallida* male body size has been studied in the same population since the 1970s. We collected body size data in 2022 and combined it with published records from 1974-2022. We find a persistent decline in the mean head width of patrolling males, and shifts towards smaller body sizes in the populations of males found foraging and hovering. Both morphs declined in average body size, and the proportion of large-morph males in the population decreased by 8%. Mating males did not decline in mean body size over the last five decades. We discuss hypotheses related to the decline in *C. pallida* male head width.

2:30 PM Afternoon Break (virtual)

3:00 PM Pesticide residues in the hive products and their potential risks to honey bees in China
Hongmei Li-Byarlay (she/her), Associate Professor, Central State University
Twitter: @insect_sciences Instagram: @hmlibee Recording Status: Yes

Co-Authors: Xiaolin Wen, Changsheng Ma, Minghui Sun, Ye Wang, Xiaofeng Xue, Jun Chen, Wencheng Song, Shudong Luo

Abstract: Research evidence suggests that pesticide residues are one of the leading potential causes of the decline in pollinators, especially during vulnerable periods such as foraging in the early springtime. It is important to quantify pesticide residues in the nectar and pollen of honey bee colonies during the early field season and examines the potential risks and toxicity of pesticides to honey bees. This talk will highlight two projects investigating 1) the pesticide residues in oilseed rape in the years 2017 and 2018 of bee population in China, and 2) the residues of pesticides in bee bread and honey of *Apis cerana* in China. The risk of detected residues of pesticides to honey bees was evaluated with hazard quotient (HQ) and BeeREX. Additional chronic and acute risks to humans according to dietary exposure were also addressed. Our results suggest that the pesticide residues detection ratio (25.4% for beebread and 2.8% for honey) and the concentrations of these residues are lower than previously reported. Among all identified pesticides, only thiamethoxam raises the concern for further risk assessment in the risk evaluation of honey bee colonies and thiamethoxam was safe for colonies in higher tier studies Our results indicated that further investigation of nearly half of the tested compounds is needed because their PHQ or NHQ values are more than 50. Especially cyfluthrin and carbofuran need advanced tier assessment due to their maximum RQ (risk quotient) values exceeding the level of concern. These results provide valuable guidance for protecting bees and other pollinators.

3:15 PM Admixture in Africanized honey bees (*Apis mellifera*) from Panamá to San Diego, California (U.S.A.)

Daniela Zarate (pronouns not provided), Postdoctoral Fellow, UC San Diego & UC Riverside
Twitter: @four_lizard Instagram: @fourlizard Recording Status: Yes
Co-Authors: Thiago Lima (Scripps Institute of Oceanography, UC San Diego), Jude Poole (UC San Diego), Erin Calfee (UC Davis), Ron Burton (Scripps Institute of Oceanography, UC San Diego), Josh Kohn (UC San Diego)

Abstract: The Africanized honey bee (AHB) is a New World amalgamation of several subspecies of the western honey bee (*Apis mellifera*), a diverse taxon grouped into four major biogeographic lineages: A (African), M (western European), C (eastern European), and O (Middle Eastern). In 1956, accidental release of experimentally bred “Africanized” hybrids from a research apiary in Sao Paulo, Brazil initiated a hybrid species expansion that now extends from northern Argentina to northern California (U.S.A.). Here, we assess nuclear admixture and mitochondrial ancestry in 15 bees from each of four regions across this expansive range: the Isthmus of Panamá; Guanacaste, Costa Rica, Tapachula, Mexico; and San Diego, U.S.A to assess ancestry of AHB several decades following initial introduction and test the prediction that African ancestry decreases with increasing latitude. We find that AHB nuclear genomes from Central America and Mexico have majority African ancestry (Mexico, 79%; Costa Rica 90%; and Panamá 94%) with varying contributions from western and eastern European lineages. AHB from San Diego (CA) show markedly lower African ancestry (40%) with substantial genomic contributions from all four major honey bee lineages. The mitochondria of all bees sampled in Costa Rica and Panamá originated in Africa. The majority (11) of bees sampled in Mexico carried African mitochondria with the remainder carrying eastern European mitochondria. In the San Diego population, mitochondria from all four lineages are present. Genetic diversity measures from all New World populations are similar and exceed those of ancestral forms. The unique genetic makeup of the San Diego honey bee population makes it a rich source of genetic material for honey bee breeding.

3:30 PM Reconciling estimates of diploid male frequencies in populations of euglossine bees; allozymes vs. microsatellites

Robin Owen (he/him), Professor, Department of Biology, Mount Royal Univerity, Calgary, Alberta
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: n/a

Abstract: Since diploid males are potential indicators of population decline in Hymenoptera, it is essential to have accurate estimates of their frequencies to make informed conservation decisions. Although the sampling theory of the estimators of diploid male frequencies using marker loci was published over 25 years ago by Owen and Packer (1994, Heredity 72:219-227), their methods have either been ignored or not understood by various authors. The result is a mishmash of ways in which the proportion of diploid males in a population are reported. Thus, it is difficult to compare populations and species, but more disturbing is that the lack of understanding of basic statistics has led some authors to make statements that are not supported by their own data. Here I (1) review and clarify the theory for estimating the proportion of diploid males in populations of Hymenoptera using multiple microsatellite loci, (2) reanalyse data from papers recording diploid males in euglossine bees where there is disagreement over the results, and opinions have been expressed that allozyme data are unreliable. My analysis allows comparison of estimates across populations and species in a standard format, and leads to considerable reconciliation between the divergent estimates of diploid male frequencies in euglossines.

3:45 PM Wild bees of Manitoba: there's more than you may think

Jason Gibbs (he/him), Associate Professor, University of Manitoba
Twitter: @dialictus Instagram: n/a Recording Status: Yes
Co-Authors: Emily Hanuschuk, Canadian Grain Commission; Reid Miller; Melanie Dubois, AAFC-Brandon; Massimo Martini; Steve Robinson; Phoenix Nakagawa; Cory Sheffield, Royal Saskatchewan Museum; Sophie Cardinal, AAFC-Canadian National Collection; Thomas Onuferko, Canad

Abstract: 390 species / morphospecies are recorded for Manitoba, which is 153 more species than reported in 2015 (a 63% increase) and includes five new generic records since 2015 (*Ashmeadiella, Brachymelecta, Eucera, Neolarra,* and *Triepeolus*). 11 records are new for Canada: *Brachymelecta interrupta* (Cresson 1872), *Calliopsis (Nomadopsis) australior* Cockerell 1897, *Perdita (Perdita) tridentata* Stevens 1919, *Diadasia (Dasiapis) ochracea* (Cockerell 1903), *Melissodes bidentis* Cockerell 1914, *Nomada crawfordi crawfordi* Cockerell 1905, *Nomada fuscicincta* Swenk 1915, *Nomada sphaerogaster* Cockerell 1903, *Nomada xantholepis* Cockerell 1911, *Coelioxys (Xerocoelioxys) nodis* Baker 1975, and *Megachile (Megachiloides) dakotensis* Mitchell 1926. We remove 13 species from the list of Manitoba bees. We propose that *Nomada alpha paralpha* Cockerell 1921 and *N. alpha dialpha* Cockerell 1921 are junior synonyms of *N. alpha* Cockerell 1905. *Nomada arenicola* Swenk 1912 is considered a junior synonym of *N. fervida* Smith 1854. *Protandrena albertensis* (Cockerell) and *Neolarra mallochi* (Crawford) are recognized as a valid species.

4:00 PM Minnesota Statewide Bee Survey

Jessica Petersen (she/her), Invertebrate Ecologist, Minnesota Department of Natural Resources
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Nicole Gerjets, Gerda Nordquist

Abstract: Bees are incredibly diverse and provide important ecological services such as pollination. However, baseline information such as faunistic surveys and habitat associations are lacking for most

bee species in Minnesota. The goal of this project was to document the bee diversity in the state to inform conservation decisions. The bee diversity in Minnesota was largely undescribed prior to investments in this project. We began the statewide bee survey in 2015 and are wrapping up field work this year having sampled in all Minnesota counties. Field surveys consisted of passive trapping including pan trapping, Malaise traps, and blue vane traps, and hand netting from flowers during meandering walks and standardized plot monitoring. Sampling thus far has resulted in more than 50,000 specimens collected resulting in over 250 total species identified from these surveys. We will present challenges and solutions with completing a statewide survey of bees, new and expanded state and county records, and a vision for future bee surveys and monitoring in Minnesota.

4:15 PM Bee$Pay: Calculating honey bee stocking rates for lowbush blueberry and almonds
Richard E.L. (Dick) Rogers (he/him), Entomologist / Science Communicator, Bayer | Crop Science
Twitter: @wildwoodlabs Instagram: n/a Recording Status: Yes
Co-Authors: Stephen House, California Almond Pollination Service, Inc

Abstract: How many honey bee colonies are needed to pollinate a crop? This is a question that is frequently asked, but the answer has been elusive. Traditionally, the number of colonies recommended for a particular crop has been determined by trial and error, which is supported by experience. Also, intuition, the same number as previous years, and pure guesswork. Over the past 3 to 5 decades, the stocking rates for colonies of honey bees needed to pollinate lowbush blueberry and almonds has ranged from 5 to 25 colonies per hectare (2 to 10 col/ac) with the typical recommendation being closer to 5 col/ha (2 col/ac). The problem is that the optimal pollination of a crop requires an optimal stocking rate that takes into account an abundance of ecological parameters such as available flight hours, pollen availability, pollen viability and compatibility, number of honey bees and other pollinators working the crop, among others. This presentation will present the parameters needed to calculate honey bee stocking rates for lowbush blueberry in eastern Canada, and for almonds in California. Sample calculations will be examined and preliminary cost-benefit analyses will be discussed.

4:30 PM A Decade of WPC's Bumble Bee Recovery Program: Annual Surveys
Tiffani Harrison (she/her), Ontario Progam Coordinator- Native Pollinator Initiative, Wildlife Preservation Canada
Twitter: @WPCWild911 Instagram: @wildlife_preservation_canada Recording Status: Private
Co-Authors: Sarah MacKell

Abstract: With current declines, long-term bumble bee population monitoring is crucial. One major component of Wildlife Preservation Canada's Bumble Bee Recovery Program is conducting annual bumble bee population surveys across Ontario. These surveys focus on locating declining species, especially the Special Concern yellow-banded bumble bee and the Endangered rusty-patched bumble bee (which hasn't been found in Canada since 2009). This program has been running since 2013 and this talk will summarize WPC's decade of survey data that was collected at over 450 sites and include over 25,000 Bombus records and observation of 20 species.

4:45 PM An enduring aesthetic appreciation of bees in art and culture through the ages
Kit Prendergast (pronouns not provided), Bee ecologist, None
Twitter: @BeeBabette Instagram: @bee.babette_performer Recording Status: Yes
Co-Authors: Jair E Garcia, Scarlett Howard, Zong-Xin Ren, Stuart McFarlane, Adrian G Dyer

Abstract: Bees have been making headlines in recent times due to concerns over a pollinator crisis, but how have humans considered bees throughout time? Using a bioaesthetics approach, we looks at how bees have featured in human artforms. It is evident that humans have a long-standing appreciation of bees, from the earliest records of human representations in cave art over 8,000 years old through to ancient Egyptian carvings of bees and hieroglyphics, where humanity's relationship with bees primarily stemmed from benefits of honey, wax, and crop pollination. Yet this relationship frequently linked to spiritual representations in different parts of the world from Australia to Europe, South America and Asia. Art mediums included the visual and musical. In modern times, artistic representations extend to installation arts, mixed-media, and the moving image. Through examining the diverse inclusion of bees in human culture and art, we show that there are links between the functional benefits of associating with bees, which has led to an aesthetic appreciation of these creatures. Our work reveals bees have long played an important role in human society as pollinators, sources of nutrition, as well as artistic inspirations and muses. Today, with many species under threat, there has never been a more important time to understand and communicate about bees.

5:00 PM Wrap-up (Virtual)
Centre for Bee Ecology, Evolution and Conservation, York University
Twitter: @BeesYork Instagram: @BeesAtYork Recording Status: No
Co-Authors: n/a

Day 2 - Friday, October 14, 2022 Hybrid: Virtual and In-Person (LSB 105, York U)
(all times Eastern, i.e. Toronto/New York)

8:30 AM Arrival and Networking (In-Person, with Refreshments)

9:00 AM Welcome to Day 2 of BeeCon 2022!
Centre for Bee Ecology, Evolution and Conservation, York University
Twitter: @BeesYork Instagram: @BeesAtYork Recording Status: Yes
Co-Authors: n/a

9:15 AM Urbanization effects on wild bee community assemblages and plant interactions
Anthony Ayers (pronouns not provided), PhD Biology, York University
Twitter: @beekind2thebugs Instagram: @rembr.ant Recording Status: Yes
Co-Authors: n/a

Abstract: Urbanization is a major anthropogenic activity associated with environmental degradation and destruction, contributing to species declines across multiple taxa including bees. To determine how bee community composition and plant-pollinator interactions are affected by urbanization, twenty-nine sites representing three urban categories (high, medium, and low urbanization) were monitored from May through September in Toronto, Canada. Bees were collected passively and actively so that later analyses comparing community structure and plant-pollinator networks between urban categories could be performed, respectively. Functional traits such as lecty, behaviour, nesting substrate, and native or invasive status were also recorded for species to examine whether such traits contribute to bee community assemblages. In total, 5447 bees, comprising 26 genera and 163 species, were represented. The urban landscape was largely supported by ground-nesting and generalist species. Such functional traits could be explained by urban landscape characteristics such as tree cover and impervious surface. Wild bee fauna and plant-pollinator networks remained consistent along the urban gradient with the exception of a few floral host plants dominating interactions in certain urban contexts. These results aim

to broaden current understandings of urban bee ecology and influence urban policy decisions targeting pollinator conservation and informing ongoing efforts to restore wildlife habitats.

9:30 AM Impacts of systemic insecticide exposure on the movement ecology of bumble bee queens
Amanda Liczner (she/her), Postdoctoral fellow, University of Guelph
Twitter: @aliczner Instagram: @bumblebeehaviour Recording Status: Yes
Co-Authors: Elizabeth L. Franklin, Nigel E. Raine

Abstract: While foraging bumble bees can be exposed to insecticides, such as neonicotinoids, which have previously been shown to have sublethal effects. This has resulted in increased regulation of neonicotinoid use. However, a new class of insecticides that are poised to replace neonicotinoids may also have negative impacts on pollinators. While diamides have lower toxicity than neonicotinoids, they impact insect musculature that could have effects on bumble bee flight performance. Here we tested the impacts of exposure to each of these insecticide classes on bumble bee queen movement using active radio-tracking. We found no difference in flight performance metrics between control and pesticide treated queens, however, behavioural differences were observed. Control queens spent more time resting while both pesticide treatments spent more time foraging and were found in different land cover classes with neonicotinoid- and diamide-exposed queens behaving similarly. Although differing in toxicity, our findings demonstrate similar levels of impaired bumble bee behaviour when exposed to neonicotinoids or diamides that could limit their effectiveness as pollinators, ability to find a mate, or likelihood of overwintering survival. Our study describes the first relationship between an increasingly popular pesticide and pollinator flight behaviour with important implications for sustainable agriculture and biological conservation.

9:45 AM The nuances of neonicotinoids effect on cognition in honey bees
Nadejda Tsvetkov (pronouns not provided), Postdoctoral Fellow, University of British Columbia
Twitter: @nadiatsvet Instagram: n/a Recording Status: No
Co-Authors: Leonard J. Foster

Abstract: It is commonly reported that neonicotinoids affect honey bees' learning and memory. However, many of the studies fail to consider the bees' sugar responsiveness - a well documented behavior known to impact learning and memory. In our study, we exposed honey bee workers to a chronic dose of clothianidin, a neonicotinoid. We then measured sugar responsiveness and learning and memory using the Proboscis Extension Response. We found that clothianidin exposed honey bees had lower sugar responsiveness and the same learning and memory as unexposed bees. We then performed a proteomic analysis in order to determine the changes the bee brains underwent as a result of clothianidin exposure.

10:00 AM Molecular machinery of honey bee (*Apis mellifera*) detoxification systems: neonicotinoids versus traditional pesticides
Aidan Jamieson (he/him), MSc Student, York University
Twitter: n/a Instagram: n/a Recording Status: No
Co-Authors: Mateus Pepinelli, Laura R. Newburn, Amro Zayed

Abstract: Pollination is a vital ecosystem service as it is key for the reproduction of flowering plants, including important agricultural crops. The eusocial western honey bee, *Apis mellifera*, is the only honey bee in North America and is the most used managed pollinator in the world. In Canada, honey bees contribute $3.97 to $5.5 billion to the national economy each year via their pollination services.

Unfortunately, honey bees are susceptible to a wide range of interacting stressors, including chemicals used in agriculture. Many agrochemicals are systemic in the environment and can affect off-target organisms. Canadian beekeepers have been losing more than a quarter of their colonies annually since 2006. The use and overuse of agrochemicals are hypothesized to have played a role in increasing rates of colony mortality in Canada and across the globe. It can be difficult to disentangle and identify specific stressors that affect a particular colony. Therefore, research is needed to understand how agrochemicals affect honey bees on the molecular and genetic level. Here, I explored the gene expression signatures associated with exposure to various agrochemicals in honey bees. By investigating which genes are differentially regulated in response to exposure, my research sheds light on the honey bee's detoxification system and how it responds to different types of agrochemicals.

10:15 AM Effects of urban land use gradients on the wild bee microbiome
Phuong (Cindy) Nguyen (she/her), MSc Student, York University
Twitter: @CindyPNguyen Instagram: n/a Recording Status: Yes
Co-Authors: Sandra Rehan

Abstract: Bees and their microbes interact in complex networks that allow bees to benefit from symbioses with bacteria and fungi. Microbial composition and abundance affect bee health through immunity, nutrition, and fitness. In everchanging landscapes of urban cities, land use development changes bee habitats and floral resource availability, thus altering the sources of microbes that bees need to establish their microbiome. We implemented metabarcoding of the 16S and ITS regions to characterize the diversity and composition of the bacterial and fungal microbiome in Ceratina calcarata, a small carpenter bee, across urban land use gradients. By categorizing percent land use development, percent green space, annual precipitation, and annual temperature as indicators for urbanization across Toronto, we found that such land use variables can predict microbial diversity. Microbial composition also varied across urban land use gradients, with certain taxa exclusive to rural or urban areas. Environmental features may also lead to different microbe interactions, as co-occurrences between bacteria and fungi varied across urbanization gradients. As surrounding landscapes change the microbial landscape in wild bees and alter the holobiont, urban centres should consider the impact of growing cities on their pollinators' health and protect wild bees from the effects of anthropogenic activities.

10:30 AM The brain-gut axis of honey bees: Testing how microbiota affect individual and collective behavior
Anna Chernyshova (pronouns not provided), PhD, Western University
Twitter: n/a Instagram: n/a Recording Status: Yes
Co-Authors: Brendan A Daisley, Andrew P Pitek, Jeremy P Burton, Graham J Thompson

Abstract: The holobiont theory of evolution depicts the individual as deeply symbiotic with its gut microbes, which may influence host metabolism, immunity, and behaviour via signaling from the gut to the brain. This gut-brain axis takes on added complexity for social taxa, since individual behaviour can scale-up to affect the entire colony. Here, we use the Western honey bee (*Apis mellifera*) as a model to study how gut microbiota composition influence individual and social behaviour. Through a series of integrated field assays, we manipulate the bee brain-gut axis to measure how antibiotic depletion or probiotic enrichment of core worker gut fauna affect a bee's hygienic, defensive, foraging and recruitment behaviours. So far, we have observed a wide variety of changes consistent with a brain-gut axis that can alter individual as well as colony-level behaviours, potentially through immune modulatory pathways. We plan to further evaluate the functionality of this axis via 16S rRNA bacterial gene amplicon sequencing and histochemical staining of individual bee brains. Our findings should provide a test of the

brain-gut axis in a highly social insect, and thus advance the brain-gut axis framework from its current focus on individuals into the realm of higher-order social interactions.

10:45 AM Morning Networking (In-Person, with Refreshments)

11:15 AM Museomics: a powerful tool to understand wild bees' genetic responses to climate and land use change

Sandara Brasil (she/her), Postdoctoral fellow, York University
Twitter: @sandarab Instagram: n/a Recording Status: Yes
Co-Authors: Sandra Rehan

Abstract: Climate change and human-altered habitats are currently major threats to biodiversity, affecting organisms' permanence by modifying their habitat, and acting as potential drivers of species decline. As genetic responses take time to be detected, becoming highly impractical, the use of historic DNA becomes an essential source for identifying species under threat. Museomics is the study of DNA acquired from museum specimens and is an effective way to understand how populations are affected by human and climate factors from a historic perspective. We investigated genetic changes in wild populations of two small carpenter bee species (*Ceratina calcarata* and *C. dupla*) across 50 years. We compared recent populations to museum specimens to determine changes in genetic diversity, population structure, and signatures of selection. Both species displayed reduced genetic diversity and effective population size over time. We found signatures of selection in genes related to biochemical defense, insecticide, and thermal tolerance, which are consistent with the observed increase in agricultural land use development and rising temperatures over the past 50 years. Our study suggests that these species are facing population inbreeding, possibly attributable to human land-use change and agrochemicals in their environment, and highlights the use of museomics to understand threats to populations.

11:30 AM Regulatory changes underly the transition from solitary to social behavior in *C. calcarata*

Dova Brenman-Suttner (she/her), PhD Candidate, York University
Twitter: n/a Instagram: n/a Recording Status: No
Co-Authors: Sandra Rehan, Amro Zayed

Abstract: Studies investigating social evolution often utilize species that are already eusocial, where presumably all of the adaptive genetic changes associated with sociality have already been completed. To fully understand eusociality, we must study species with incipient stages of social behaviour. The small carpenter bee *Ceratina calcarata* is an ideal model for studying the genetics and molecular biology of eusocial evolution as they can exhibit both subsocial behavior with parental care as well as social behavior with the help of the altruistic dwarf eldest daughter. Here, we sequenced the genomes of subsocial and social *C. calcarata* to identify mutations and genes associated with social behaviour and used this data to test several hypotheses related to the evolution of eusociality. We found that many genes associated with social behavior in *C. calcarata* were involved in the regulation of gene expression and were members of conserved genetic pathways such as those involved in the regulation of lifespan and reproduction. Many of these genes were also found to significantly overlap with previous studies of differentially expressed genes found in the brains of *C. calcarata* associated with behavioral states (foraging and guarding behaviour) and with daughters in early autumn. These results are consistent with both the genetic toolkit hypothesis as well as the ovarian ground plan hypothesis of eusocial evolution. Our findings clearly indicate that the earliest stages of social evolution leverage existing regulatory genes and gene networks to generate new phenotypes associated with sociality.

11:45 AM Is the mutation rate different in bees with varying lifespans?
Clement Kent (he/him), adjunct professor, Dept of Biology, York U
Twitter: n/a Instagram: n/a Recording Status: Private
Co-Authors: n/a

Abstract: A recent paper noted differing genome AT/GC content in various Hymenopterans and suggested it could be due to higher mutation rates in eusocial colonies where the queen(s) have longer lifetimes. I will present genomic and population genetic data examining this suggestion.

12:00 PM No evidence of environmental filtering of solitary cavity-nesting solitary bees and wasps via urbanization
Garland Xie (he/him), PhD Candidate, University of Toronto Scarborough
Twitter: @garlandxie Instagram: n/a Recording Status: Yes
Co-Authors: Nicholas Sookhan, Kelly A. Carscadden, J. Scott MacIvor

Abstract: Spatial patterns in biodiversity are used to establish conservation priorities and ecosystem management plans. The environmental filtering of communities along urbanization gradients has been used to explain biodiversity patterns but demonstrating filtering requires precise statistical tests to link suboptimal environments at one end of a gradient to lower population sizes via ecological traits. Here we employ a three-part framework on observational community data to test: I) for trait clustering (i.e., phenotypic similarities among co-occurring species) by comparing trait diversity to null expectations, II) if trait clustering is correlated with an urbanization gradient, and III) if species' traits relate to environmental conditions. If all criteria are met, then there is evidence that urbanization is filtering communities based on their traits. We use a community of 46 solitary cavity-nesting bee and wasp species sampled across Toronto, a large metropolitan city, over three years to test these hypotheses. None of the criteria were met, so we did not have evidence for environmental filtering. We emphasize that changes in the prevalence of different traits across urban gradients without corresponding changes in trait diversity with urbanization, do not constitute environmental filtering.

12:15 PM Dominance hierarchy formation and maintenance in a facultatively social bee species (*Xylocopa virginica*)
James Mesich (he/him), MSc Student, Brock University
Twitter: @MesichJames Instagram: n/a Recording Status: Yes
Co-Authors: Miriam Richards

Abstract: Being dominant is important for increasing an individual's fitness in social contests. For many model organisms, dominant individuals are the most aggressive, however this has not been studied in the Eastern carpenter bee (*Xylocopa virginica*). *X. virginica* is a facultatively social species who display linear dominance hierarchies with high reproductive and ergonomic skew towards dominant females, meaning dominants have greater reproductive success than subordinates. To test if *X. virginica* follow this well-established trend of dominants being more aggressive, I used circle tube assays to compare levels of aggressive behaviours in dyads of unfamiliar socially dominant and subordinate females. It was found that aggressive behaviours were not more likely in dyads consisting of two dominant females compared to dyads with two subordinates or with one dominant and one subordinate female. Rather than the most aggressive females becoming dominant, it appears that other factors that are more important for this species. *X. virginica* are known to spend time early in their foraging season feeding, often unrelated, nestmates. Given the lack of aggression displayed by dominant females it is possible

that females are relying on bribery to gain advantage, using their innate skills and foraging ability instead of aggression to become dominant.

12:30 PM Honey bee exposure to multi-stressor landscapes
Sarah French (she/her), Postdoctoral fellow, York University
Twitter: @SK_French Instagram: n/a Recording Status: No
Co-Authors: Amro Zayed, BeeCSI Consortium

Abstract: Managed honey bees are important pollinators of crops in agricultural systems but are exposed to multiple stressors in-hive and in surrounding landscapes. Honey bees are vulnerable to an array of parasites, diseases, viruses, and pesticides. These stressors can act individually or interact to cause honey bee mortality and colony loss. Determining the prevalence and co-occurrence of honey bee stressors is vital for managing honey bee and colony health within and across agricultural regions. In order to identify crop-specific stressors of honey bees, experimental colonies were exposed to several focal crops located across Canada. The colonies were positioned either near to or far from the focal crop to assess whether proximity to crop impacted exposure to stressors. The colonies were sampled for stressors before, during, and after exposure to crops during a growing season. Our results indicate that a number of stressors co-occurred across regions. Stressor prevalence depended greatly on the timing of exposure to focal crops but not proximity to crops. Our results, coupled with ongoing experimental manipulations of these stressors, will inform beekeepers and policymakers on how best to monitor and regulate environmental stressors to sustain healthy honey bee colonies for Canadian agricultural production.

12:45 PM Closing Comments
Centre for Bee Ecology, Evolution and Conservation, York University
Twitter: @BeesYork Instagram: @BeesAtYork Recording Status: No
Co-Authors: n/a

1:00 PM Lunch and Networking (In-Person, with Refreshments)

That's It For BeeCon 2022!
If you have any feedback on this event, please contact Victoria at beec@yorku.ca. We hope that you enjoyed BeeCon 2022 and will join us again in the future. Visit us online at https://www.yorku.ca/bees/.

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