Entomological Society of British Columbia

2023 Conference and AGM Program

September 15 – 16, 2023

Thompson Rivers University

Kamloops, B.C.

Insects: the environmental heartbeat.

Friday, September 15th

8:15am – 8:30am	**Welcome** – Lorraine Maclauchlan, ESBC President
8:30am – 9:00am ***Introduction**, Rob McGregor*	**Plenary speaker:** Dr. Michelle Tseng, Assistant Professor in the departments of Botany and Zoology and the Biodiversity Research Centre, University of British Columbia. "Climate, conservation, and collaboration: insect ecology in a time of rapid environmental change."
	Dr. Michelle Tseng is an Assistant Professor in the departments of Botany and Zoology and the Biodiversity Research Centre at the University of British Columbia, Vancouver campus. Her lab group investigates the responses of insect and plankton communities to climate and habitat change. Current research being led by her graduate students include studies related to how plant preferences of urban gardeners shape pollinator diversity in cities; movement, microplastics, and species interactions in the mosquito *Culex pipiens*; and understanding the broad ecological effects of microplastic pollution in zooplankton and fish in British Columbia. *Photo credit to Marie Rieseberg.*
9:00am – 10:00am	**Ph.D. presentations**
9:00am - 9:15am ***Moderator**, Rob McGregor*	Asim Renyard, Simon Fraser University. Do the locomotion: Bimodal alarm signals of Western carpenter ants alter locomotory responses of nestmates.
9:15am – 9:30am	Matt Tsuruda, University of British Columbia. Farmland diversification practices support beneficial predaceous insects but also provide resources for an invasive insect pest.
9:30am - 9:45am	Emmanuel Hung, Simon Fraser University. Investigating the relative importance of reflective intensity, colour, and polarization of light for stable fly attraction.
9:45am -10:00am	Sam Meraj, Simon Fraser University. Functional Insights into Prolixicin: Its Expression and Efficacy as an Antimicrobial Peptide in Bed Bugs.
10:00am -10:30am	**Break**
10:30am -12:00pm	**M.Sc. presentations**
10:30am – 10:45am ***Moderator**, Juli Carrillo*	Saif Nayani, Simon Fraser University. Bovine mastitis, *Staphylococcus aureus* and stable flies: Evidence for a (not so positive) positive feedback loop.

Friday, September 15th (*continued*)

10:45am – 11:00am	Kelly Wang, University of British Columbia, Vancouver; Agriculture and Agri-Food Canada. Historical trends in cranberry pest populations and their dependence on key climate variables.
11:00am – 11:15am	Hannah Anderson, University of British Columbia, Vancouver. Not just the birds and the bees: Nocturnal moth pollination in agroecosystems.
11:15am – 11:30am	Andres Mancera Barreto, Agriculture and Agri-Food Canada; University of British Columbia Okanagan Campus. The rise of weevil: Abundance and phenology of *Bangasternus fausti* and *Larinus minutus* in the Okanagan Valley of British Columbia.
11:30am – 11:45am	Claire Gooding, Simon Fraser University. Ticks utilize a saprophytic fungus to identify suitable resting sites.
11:45am – 12:00pm	Daphne Chevalier, University of British Columbia, Vancouver. Lights, camera, attraction? Changes in predator-prey activity due to artificial light at night.
12:00pm – 12:55pm	**Lunch Provided**
12:55pm – 1:00pm	**Introduction of afternoon session** – Lorraine Maclauchlan
1:00pm – 1:30pm ***Introduction**, Lorraine Maclauchlan*	**Plenary speaker:** Dr. Celia Boone, P.Ag., BC Ministry of Forests, Skeena Region. "Bark Beetles and the Cycle of Life of Conifer Forests"

Dr. Celia Boone has an BSc and MSc in agricultural/forest pest management (Dalhousie University, Nova Scotia) and a PhD in Entomology (University of Wisconsin-Madison). She has international research experience in bark beetle ecology, population genetics, natural disturbance regimes, invasive species, and species at risk. She was the Provincial Forest Entomologist in Nova Scotia prior to becoming the Skeena Region Forest Entomologist.

Friday, September 15th (*continued*)

1:30pm – 3:00pm	**Undergraduate presentations**
1:30pm – 1:45pm ***Moderator**, Michelle Franklin*	Charlotte Pinard, Simon Fraser University. Blacklegged ticks, *Ixodes scapularis*, reduce predation risk by eavesdropping on ant alarm communication.
1:45pm – 2:00pm	Solène Boisclair-Joly, University of Victoria; Agriculture and Agri-Food Canada, Agassiz Research and Development Centre. Canadian agricultural pests and their natural enemies: first steps in compiling a compendium of VIPs (Very Important Parasitoids).
2:00pm – 2:15pm	Anya Gould, Simon Fraser University. Characterizing the stable fly, *Stomoxys calcitrans*, multi-modal host-seeking cue complex.
2:15pm – 2:30pm	Eva Burghardt, University of British Columbia, Vancouver, PIEE Lab. From Detestable to Protectable: Childhood Curriculum on Insect Conservation.
2:30pm – 2:45pm	Phillip Phung, Simon Fraser University. Stable fly, *Stomoxys calcitrans*, larvae exhibit positive chemotaxis towards ammonia using gradient-guided olfaction.
2:45pm – 3:00pm	Nicholas Hivon, University of British Columbia Okanagan Campus; Agriculture and Agri-Food Canada. The presence and abundance of *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae) along an elevational gradient in the Okanagan Valley of British Columbia.
3:00 – 3:15pm	**Break**
3:15pm – 3:30pm ***Moderator**, Adam Blake*	Augustus Negraeff, Simon Fraser University. The presence of flies increases the attractiveness of objects to host-seeking stable flies, *Stomoxys calcitrans*.
3:30pm – 3:45pm	Alexandra Gregg, Simon Fraser University. Specialism is not Specialism: Quantifying Multiple Axes in Niche Specialism in Canadian Butterflies Across Species and Space.

Friday, September 15th (*continued*)

3:45pm – 4:00pm	Jacob McPherson, Agriculture and Agri-Food Canada; Simon Fraser University. Understanding aphid mediated virus transmission in highbush Blueberry in British Columbia.
4:00pm – 4:15pm	Cassandra Merkens and Nicole Dziekciowski, Agriculture and Agri-Food Canada; AAC. Dispersal of three *Limonius* pest click beetle species on agricultural land.
4:15pm – 4:30pm	Sophie Hennig, Simon Fraser University. Investigating the effects of blowfly 'fly factor' microbe-derived odor on stable fly oviposition.
4:30pm	**Conclusion Day 1**

5:30pm gathering 	The Noble Pig – a brew pub in downtown Kamloops. Located at 650 Victoria Street, Kamloops Meet at The Noble Pig for appetizers, beverages and good conversation. Some snacks & beverages will be provided, and you can also order additional food from the menu.

Saturday, September 16th

8:30am – 8:45am	**Good morning –** overview of Day 2. *Lorraine Maclauchlan*
8:45am – 10:00am	**Scientist presentations**
8:45am - 9:00am ***Moderator**, Rob Higgins*	Jennifer Heron, BC Ministry of Water, Land and Resource Stewardship. BC's Community Bumble Bee Project.
9:00am – 9:15am	Dr. Imran Ahmed, Effective control and prevention of Dengue (*Aedes aegypti*) vector from *Citrullus colocynthis*, *Datura stramonium* and *Azadirachta indica* plant extracts through ether.
9:15am – 9:30am	Michelle Franklin, Agriculture and Agri-Food Canada. Examining the efficacy of chemical controls for the management of the invasive strawberry blossom weevil, *Anthonomus rubi* in raspberries.
9:30am – 9:45am	Adam Blake, University of Washington. Interplay of visual and olfactory coupling in mosquitos.
9:45am – 10:00am	Jorge Macias, Synergy Semiochemicals Corporation. Preliminary results from a survey of forest coleoptera at the Burns Bog Ecological Conservancy Area.
10:00am – 10:15am	Tracy Hueppelsheuser, British Columbia Ministry of Agriculture and Food. Japanese Beetle (*Popillia japonica*) in British Columbia: Progress Towards Eradication.
10:15am – 11:30am	**AGM and presentation of awards**
11:30am	**Adjourn and safe travels home.**

Entomological Society of British Columbia Awards

James Grant Award

The James Grant Award is given to the best MSc presentation. This award is sponsored by the North Okanagan Naturalist Club and memorializes their founder and first president.

Dexter Johnson Award in Insect Ecology

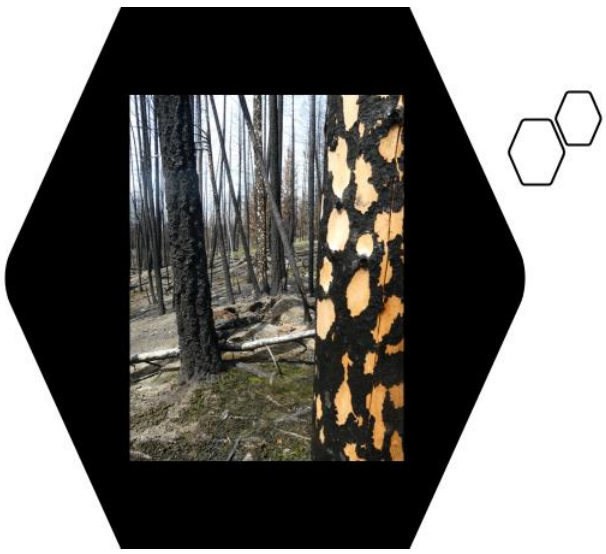
This is an **annual award** (kindly sponsored by Professor Dan Johnson) that recognizes the best manuscript submitted in any peer-reviewed journal by a student in the field of insect ecology. The award is open to all students (membership in the ESBC is not necessary).

Graduate Student Scholarship Competition

The Entomological Society of British Columbia awards annually a scholarship of $1000 to up to two postgraduate students to encourage students engaged in entomological research in B.C.

NEW ESBC Legacy Award

The Legacy Award recognizes B.C. entomologists that have made outstanding contributions to their discipline of entomology throughout their career. This award acknowledges their significant contributions in research, mentoring, teaching, extension, innovation, pest management and volunteer activities in the ESBC and other societies and organizations.



2023 ESBC AGM

"Insects: the Environmental Heartbeat"

List of presenters, co-authors and abstracts

Plenary speakers

Dr. Michelle Tseng, Assistant Professor in the departments of Botany and Zoology and the Biodiversity Research Centre, University of British Columbia.

Title: "Climate, conservation, and collaboration: insect ecology in a time of rapid environmental change."

Dr. Michelle Tseng is an Assistant Professor in the departments of Botany and Zoology and the Biodiversity Research Centre at the University of British Columbia, Vancouver campus. Her lab group investigates the responses of insect and plankton communities to climate and habitat change. Current research being led by her graduate students include studies related to how plant preferences of urban gardeners shape pollinator diversity in cities; movement, microplastics, and species interactions in the mosquito *Culex pipiens*; and understanding the broad ecological effects of microplastic pollution in zooplankton and fish in British Columbia. *Photo credit to Marie Rieseberg.*

Abstract: In this presentation I will discuss multiple ways that warming temperatures are affecting insect form and function, and I will touch on some recent work related to Lepidoptera conservation in BC. Our research team has documented that warming temperatures alter insect body size, flight potential, and colouration. With respect to conservation, I will share results from our most recent study investigating the suitability of urban street trees as host plants for native Lepidoptera. I'll end by highlighting some incredible butterfly monitoring work that is being led by volunteers throughout the province.

Dr. Celia Boone, P.Ag., BC Ministry of Forests, Skeena Region.

Title: "Bark Beetles and the Cycle of Life of Conifer Forests."

Dr. Celia Boone has an BSc and MSc in agricultural/forest pest management (Dalhousie University, Nova Scotia) and a PhD in Entomology (University of Wisconsin-Madison). She has international research experience in bark beetle ecology, population genetics, natural disturbance regimes, invasive species, and species at risk. She was the Provincial Forest Entomologist in Nova Scotia prior to becoming the Skeena Region Forest Entomologist.

Abstract: British Columbia is rich in ecosystem diversity. This is particularly exemplified in the forested landscape across the entire province, from manicured urban forests and managed timber stands to the pristine boreal and rainforests. The entomofauna is correspondingly diverse and integral to forest ecosystem function. While insects have intricate associations with their environment, our relationship with insects is more complicated and vacillates when at odds with human expectations. With climate change and the expanding global economy, what we acknowledge as natural ecosystem patterns and processes, including insect population dynamics, are under increasing and often unpredictable pressures. How we identify, assess, predict, and respond to these pressures will ultimately shape our forests in the future. Among many factors affecting forest ecosystems, British Columbia has a noteworthy legacy with a suite of bark beetle species, and their impacts are well documented. This history and lessons learned, partnered with innovative science, presents a model for the development of strategic ecosystem management approaches aimed at sustaining the diversity and complexity necessary for resilient forests.

Ph.D. presentations

Asim Renyard, Simon Fraser University; Regine Gries (SFU); Gerhard Gries (SFU).

Title: Do the locomotion: Bimodal alarm signals of Western carpenter ants alter locomotory responses of nestmates.

Abstract: When threatened, many social insects produce alarm signals that alert and recruit nestmates. Ants commonly communicate distress using both pheromonal and vibratory signals. We have previously shown that distressed Western carpenter ants, *Camponotus modoc*, emit alarm pheromone that attracts nestmates and that their drumming on substrate generates vibrations that prompt their nestmates to freeze. Here, we tested the hypothesis that pheromonal and vibratory signals in combination elicit the strongest and fastest alarm response from nestmates. To test this hypothesis, we video-recorded the behavior of groups of ants on wood veneer in response to (i) synthetic alarm pheromone, (ii) laser-guided play-back recordings of vibratory signals, or (iii) pheromonal and vibratory signals in combination. The bimodal signals did not enhance attraction of nestmates but they altered the freezing response and running speed of nestmates. Freezing behaviour is likely adaptive in the context of predator avoidance because ant movement provides a strong visual cue for predators whereas higher running speed would allow ants to flee dangerous scenarios.

Matt Tsuruda, University of British Columbia; Martina Clausen (UBC); Claire Kremen (UBC); Drew Bondar (Delta Farmland and Wildlife Trust); Juli Carrillo (UBC).

Title: Farmland diversification practices support beneficial predaceous insects but also provide resources for an invasive insect pest.

Abstract: The intensification of the agricultural industry has substantially reduced the proportion of natural habitat in and around agricultural ecosystems. Preservation and restoration of these habitats can increase the abundance and diversity of predaceous, natural enemy insects that play a key role in agricultural pest control. We evaluated the insect community responses to farmland diversification in the Lower Mainland Region of British Columbia across two growing seasons and four types of restored on-farm habitat (differently managed hedgerows and grassland set-asides). We sampled using several trapping techniques and identified to a taxonomic level where a functional guild could be assigned. Our analyses indicated that both ground-dwelling and insect-

vacuumed natural enemies were more overall abundant, but not, diverse, in grassland set-asides compared to unenhanced production fields. Hedgerows did not respond similarly, with no overall effect of hedgerows on predaceous or phytophagous insects. In more taxonomically resolved groups, grassland set-asides supported a more abundant and diverse community of beneficial carabid beetles, while hedgerows supported higher populations of the invasive berry pest *Drosophila suzukii*. These findings indicate the potential for non-crop habitat, especially grassland set-asides, to support diverse and abundant beneficial insect communities. However, careful management is necessary to prevent the inadvertent support of pests.

Emmanuel Hung, Simon Fraser University; Sophie Hennig (SFU); Miele McGowan (SFU); Sonali Timmath (SFU); Adam J. Blake (University of Washington); Gerhard Gries (SFU).

Title: Investigating the relative importance of reflective intensity, colour, and polarization of light for stable fly attraction.

Abstract: In previous studies, stable flies, *Stomoxys calcitrans*, were attracted to the visual cues of blue and black fabric, Alsynite panels, and white coroplast cards. This variety of attractive materials, and their seemingly context-dependent efficacy, have rendered the underlying mechanisms by which stable flies seek visual targets largely inconclusive. Multiple visual cues, such as radiance (intensity), wavelength (color), degree of linear polarization (DoLP), and angle of polarization (AoP) of reflected light, can each contribute to long-range attraction of foraging flies. The objective of our study was to identify the key visual characteristics which mediate stable fly host-foraging responses. In laboratory bioassays, we presented flies with test stimuli (filter stacks consisting of UV-visible light polarizers, light-diffusing cheesecloth, and light-absorbing black screens, transmitting specific LED-emitted wavebands) that differed in intensity, wavelength, DoLP, and AoP. Independent adjustments of single visual elements in a series of experiments, and comparisons of fly landing rates on test stimuli across experiments, allowed us to determine the relative effect size that each visual element contributed to the flies‘ foraging responses. All characteristics of visual targets play some role in host location and/or recognition but light intensity plays an essential role.

Sam Meraj, Simon Fraser University; Arshvir Singh Dhari, Emerson Mohr, Carl Lowenberger, Gerhard Gries (SFU).

Title: Functional Insights into Prolixicin: Its Expression and Efficacy as an Antimicrobial Peptide in Bed Bugs.

Abstract: In the study of the common bed bug, *Cimex lectularius*, a hematophagous ectoparasite that has not been proven to transmit human diseases in natural settings, we explore the insect's innate defense mechanisms. Specifically, we focus on the newly discovered prolixicin antimicrobial peptides (AMPs), which share strong homology with previously identified AMPs in other insect families such as kissing bugs. Our findings indicate that the expression of these prolixicin transcripts is significantly upregulated in the bed bugs' immune-related organs—specifically the midgut and the rest of the body—following exposure to Gram-positive (Gr+) *Bacillus subtilis* and Gram-negative (Gr–) *Escherichia coli* bacteria. Notably, we reveal for the first time a sex-specific and immunization mode-specific upregulation of these prolixicins in response to bacterial exposure. Further, our evidence suggests that these AMPs may be co-regulated by both the IMD and Toll immune regulatory pathways, underscoring the potential for inter-pathway communication in hemipteran immunity. This research enhances our understanding of host-pathogen interactions within bed bugs and offers potential explanations for their inability to

transmit pathogens to humans, thus presenting novel avenues for exploring innate immune responses.

M.Sc. presentations

Saif Nayani, Simon Fraser University; Sanam Meraj (SFU); Gerhard Gries (SFU).

Title: Bovine mastitis, *Staphylococcus aureus* and stable flies: Evidence for a (not so positive) positive feedback loop.

Abstract: *Staphylococcus aureus* is a causative agent of bovine mastitis, which causes significant animal suffering and productivity loss in the dairy industry. Stable flies, *Stomoxys calcitrans*, are major cattle pests known to be attracted to various bacteria in the cattle microbiome. If stable flies were to be attracted to *S. aureus* and able to transmit it from infected hosts to healthy hosts, then there would be a 'positive feedback loop' in which flies attack cows infected with *S. aureus*, and thereby worsen the infection and attract even more flies. Our objectives were to investigate whether stable flies (1) are attracted to *S. aureus*, and (2) transmit *S. aureus* from infected blood to sterile blood. When stable flies in laboratory experiments were offered a choice between strains of *S. aureus* grown on agar and blank agar controls, flies were significantly attracted to several *S. aureus* strains. When flies fed on bovine blood infected with *S. aureus* and subsequently fed on sterile blood, they infected the sterile blood. Our results support the concept of the 'positive feedback loop' and underscore the need for both effective management of stable flies in life stock production facilities and treatment for mastitis.

Kelly Wang, University of British Columbia, Vancouver; Juli Carrillo (Plant Insect Ecology and Evolution Lab, Faculty of Land and Food Systems, UBC); Michelle Franklin (Agriculture and Agri-Food Canada, Agassiz Research and Development Centre); Todd Kabaluk (Agriculture and Agri-Food Canada, Agassiz Research and Development Centre).

Title: Historical trends in cranberry pest populations and their dependence on key climate variables.

Abstract: British Columbia (BC) produces over $35 million annually in Canadian cranberries sales and relies on integrated pest management (IPM) to support these production levels. However, there is limited information on how weather affects long-term insect development and populations, which could help predict pest risks in cranberry fields. We are analyzing historical insect and weather records to understand the influence of climate on key lepidopteran cranberry pests over time within the lower mainland of BC. We will use temporal and spatial models to determine the association between weather variables and the timing of first insect emergence, number of generations, and timing to reach economic thresholds to initiate control measures. This research will inform future pest management practices, supporting the cranberry industry to respond quickly and proactively to mitigate pest risks effectively with changing weather patterns and providing a model for other crops with similar historical data.

Hannah Anderson, University of British Columbia; Eva Burghardt (UBC); Juli Carrillo (UBC).

Title: Not just the birds and the bees: Nocturnal moth pollination in agroecosystems.

Abstract: Agricultural crops are facing a pollination crisis, yet the bulk of current research is on daytime pollinators. Night-dwelling insects, specifically moths, are important pollinators for wild plants, but their pollination services for crops are underrecognized. Nocturnal moths are the most prominent and efficient nighttime pollinators – many plant species depend solely on nocturnal moths for reproduction. Emerging research suggests the critical, unsung contributions of nocturnal

pollinators to agriculture and stresses the urgency of investigating nocturnal pollination in crop systems. We sampled nocturnal moths during peak flowering season in fields of cultivated blueberry and strawberry crops. We looked for and identified pollen carried on each moth as an indication to the flowering plant species they had potentially pollinated. We identified moths to species and found an assemblage of nocturnal moths previously unknown to be pollinators carrying pollen from a variety of plant species including blueberry and strawberry crops. We provide further support to the importance of moths as pollinators and stress the need to include nocturnal insects in future pollination studies.

Andres Mancera Barreto, Agriculture and Agri-Food Canada; University of British Columbia Okanagan Campus; Tyler D. Nelson (AAFC); David J. Ensing (AAFC); Robert G. Lalonde (University of British Columbia Okanagan Campus); Nathan G. Earley (University of Victoria); Valerie Marshall (AAFC); Christine L. Cock (AAFC); Chandra E. Moffat (AAFC).

Title: The rise of weevil: Abundance and phenology of *Bangasternus fausti* and *Larinus minutus* in the Okanagan Valley of British Columbia.

Abstract: Classical biological control uses highly specialized natural enemies to control invasive pests. *Bangasternus fausti*, a biocontrol agent of diffuse knapweed (*Centaurea diffusa*), established in the USA following releases in the early 1990s. It was never released in Canada due to concern that it would compete with *Larinus minutus*, a successful agent of diffuse knapweed. However, *B. fausti* was detected in the Okanagan Valley of British Columbia in 2020. To understand the potential influence of adventive *B. fausti* on the successful biocontrol of knapweeds in Canada, we established seven study sites across a 1° latitudinal transect in the Okanagan. We monitored *B. fausti* and *L. minutus* populations at each site between April and November 2022 to document their adult phenological periods. We predicted (i) higher *B. fausti* abundance at southern latitudes due to presumed longer residence time since introduction, and (ii) an earlier peak in *B. fausti* abundance relative to *L. minutus*. We found (i) no significant relationship between *B. fausti* abundance and latitude, and (ii) earlier median abundance of *B. fausti*. Our study is the first step in clarifying the interactions between *B. fausti* and *L. minutus*, with important implications for knapweed biocontrol in BC.

Claire Gooding, Simon Fraser University; Layla Gould, Gerhard Gries (SFU).

Title: Ticks utilize a saprophytic fungus to identify suitable resting sites.

Abstract: Ticks are well known globally as blood-feeding parasites but despite this reputation, most ticks spend less than 10% of their lifespans interacting with hosts. Off-host ticks are highly susceptible to desiccation and must efficiently locate high humidity, low sunlight resting sites to survive. Furthermore, these microclimates provide oviposition sites and overwintering sites in addition to preventing desiccation. Despite the high importance of these habitats to tick survival, it is not known how ticks locate suitable microclimates nor what factors mediate arrestment behaviour off-host. Microclimates that support ticks are often also optimal for the growth of some fungi. Specific fungi and their associated metabolites may reliably predict micro-locations that are suitable as tick resting sites. In two-choice olfactometers, we tested the hypothesis that ticks preferentially settle on substrates colonized by a soil dwelling fungus. Our findings show that multiple tick species prefer substrate colonized by a fungus and that this behaviour appears to be mediated primarily by contact chemoreception. We propose that ticks evaluate the suitability of microclimates based off metabolites produced by fungi which thrive in high humidity, low sunlight environments.

Undergraduate presentations

Charlotte Pinard, Simon Fraser University; Claire Gooding (SFU); Regine Gries (SFU); Anand Devireddy (SFU); Gerhard Gries (SFU).

Title: Blacklegged ticks, *Ixodes scapularis*, reduce predation risk by eavesdropping on ant alarm communication.

Abstract: Blacklegged ticks, *Ixodes scapularis*, are obligatory blood feeders and transmit more disease-causing microbes than any other blood-feeding arthropod. Despite their reputation as blood-feeders, ticks spend most of their lifespan off hosts. Off-host ticks are highly susceptible to predation, particularly by ants, but the mechanisms underlying ant avoidance behavior have not yet been studied. Because foraging ants deposit semiochemicals to communicate with nestmates, and because blacklegged ticks have no defenses against ant predation, we tested the hypothesis that ticks avoid ant-frequented areas by sensing the ants' semiochemical deposits. In two-choice still-air olfactometers, we show that semiochemical deposits of thatching ants, *Formica rufa*, deter adult female and male blacklegged ticks. The deterrent semiochemicals originate from both the poison gland and Dufour's. Extracts of both glands combined, but not of either gland alone, proved deterrent to ticks. Additionally, we test synthetic gland extracts for potential future use in tick management.

Solène Boisclair-Joly, University of Victoria and Agriculture and Agri-Food Canada, Agassiz Research and Development Centre; José L. Fernández-Triana (AAFC, Ottawa Research and Development Centre, Ottawa); Paul K. Abram (AAFC, Agassiz Research and Development Centre, Agassiz); Michelle T. Franklin (AAFC, Agassiz Research and Development Centre, Agassiz).

Title: Canadian agricultural pests and their natural enemies: first steps in compiling a compendium of VIPs (Very Important Parasitoids).

Abstract: Parasitoids provide self-perpetuating control of insect pest populations, and so can be an important part of IPM programs. However, in Canada there is no centralized compendium of pests in economically important crops or the economically important parasitoids that attack them. Here, we detail the challenges of collating such a compendium, using Lepidoptera pests in berry crops (blackberry, blueberry, cranberry, haskap, raspberry, saskatoon and strawberry) across Canada and their braconid natural enemies as a pilot project for what is envisioned as a long-term undertaking. As a starting point, we provide a few examples of lepidopteran berry pests and their associated braconid parasitoids based on archived records. We also highlight the potential of such a compendium to provide insight into characteristics of our agricultural pests in Canada. For example, we examine differences in geographic range and host plant use between introduced and native lepidopteran pests. This project is the first step in developing a comprehensive compendium of VIPs (Very Important Parasitoids) associated with economically important insect pests in Canadian crops.

Anya Gould, Simon Fraser University; Emmanuel Hung (SFU); Miele McGowan (SFU); Gerhard Gries (SFU).

Title: Characterizing the stable fly, *Stomoxys calcitrans*, multi-modal host-seeking cue complex.

Abstract: As major blood-feeding pests of cattle, stable flies, *Stomoxys calcitrans*, utilize multiple sensory modalities to locate and recognize their cattle hosts. Previous research has demonstrated that host-seeking flies exploit visual, olfactory and moisture host cues for orientation towards, landing upon, and probing of vertebrate hosts. Although it was known that foraging stable flies

respond to a host cue complex, a comprehensive study characterizing the respective contributions and roles of each cue and sensory modality was lacking. In two-choice bioassays inside a greenhouse compartment, we presented starved stable flies with paired large barrels as surrogate hosts, representing various combinations of host cues. Current data indicate that visual cues coupled with select other cues synergistically attract flies and prompt landing on surrogate hosts. A complex of essential host cues could be developed to attract and capture stable flies.

Eva Burghardt, University of British Columbia, PIEE Lab.

Title: From Detestable to Protectable: Childhood Curriculum on Insect Conservation.

Abstract: Community conservation efforts and globalized data collection assisted by non-scientist participation are currently indispensable to the entomological community; as climate change continues to diminish insect abundance, diversity, and biomass, it also deepens the gaps in sampling data due to both geographic and taxonomic biases. Citizen science can help to fill in these gaps, but public perception of insects plays a key role in a person's willingness to participate in such efforts. This presentation focuses on the importance of involving children in insect conservation initiatives and fostering a sense of compassion and a positive perception towards insects from a young age. Examples of successful elementary aged outreach materials are included, as well as discussion about how all of us can work to make entomological discoveries and conservation efforts more palatable to a younger audience. It is also emphasized how educators can continue to focus on conservation efforts of less alluring species into adulthood. With children making up our future pool of amateur naturalists and brilliant entomologists, it's never too early in life to emphasize how grateful we all need to be to all insects.

Phillip Phung, Simon Fraser University; Emmanuel Hung (SFU); Justin Wong (SFU); Gerhard Gries (SFU).

Title: Stable fly, *Stomoxys calcitrans*, larvae exhibit positive chemotaxis towards ammonia using gradient-guided olfaction.

Abstract: Ammonia (NH3) is commonly reported as a gas emanating from decaying organic substrates suitable for the development of stable fly, *Stomoxys calcitrans*, larvae. We investigated whether stable fly larvae are attracted to NH3 as an olfactory indicator of suitable larval habitat. When larvae in two-choice bioassays were offered a choice between organic substrates that were treated, or not (control), with ammonium bicarbonate (NH4HCO3) in water (which liberates both NH3 and CO2), larvae oriented towards stimuli emitting NH3 and CO2. Additionally, the range over which larvae were attracted was dependent upon stimulus dose and distance-dependent stimulus gradient. Notably, larvae responded to NH4HCO3-treated substrates even at a distance of 40 cm away from the larval release point. We are currently testing attraction of larvae to NH3 (released from ammonium hydroxide) and CO2 (released from sodium bicarbonate) as single gas stimuli. Our study demonstrates olfaction-based chemotaxis of stable fly larvae to suitable larval habitat. Further investigations are recommended to unravel the underlying molecular and physiological mechanisms of larval olfaction in stable flies.

Nicholas Hivon, University of British Columbia Okanagan Campus and Agriculture and Agri-Food Canada; Tyler D. Nelson (AAFC); Chandra E. Moffat (AAFC).

Title: The presence and abundance of *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae) along an elevational gradient in the Okanagan Valley of British Columbia.

Abstract: Spotted-wing drosophila, *Drosophila suzukii* (Matsumura), is an invasive agricultural pest that feeds on fruit hosts in diverse landscapes across the Pacific Northwest of North America.

Since its detection, there has been regular sampling of *D. suzukii* associated with fruiting plant species in the low elevation valley bottom of the Okanagan in British Columbia. We have expanded these sampling efforts to include higher elevation patches of black huckleberry, *Vaccinium membranaceum* Douglas ex. Torr, an important Indigenous food plant. To monitor *D. suzukii*, we are counting and sexing flies collected in traps, as well as rearing fruits from each site. This sampling is still in progress; however, we can examine trends in the data from previous years and compare those to our findings from this season. Our preliminary results suggest that higher elevation sites have fewer *D. suzukii* in both traps and fruit, and that their activity begins later in the season as elevation increases. Notably, we find that early season trap catch has a female bias, demonstrating that females often begin their flight period earlier than males. With a complete dataset for this season, we can further investigate the abundance and sex ratios of *D. suzukii* in relation to elevation.

Augustus Negraeff, Simon Fraser University; Emmanuel Hung (SFU); Justin Wong (SFU); Anya Gould (SFU); Gerhard Gries (SFU).

Title: The presence of flies increases the attractiveness of objects to host-seeking stable flies, *Stomoxys calcitrans*.

Abstract: The fly 'friend factor' describes the phenomenon that the presence of flies on a foraging site increases its attractiveness to conspecific flies. Working with stable flies, *Stomoxys calcitrans*, that blood-feed once or twice per day on bovine hosts, we tested whether the presence of conspecific flies on a site increases its attractiveness to foraging flies. In cage bioassays, we offered food-deprived, CO2-stimulated female stable flies a choice between two small black platforms with or without conspecific females present. As foraging females preferentially alighted on platforms with conspecific flies present, we further tested whether the flies' preferential responses were affected by visual characteristics of the platform as well as the numerical density, orientation, sex, and species of flies presented. We found that the stable fly friend factor is expressed on both black and white platforms, is density-independent, and is neither sex- nor species-specific. The friend factor is triggered by male or female conspecifics, by house flies, and even by 3-D decoys. However, the friend factor could not be triggered by distinctively different horn flies and blow flies, and by 2-D (instead of 3-D) decoys. Field testing of the friend factor was underway at the time of abstract submission.

Alexandra Gregg, Simon Fraser University; Arne Mooers (SFU); Alexa Gemby (SFU); Jayme Lewthwaite (University of Southern California, EDS Lab).

Title: Specialism is not Specialism: Quantifying Multiple Axes in Niche Specialism in Canadian Butterflies Across Species and Space.

Abstract: We ask how urbanization affects Canadian butterfly assemblage composition. We combine the Land Use Harmonization dataset, 50,000 butterfly occurrence records for 228 Canadian species across 96 well-sampled 10x10km plots from 1950 to 2014 and three measures of species-level specialization (habitat, climate and diet). Overall, we find that specialists tend to be less common than generalists across all three axes but little evidence that plots that have undergone more transition to urban landscapes over this time period now harbour a larger proportion of specialist species, suggesting that butterflies may be sampling landscapes at smaller or larger spatial grains.

Jacob McPherson, Agriculture and Agri-Food Canada and Simon Fraser University; Yonathan Uriel (AAFC); Jim Mattsson (SFU); Sachithrani Kannangara (SFU); Michael Dossett (BC Berry Cultivar Development Inc.); Bryan Brunet (AAFC); Michelle Franklin (AAFC).

Title: Understanding aphid mediated virus transmission in highbush Blueberry in British Columbia.

Abstract: Blueberry Scorch Virus (BlScV), first detected in British Columbia (BC) in 2000, is an aphid-transmitted virus that is causing serious plant disease symptoms and yield loss in highbush blueberries (*Vaccinium corymbosum*). In addition to BIScV, a novel luteovirus has been detected in blueberries, for which disease impacts remain unknown. Our successful detection of the novel luteovirus suggests that it may also be transmitted by aphids. The dominant aphid in BC blueberries, *Ericaphis fimbriata*, is known to transmit BIScV, however the long latency period (1-2 years) for this virus has made it difficult to monitor and manage infections. Current management strategies rely on testing and removing symptomatic plants. Here, we aim to develop a molecular assay to detect BIScV and the novel luteovirus in field-collected and scorch-fed aphids. This novel assay will be used in subsequent years to improve our knowledge of the temporal incidence of viral transmission and determine the optimal timing for aphid controls. In addition, we measure aphid abundance on blueberry breeding germplasm under development by the BC Berry Breeding program in an effort to identify aphid-resistant genotypes. This work will help guide the selection of Blueberry germplasm that could be used to develop aphid-resistant cultivars.

Cassandra Merkens and **Nicole Dziekciowski**, Agriculture and Agri-Food Canada; AAC; Wim van Herk (AAFC).

Title: Dispersal of three *Limonius* pest click beetle species on agricultural land.

Abstract: Larvae of three *Limonius* click beetle species are important pests of vegetable and field crops in BC. The beetles themselves are not pests, but can be monitored with pheromone traps to assess populations and targeted in management tactics (e.g. mass trapping). To determine the effective range of pheromone traps we conducted two mark-release-recapture field studies in 2023. Our results will help determine optimum trap spacing in the field for monitoring and management of these species. Larvae of three *Limonius* click beetle species are important pests of vegetable and field crops in BC. The beetles themselves are not pests, but can be monitored with pheromone traps to assess populations and targeted in management tactics (e.g. mass trapping). To determine the effective range of pheromone traps we conducted two mark-release-recapture field studies in 2023. Our results will help determine optimum trap spacing in the field for monitoring and management of these species.

Sophie Hennig, Simon Fraser University; Emmanuel Hung (SFU); Claire E. Gooding (SFU); Gerhard Gries (SFU).

Title: Investigating the effects of blowfly ‘fly factor’ microbe-derived odor on stable fly oviposition.

Abstract: Stable flies, *Stomoxys calcitrans*, are major pests of cattle. They frequently co-inhabit livestock production facilities with other filth flies. The ‘fly factor’ describes the phenomenon whereby microbes deposited by flies on substrates via regurgitate and feces produce fly-attracting semiochemicals. Previous work has demonstrated that gravid female black blow flies, *Phormia regina*, land more frequently on potential oviposition sites that have previously been fed on by con- or heterospecific (*Lucilia sericata*) blow flies. Notably, stable fly larval habitats – ephemeral sites of decaying organic matter – overlap with blow fly foraging sites. Here, we investigated the effects

of *P. regina* 'fly factor' semiochemicals on stable fly oviposition preferences. In two-choice laboratory bioassays, we tested oviposition decisions by gravid female stable flies in response to tryptic soy agar inoculated, or not (control), with blow fly feces or feces-derived microbial isolates. Our data show that microbe-derived odor from the excreta of black blow flies deter stable fly oviposition. The repellant effect appears to be mediated primarily by the bacterium *Morganella morganii* subsp. *sibonii*. The semiochemicals that affect oviposition decisions by gravid female stable flies could possibly be developed as a stable fly control tactic.

Scientist presentations

Jennifer Heron, BC Ministry of Water, Land and Resource Stewardship; Cory S. Sheffield (Royal Saskatchewan Museum).

Title: BC's Community Bumble Bee Project.

Abstract: There are approximately 37-39 bumble bee species in British Columbia, and most are wide-ranging and live in a variety of habitats across the vast provincial landscape. Five of these species have been assessed nationally at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and at least three additional species are potentially at risk. Data on bumble bee species population trends is lacking, making it difficult to monitor trends and assess a species conservation status. This presentation will be a summary of a pilot project that aims to establish long term (> 10 years) bumble bee monitoring routes throughout the province, and concurrently build a community of trained volunteers who, once or twice within the summer months, would survey one or two of these routes within the areas they live and work. Survey routes include some of the same routes monitored as part of the North American Breeding Bird Survey program, as well as new routes; and routes travel through all the provinces ecozones. Ultimately, the data collected over the ten-year assessment time-frame will be used to determine long-term trends in bumble bee distribution and abundance and update conservation status assessments and range maps for the province's bumble bees. 2023 is the third year of the pilot (the project started in 2021), challenges and successes to date will be briefly summarized.

Dr. Imran Ahmed.

Title: Effective control and prevention of Dengue (*Aedes aegypti*) vector from *Citrullus colocynthis*, *Datura stramonium* and *Azadirachta indica* plant extracts through ether.

Abstract: Mosquitoes cause of life threatening disease vectors. Due to non-availability of vaccine and treatment for most of these diseases, the only solution is to control the mosquito population. The excess use of synthetic insecticides causes development of resistance (in vector species), biological magnification (of toxic substances through the food chain) and adverse effects (on environmental quality and non-target organisms including human health). So, under the biological control of mosquito by the use of different plant extracts, such as *Citrullus colocynthis*, *Datura stramonium* and *Azadirachta indica* emphasis is given on the application of plant extracts through petroleum either. Six concentrations of each treatment were applied against 2nd and 3rd instars larvae. The data was collected to check knock down affect after 2, 4, 8 and 10 hours respectively. The data was analyzed through ANOVA to find significant factors (plant extracts,) contributing for mortality. Different significant oil to test their efficacy against Aedes larvae. Again mortality data was collected and subjected to probit analysis to calculate LC50. The least value of LC50 (1.5-40 ppm) and LT50 (0.4-0.8hrs) was observed with solution of *Citrullus colocynthis*, *Datura stramonium* and *Azadirachta indica* extracts through ether, for *Aedes* larvae. By adopting these techniques we should able to manage the populations of Aedes in the environment.

Michelle Franklin, Agriculture and Agri-Food Canada; Yonathan Uriel (AAFC); Seth Nussbaum (AAFC); Markus Clodius (AAFC).

Title: Examining the efficacy of chemical controls for the management of the invasive strawberry blossom weevil, *Anthonomus rubi* in raspberries.

Abstract: The Eurasian strawberry blossom weevil, *Anthonomus rubi* (Herbst) was first reported in the Fraser Valley of British Columbia (BC) in 2019. It is a serious pest of plants in the family Rosaceae, including economically important berry crops such as strawberries and raspberries. The female weevil lays her eggs inside of closed developing flower buds and clips the stem below, which results in fruit loss. Since *A. rubi* is a new pest to Canada, no chemical insecticides are yet registered for its management. As a first step, we conducted a screening trial in a raspberry crop to evaluate the efficacy of foliar applications of four insecticides. We observed a high level of damage in untreated plots, with an average of over 40% clipped raspberry buds in mid-June. Bud clipping was highly correlated with yield loss, indicating that that this may be a useful measure for monitoring this weevil in raspberries. One of the insecticides tested showed a high level of efficacy, with two applications resulting in a 30% reduction in bud clipping and 30% increase in raspberry yield when compared to the untreated plots. While further screening trials are needed, these results are the first to help guide the registration of insecticide products for this new invasive weevil.

Daphne Chevalier, University of British Columbia, Vancouver; Dr. Quentin Geissmann, Nisa Chavez, Katherine Pryer, Dr. Juli Carrillo (UBC).

Title: Lights, camera, attraction? Changes in predator-prey activity due to artificial light at night.

Abstract: To protect biodiversity, we urgently need to better understand the effects of artificial light at night (ALAN) on ecosystems. Despite copious evidence linking ALAN to negative biological impacts on individual species, little is known about its role in disrupting ecological communities; meanwhile, ALAN continues to intensify and spread. Correspondingly, we have developed ALANizer, a programmable battery-powered system for introducing ALAN to experimental sites while monitoring light intensity and quality. We are monitoring the effects of twelve ALANizer units on the UBC Farm with pitfall traps and two open-source automated tools: smart traps to identify captured insects and map their activity across 24-hour cycles and smart microphones that detect and record bat calls. With these data, we plan to compare and analyse the activity patterns of ground-dwelling arthropods, flying insects, and bats. These results will shed more light on ALAN's impacts, both within and across trophic levels.

Adam Blake, University of Washington; Jeffrey A. Riffell (Department of Biology, University of Washington).

Title: Interplay of visual and olfactory coupling in mosquitos.

Abstract: Vision underlies many important behaviors in mosquitos, and recent work has shown visual responses are color dependant. Despite the medical importance of mosquito born illness and the importance of visual cues in vertebrate host finding, the spectral sensitives of their photoreceptors remain uncharacterized, and little is known about how olfactory stimuli can modulate visual responses. To investigate the interplay of olfactory and visual cues, we adapted previously used wind tunnel bioassays to use targets created with a novel LED synth. We coupled these visual targets with CO2 and the odors of either vertebrate hosts or floral resources and assessed their response to these quasi-monochromatic targets (390-740 nm) with real time 3D

tracking of the flight path of female mosquitos. When CO2, human foot odor or their combination is present, we observe a preference for wavelengths above 600 nm as with previous bioassays using paper targets, however unlike in previous work we also observe a preference for stimuli at or around 400 nm. We expect the presence of floral odor. In contrast we expect floral odors to shift mosquito preference more towards the green portion of the visible spectrum, better matching the reflectance of most flowers.

Jorge Macias, Synergy Semiochemicals Corporation; Robert Setter (Synergy Semiochemicals Corporation).

Title: Preliminary results from a survey of forest coleoptera at the Burns Bog Ecological Conservancy Area.

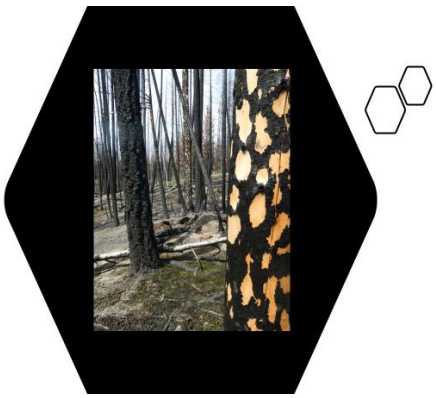
Abstract: The Burns Bog Ecological Conservancy Area is a rare, raised peatland bog covering approximately 2200 ha in metropolitan Vancouver. The area contains a forest with dominance of pine, birch, Douglas-fir and some sprue. Monitoring local insect populations help to understand biodiversity and inform on the presence of potentially exotic invasive species. A total of 6 baited interception traps were set up at each of 3 different sites (a total of 18 traps). Each site had a replicate of one of the following color traps, green, purple, black, and yellow. Commercial baits were deployed containing semiochemicals regularly use to catch wood borer insects. Results are presented from a 2-year trapping program aiming to survey a wide range of forest coleoptera species flying within the area. Specimen identifications are preliminarily and required confirmation from a taxonomist. We had collected 54 genera belonging to 24 Coleoptera families.

Tracy Hueppelsheuser, British Columbia Ministry of Agriculture and Food.

Title: Japanese Beetle (*Popillia japonica*) in British Columbia: Progress Towards Eradication.

Abstract: Japanese Beetle, *Popillia japonica*, a regulated pest in Canada, was detected in annual survey by the Canadian Food Inspection Agency for the first time in Vancouver, British Columbia, in July 2017. Western North America is free of this pest. Vancouver is highly urbanized and surrounded by a diverse agriculture sector, as well as unique natural environment. In response to this pest incursion, a collaboration of 3 levels of government, industry, and non-government, we set out to eradicate the pest from British Columbia.

Surveillance with pheromone-baited traps is the cornerstone for data collection on pest distribution and tracking effectiveness of treatments. As a result of ground treatments and movement control regulations, beetle numbers have plummeted, and the original detection site appears free from the pest. However, detections have occurred in 2 adjacent cities. Information about progress of the project innovations, and future directions will be discussed.



2023 ESBC AGM

"Insects: the Environmental Heartbeat"

Saturday, 10:00am – 11:00am

ESBC Annual General Meeting 2023

1. Welcome
2. Agenda approval
3. Minutes from 2022 AGM (Appendix 1)
4. Executive Reports
    a. Graduate Student Representative: Asim Renyard
    b. EDI Committee: Asim Renyard
    c. Outreach Committee: Asim Renyard
    d. Regional Director of the ESC : Brian van Hezewijk
    e. Editors
        i. Boreus: Gabriella Zilahi-Balogh
        ii. Website: Adam Blake
        iii. Journal: Dezene Huber
    f. Treasurer: Markus Clodius
    g. First VP: Juli Carrillo
    h. President: Lorraine Maclauchlan
5. New business
6. Student Awards: Lorraine Maclauchlan
    a. Scholarships for Graduate Students
    b. Dexter Johnson Award
    c. Student Presentation Awards
    d. Legacy Award
7. Executive Election: Rob Higgins
    a. Second Vice President
    b. Treasurer
    c. Director
    d. Graduate Student Director
8. Transfer of Presidency from Lorraine Maclauchlan to Juli Carrillo
9. Adjourn

Appendix 1
Minutes
of the
Annual General Meeting of the Entomological Society of British Columbia
15 November 2022
12:00-1:00pm
Vancouver Convention Centre
Meeting Room 208/209

Chair: Chandra Moffat, President

1. Welcome from the President Chandra Moffat
    - Chandra Moffat opened the meeting at 12:15pm
2. Acceptance of the Agenda
    - Moved by Joel Gibson / 2nd Gabriella Zilahi-Balogh
3. Minutes from 2021 AGM (see Appendix 1)
    - Moved to accept by Joel Gibson / 2nd Gabriella Zilahi-Balogh

4. Reports (all reports on website)

a. Student Director: Asim Renyard.
b. Director: Dan Peach
- About 800 students presented
- Mentioned good work by DEI committee
- The Bio. Blitz was a huge success and thanked the good work of Biological Survey of Canada, ESBC members and all the volunteers

c. Director: Joyce Leung
- Helped at ESBC booth
- Integral in developing Special Projects Fund

d. Regional Director to the ESC: Brian van Hezewijk
e. Editors

i. *Boreus*: Gabriella Zilahi-Balogh and Elton
- Very little input/contributions from Society or members so please send photographs and / or short articles for publishing in *Boreus*

ii. Website: Adam Blake
- Excellent new website up & running
- thanks to others who helped and for their hard work on this initiative

iii. Asim Reynard - EDI Award now on website – thanks to committee for their hard work on this initiative

iv. Journal: Dezene Huber (acting) – need new subject editors (volunteers)

f. Secretary: Rob Higgins

- Chandra Moffat read report
- Responds to all inquiries and sends on to Executive/members for response
- Spring ESBC meeting should be earlier in the future

h. Treasurer: Markus Clodius.

- Society in good shape; should make good profit from the JAM; GIC's maturing

g. First VP: Lorraine Maclauchlan

- Organized ESBC Booth with many volunteers/help – thank you
- Booth showcased large selection of t-shirts, stickers, and other mementos

h. President: Chandra Moffat

5. New business – no new business put forward from members in attendance

6. Student Awards

EDI Award (announced by Asim Reynard) – recipient Matthew Kirin Tsuruda, UBC

Dexter Johnson Award (announced by Chandra Moffat) – delivered a moving introduction on the renaming of this award – recipients:
Debra Wertman, UBC
Asim Reynard, SFU

Graduate Student Award – recipients:

Emmanuel Hung – MPM Program, SFU
Sophia Fan – MSc, UBC

7. Elections

a) Call for Nominations from the Floor – no nominations

2nd VP:
Secretary: Rob Higgins will stand again for Secretary
Director: Joyce Leung will stand again as Director

Nomination for 2nd VP will be determined in the coming months and a notice of the 2023 ESBC Annual Meeting (date, location / virual) will be posted on the website

b) Vote - NA

8. Recognition of service – thank you to Chandra Moffat for her dedication, time and calm passion serving as President of our "small but mighty" Society. Thank you to all the members, Executive and Directors for making this 2022 JAM a success.
9. Transfer of Presidency from Chandra Moffat to Lorraine Maclauchlan
10. Adjourn – about 1:00pm