The 2021 Entomological Society of Canada and Entomological Society of Ontario's Joint Annual Meeting

ESC-ESO 2021

JAM theme and vision

Strength in Diversity. The insects are among the most diverse group of organisms on the planet, and entomologists are applying an increasingly diverse toolkit to advance knowledge on a diversity of topics in the field. We are keenly aware of the declines in the diversity of insects that threaten vital ecosystem functions, human health, and our economy. We are also becoming increasingly aware of systemic barriers that preclude many from studying and practicing entomology, threats that likely impact the productivity and ingenuity of entomological research in Canada. Our goal for the 2021 JAM – Strength in Diversity - is to showcase state of the art entomological research on a diversity of taxa, ecosystems and disciplines, and to collectively discuss solutions to enhancing equity and diversity in Entomology.

Monday, November 15 to Thursday, November 18, 2021

The Joint Annual Meeting of the Entomological Societies of Canada & Ontario is sponsored by:
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Message from the Organizers:

We hope that you enjoy this year's JAM, and we appreciate your support! Organizing a conference during a pandemic is not an easy task, and we would like to thank the following volunteers who have helped us along the way:

JAM Scientific Programming Committee: Amro Zayed, Miriam Richards, Brent Sinclair, Sheila Colla, Amanda Roe, Chis MacQuarrie. Career Workshop Organizers: Marlee-Ann Lyle and Aleksandra Dolezal. Fundraising Committee: Rose Buitenhuis, Geoff Powell, Miriam Richards

ESO JAM Webmaster: Kaitlyn Fleming. Logo Design: Spencer Monckton. Program Document: Carolyn Davies. Volunteer Moderators: Nadia Tsvetkov, Carolyn Davies, Ida Conflitti, Kathryn Galang, Kathleen Dogantzis.President Prize Judges: Katilyn Fleming, Heath MacMillan, Laura Timms, Tracey Baute, Amanda Roe, Cynthia Scott-Dupree, Hume Douglas, Patrice Bouchard, Nadia Tsvetkov, Nigel Raine, Chris MacQuarrie, Nusha Keyghobadi, Olav Rueppell. Registration System: Ryan Jones. Showcare: Zahra Bouchikhi.

We would like to thank all the symposium organizers for putting together a fantastic set of invited talks for the JAM. Finally, we would like to thank Bill Riel, Neil Holliday and Chris MacQuarrie for helping us navigate organizing our first JAM!

Sincerely,

Amro Zayed (Chair) and Miriam Richards (Co-Chair and Treasurer)

Meeting Code of Conduct: Please see the Entomological Society of Canada's code of conduct for the Joint Annual Meeting https://esc-sec.ca/annual-meetings/. Please report any code of conduct violations to Geoff Powell (gap@strauss.ca).

Message des Organisateurs:

Nous espérons que vous apprécierez cette réunion annuelle et nous apprécions votre soutien! Organiser une conférence pendant une pandémie n'est pas une tâche facile, et nous tenons à remercier les bénévoles suivants qui nous ont aidés tout au long du processus:

Le comité de programmation scientifique de la réunion annuelle: Amro Zayed, Miriam Richards, Brent Sinclair, Sheila Colla, Amanda Roe, Chis MacQuarrie. Organisateurs de l'atelier sur les carrières: Marlee-Ann Lyle et Aleksandra Dolezal. Comité de collecte de fonds: Rose Buitenhuis, Geoff Powell, Miriam Richards

Webmestre de la réunion: Kaitlyn Fleming. Créateur du logo: Spencer Monckton. Document de programme: Carolyn Davies. Modératrices bénévoles: Nadia Tsvetkov, Carolyn Davies, Ida Conflitti, Kathryn Galang, Kathleen Dogantzis. Juges pour le Prix du Président: Katilyn Fleming, Heath MacMillan, Laura Timms, Tracey Baute, Amanda Roe, Cynthia Scott-Dupree, Hume Douglas, Patrice Bouchard, Nadia Tsvetkov, Nigel Raine, Chris MacQuarrie, Nusha Keyghobadi, Olav Rueppell. Système d'inscription: Ryan Jones. Présentations (Showcare): Zahra Bouchikhi.

Nous tenons à remercier tous les organisateurs du symposium pour avoir préparé un ensemble fantastique de conférences invitées pour la réunion annuelle. Enfin, nous tenons à remercier Bill Riel, Neil Holliday et Chris MacQuarrie pour nous avoir aidés à naviguer dans l'organisation de notre première réunion conjointe annuelle!

Sincèrement,

Amro Zayed (président) et Miriam Richards (coprésidente et trésorière)

Code de conduite de la reunion: Veuillez consulter le code de conduite de la Société d'entomologie du Canada pour la réunion annuelle conjointe : https://esc-sec.ca/annual-meetings/. S'il vous plait, veuillez signaler par courriel, toute violation du code de conduite à Geoff Powell (gap@strauss.ca).

	Monday, November 15		
9:30 AM	Opening Ceremonies		
10:15 AM	President's Prize Talks *(concurrent sessions)*		
	Ecology & Evolution	*Pest Management I*	*Diversity & Taxonomy*
12:00 PM	Heritage Lecture - Lisa Myers		
1:30 PM	President's Prize Talks *(concurrent sessions)*		
	Agroecology	*Pest Management II*	*Social Insects*
3:15 PM	Graduate Student Symposium		
5:45 PM	Social & Ice Breaker		
	Tuesday, November 16		
9:30 AM	*Shared Vision Symposium*	*Semiochem Symposium*	*Contributed Talks: Insect Diversity*
12:00 PM	Plenary Lecture - Jayne Yack		
1:15 PM	Career Panel - Sam Knight, Antonia Guidotti, Alexandra Dacey, Graham Ansell		
2:30 PM	*Butterfly Symposium*	*Contributed Talks: Genetics & Genomics*	*Contributed Talks: Taxonomy & Systematics*
4:15 PM	Equity Diversity & Inclusion Event - Maydianne Andrade		
5:30 PM	Poster Session (every 15 minutes)		
	Wednesday, November 17		
9:30 AM	*New Vision in BioControl Symposium*	*Contributed Talks: Ecology & Evolution*	*Contributed Talks: Pest Management*
1:00 PM	Career Panel - Sarah Jandric, Jeremy deWaard, Laura Timms & Andrew Young		
2:15 PM	Plenary Lecture - Claire Kremen		
3:30 PM	Town Hall with the ESC's EDI committee - Catherine Scott, Sebastian Ibarra, Boyd Mori & Kyle Bobiwash		
4:45 PM	ESC Award Ceremony		
5:00 PM	Plenary - Gold Medal Lecture - Michel Cusson		
6:15 PM	Social		
	Thursday, November 18		
9:30 AM	*Biodiversity of Pests Symposium*	*Physiology Symposium*	*Contributed Talks: Behaviour*
1:30 PM	Plenary Lecture - Amanda Moehring		
2:45 PM	Award Ceremonies: Student awards		
3:15 PM	Closing Ceremonies		

Monday, November 15, 2021

9:30 AM - 10:00 AM EST
Land Acknowledgement & Opening Ceremonies

10:00 AM - 10:15 AM EST
Break

10:15 AM - 11:45 AM EST
President's Prize Talks, Ecology and Evolution [Concurrent session]
Moderator: Ida Conflitti

Time	*Speaker*	*Title*
10:15 AM	Angela Demarse	Lepidoptera Marking Methods: A matched pair experiment examining nail polish and acrylic paint durability
10:30 AM	Shayla Kroeze	Using conservation genetics to inform reintroduction of the Mottled Duskywing
10:45 AM	Emily Hanuschuk	Diverse and edgy landscapes support wild bee pollinators and plant-bee networks in an agriculturally dominated region of Manitoba
11:00 AM	Justis Henault	Endangered *Oarisma poweshiek* butterfly larval host foraging and adult behaviour microhabitat requirements in Canada
11:15 AM	Zachary MacDonald	Messages from island butterflies: distinguishing effects of habitat area and isolation from the sample-area effect
11:30 AM	Andreas Fischer	Intrasexual conflict - female false black widow spiders' sense, and behaviorally and physically respond to, female conspecific sex pheromone

10:15 AM - 11:45 AM EST
President's Prize Talks, Pest Management I [Concurrent session]
Moderator: Carolyn Davies

Time	*Speaker*	*Title*
10:15 AM	Paige Desloges Baril	Exploring Native Predatory Hemipteran Species for Use as Biological Controls in Canadian Vegetable Production
10:30 AM	Thanusha Suresh	Pheromone and host plant odor detection in spruce budworm, *Choristoneura fumiferana*
10:45 AM	Allen Bush-Beaupré	Comparing the Reproductive Behavior and Life-History Strategies of the Seedcorn Maggot's (*Delia platura*) H- and N-lines
11:00 AM	Catalina Fernandez	Cold tolerance of the pepper weevil (*Anthonomus eugenii*) in non-acclimated and acclimated laboratory populations
11:15 AM	Kenneth Dearborn	Fraxinus foliage: does host species for maturation feeding alter the fecundity of emerald ash borers?
11:30 AM	Victoria Ivey	Molecular and neural plasticity in the sex pheromone response of the corn earworm (*Helicoverpa zea*)

(Monday, November 15 – continued)

10:15 AM - 11:45 AM EST
President's Prize Talks, Diversity & Taxonomy [Concurrent session]
Moderator: Nadia Tsvetkov

Time	*Speaker*	*Title*
10:15 AM	Denis Boudreau	Niche and metacommunity dynamics of sympatric Calliphoridae species competing for animal necromass
10:30 AM	Valentine Glaus	Host-parasitoid communities in spruce budworm endemic stages of two long-term studied sites
10:45 AM	Alexandre Loureiro	Beetle diversity and elevation: what do we really know?
11:00 AM	Marlee-Ann Lyle	Molecular Detection of Cyclamen Mite (*Phytonemus pallidus*) in Strawberry
11:15 AM	Nora Romero	*Liphanthus* (Hymenoptera: Andrenidae: Panurginae): a South American bee genus with numerous undescribed species
11:30 AM	Ferf Brownoff	New taxonomic records for the spider fauna of New Caledonia, including families, genera, and a species description

11:45 AM - 12:00 PM EST Break

12:00 PM - 1:00 PM EST
Heritage Lecture. Prof. Lisa Myers, York, University
Reinscribing Land: Mike MacDonald's Medicine and Butterfly Gardens
Moderator: Sheila Colla

1:00 PM - 1:30 PM EST Lunch Break

1:30 PM - 3:00 PM EST
President's Prize Talks, Agroecology [Concurrent session]
Moderator: Nadia Tsvetkov

Time	*Speaker*	*Title*
1:30 PM	Claudine Desroches	*Ceutorhynchinae* assemblage in canola agroecosystem of Quebec
1:45 PM	Caitlin MacDonald	Occurrence and Host Range of the Brown Marmorated Stink Bug Parasitoid *Trissolcus japonicus* in Ontario, Canada
2:00 PM	Aleksandra Dolezal	Re-designing agricultural landscapes: The effect of habitat on arthropod communities
2:15 PM	Sabrina Rondeau	Sublethal effects of single and combined realistic exposure to pesticides used on squash crops on a ground-nesting solitary squash bee (*Eucera pruinosa*)
2:30 PM	Maggie MacDonald	Ground beetles: diversity and dimorphism in pulse agroecosystems
2:45 PM	Jade Sherwood	Invasive and Inevitable: Parasitoid phenology and host density of *Anthonomus rubi* in their native range

(Monday, November 15 – continued)

1:30 PM - 3:00 PM EST
President's Prize Talks, Pest Management II [Concurrent session]
Moderator: Carolyn Davies

Time	*Speaker*	*Title*
1:30 PM	Saif Nayani	Microbe-mediated attraction of stable flies to host cattle
1:45 PM	Emmanuel Hung	Conductive and convective heat, but not infrared radiation, mediates stable fly alighting and probing response on thermally different targets
2:00 PM	Dylan Sjolie	The effect of early season temperature on adult life history traits of the wheat stem sawfly *Cephus cinctus* (Hymenoptera: Cephidae) and *Bracon cephi* (Hymenoptera: Braconidae)
2:15 PM	Jessica Fraser	Manipulating parasitoid behaviour with LED greenhouse lighting to improve biocontrol of aphids
2:30 PM	Rachel Pizante	Effects of canola bloom, floral availability, and field margin type on hover fly abundance, species richness, and species composition in canola crops in the Aspen Parkland
2:45 PM	Irene Jimenez	Local effects of herbaceous versus treed field margins on abundance and movement of ground beetles and spiders into and out of canola fields in Aspen Parkland

1:30 PM - 3:00 PM EST
President's Prize Talks, Social Insects [Concurrent session]
Moderator: Ida Conflitti

Time	*Speaker*	*Title*
1:30 PM	Zach Balzer	A novel anti-social response to CO2 narcosis in a subterranean termite: implications for studies of kin recognition
1:45 PM	Kathryn Galang	The molecular basis of altruistic and selfish aggression in honey bees
2:00 PM	Asim Renyard	Good vibrations: the role of multimodal pheromone and vibratory communication in Western carpenter ants
2:15 PM	Jessie deHaan	The ecological and physiological consequences of sun vs. shade nesting for the small carpenter bee, *Ceratina calcarata*, and their offspring
2:30 PM	Kathleen Dogantzis	The adaptive radiation of the European Honey bee (*Apis mellifera*)
2:45 PM	Jaime Mathew Chalissery	Identification of the Trail Pheromone of the Pavement Ant *Tetramorium immigrans* (Hymenoptera: Formicidae)

3:00 PM - 3:15 PM EST
Break

(Monday, November 15 – continued)

3:15 PM - 5:30 PM EST
Graduate Student Symposium
Moderator: Matt Muzzatti & Rowan French

Time	*Speaker*	*Title*
3:15 PM	Introduction	
3:20 PM	Rachel Rix	Phenotypic and molecular response in a beneficial insect predator stimulated by mild stress
3:50 PM	Antonia Musso	Pine Wars - A New Host: the battle between mountain pine beetle and naïve pines in Alberta
4:20 PM	Break	
4:30 PM	Matthew Meehan	From individuals to communities: The effect of climate change on ectothermic predators
5:00 PM	Asha Wijerathna	Interactions of pea leaf weevil (Coleoptera: Curculionidae) with its primary and secondary host plants in Alberta

5:30 PM - 5:45 PM EST Break

5:45 PM - 6:30 PM EST **JAM Social**

Tuesday, November 16, 2021

9:30 AM - 11:45 AM EST
Shared Vision Symposium: Bridging community engagement, entomology, and research [Concurrent session]
Organizers and Moderators: Sabrina Rondeau, Véronique Martel, Valérie Fournier, Morgan Jackson & Catherine Scott

Time	*Speaker*	*Title*
9:30 AM	Victoria MacPhail	Community science in action - Bumble Bee Watch program is fun and educational for participants, helps to fill knowledge gaps, and supports conservation efforts
9:45 AM	Sage Handler	Studying the backyard bee-cosystem: using community science to investigate cavity-nesting bees across Canada
10:00 AM	Amelie Gervais	Combining citizens's passion and scientists' knowledge: the winning story of *Abeilles citoyennes*
10:15 AM	Rodrigo Solis Sosa	eButterfl-AI: how machine learning improves citizen science data quality
10:30 AM	Spencer Monckton	Elm zigzag sawfly: a case study in detecting species introductions using social media and community science
10:45 AM	Justin Schell	Unleashing Community Science Power with Notes from Nature and MI-Bug
11:00 AM	Morgan Jackson	Are More Eyes Better? The Faunistic Advantages of Canada's iNaturalist Community
11:15 AM	Maya Evenden	A new Massive Open Online Course (MOOC): Bugs 101, Insect-Human Interactions
11:30 AM	Q&A	

9:30 AM - 11:45 AM EST
Symposium. Diversity of semiochemical-based pest management [Concurrent session]
Organizers and Moderators: Maya Evenden & Boyd Mori

Time	*Speaker*	*Title*
9:30 AM	Gerhard Gries	Semiochemicals for detection of foes and guidance of friends
9:45 AM	Kirk Hillier	Development of natural products for management of acarine pests
10:00 AM	Nicoletta Faraone	Chemical ecology of ticks: olfaction, behaviour, chemistry and control
10:15 AM	Jeremy Allison	Origami, Trap Development and Survey and Detection of Forest Insects
10:30 AM	Rylee Isitt	Using semiochemicals to predict invasion potential of exotic bark beetles
10:45 AM	Maya Evenden	Semiochemical recruitment of parasitoids to ash trees infested with *Caloptilia fraxinella* (Lepidoptera: Gracillariidae).
11:00 AM	Rebecca Hallett	Pheromone-based management of the swede midge
11:15 AM	Boyd Mori	Identification of the sex pheromone of *Contarinia brassicola*, a newly described canola pest
11:30 AM	Don Thomson	Codling Moth Mating Disruption: Still Crazy After All These Years

(Tuesday, November 16 – continued)

9:30 AM - 11:45 AM EST
Contributed Talks: Insect Diversity [Concurrent session]
Moderators: Nadia Tsvetkov & Kathryn Galang

Time	*Speaker*	*Title*
9:30 AM	Louka Tousignant	Effects of landscape-scale conservation on forest beetle assemblages in late successional stages of a secondary forest
9:45 AM	Anthony Zerafa	Ecological monitoring of terrestrial arthropods on Umingmat Nunaat/Axel Heiberg Island, in high Arctic Canada
10:00 AM	Jocelyn Armistead	A comparison of *Bombus* collection methods for detecting trends in species abundance
10:15 AM	Kaitlyn Fleming	Range updates and extensions of Carabidae (Coleoptera) in Ontario's Boreal Forest
10:30 AM	Break	
10:45 AM	Heather Proctor	Variation in ectosymbiont assemblages of Rock Pigeons across Canada
11:00 AM	Kevin Judge	Tracking an invader: Roesel's katydid in Alberta
11:15 AM	Leah Flaherty	Impact of an invasive and allelopathic weed on below-ground oribatid mite communities
11:30 AM	Seung-Il Lee	Trends in recovery of beetles and spiders after variable retention harvesting in boreal forests: evidence from the Ecosystem Management Emulating Natural Disturbance (EMEND) experiment

11:45 AM - 12:00 PM EST Break
12:00 PM - 1:00 PM EST
Keynote Lecture.
Dr. Jayne Yack, Carleton University
What Does an Insect Hear?
Moderator: Miriam Richards

1:00 PM - 1:15 PM EST Break

1:15 PM PM - 2:15 PM EST
Career Panel 1 - MSc Students
Panelists: Sam Knight, Antonia Guidotti, Alexandra Dacey, Graham Ansell
Moderators: Marlee-Ann Lyle & Aleksandra Dolezal

2:15 PM - 2:30 PM EST Break

2:30 PM - 4:00 PM EST
Symposium. Innovative and Collaborative Approaches to Conserving Canada's At-Risk Butterflies [Concurrent session]
Organizer and Moderator: Jessica Linton

Time	*Speaker*	*Title*
2:30 PM	Jaret Daniels	At-Risk Butterfly Recovery Efforts: A look at the big picture of small organism Conservation

(Tuesday, November 16 – continued)

3:00 PM	Nusha Keyghobadi	Genetics to inform conservation of at-risk butterflies
3:15 PM	Erik Runquist	Butterflies across Borders: Fostering international conservation
3:30 PM	Adrienne Brewster	Collaborative Efforts to Recover the Endangered Mottled Duskywing Butterfly in Ontario
3:45 PM	Jennifer Heron	Taylor's Checkerspot: successes, challenges and future work for an endangered butterfly in British Columbia, Canada

2:30 PM - 4:00 PM EST
Contributed Talks: Genetics and Genomics [Concurrent session]
Moderator: Kathryn Galang

Time	*Speaker*	*Title*
2:30 PM	Sandrine Picq	Identifying the geographic origins of intercepted gypsy moth (*Lymantria dispar*) specimens using genotyping-by-sequencing (GBS)-derived SNPs
2:45 PM	Arshad Imrit	Bees in the six: Determinants of bumblebee habitat quality in urban landscapes
3:00 PM	Ida Conflitti	BeeCSI: tools for assessing bee health
3:15 PM	Aidan Jamieson	Development of diagnostic tools for neonicotinoid exposure in the western honey bees (*Apis mellifera*) using transcriptomics
3:30 PM	Break	
3:45 PM	Break	

2:30 PM - 4:00 PM EST
General talks: Taxonomy and Systematics [Concurrent session]
Moderator: Carolyn Davies

Time	*Speaker*	*Title*
2:30 PM	Julie-Éléonore Maisonhaute	Diversity of Arthropods Associated with Human Remains during the Summer and Fall Seasons in Quebec
2:45 PM	Pat Bouchard	Review of genus-group names in the family Tenebrionidae (Insecta: Coleoptera)
3:00 PM	Kelly Murray-Stoker	Assessing effects of urbanization on caddisfly assemblages within a regional context using community science
3:15 PM	Tomislav Terzin	*Pachyrhynchini* weevils as mimics of Salticidae and Gnaphosidae spiders
3:30 PM	Joel Gibson	New perspectives on Marine Insects
3:45 PM	Break	

4:00 PM - 4:15 PM EST Break

4:15 PM - 5:15 PM EST
Keynote Lecture.
Dr. Maydianne Andrade, University of Toronto
Bias and Inclusion in Practice
Moderators: Catherine Scott & Amro Zayed

(Tuesday, November 16 – continued)

5:15 PM - 5:30 PM EST Break

5:30 PM - 6:30 PM EST
Poster Session

Presenter	*Poster Title*
Samara Andrade	The influence of sex pheromones in the reproductive isolation of *Monochamus* spp. in Ontario
Hector Carcamo	Parasitism of lygus and alfalfa plant bugs by Peristenus wasps in southern Alberta, Canada
Natali Demers	Slug-like aphids, the disruptive effect of vibrations on the offspring of the green peach aphid *Myzus persicae*
Emily Glasgow	A genetic analysis of the distribution of pheromone races of the European corn borer, *Ostrinia nubilalis* (Hübner), in Canada
Sara Khan	Vibration mediated predator avoidance in the eastern tent caterpillar (*Malacosoma americanum*)
Sarah Koerte	Investigating the semiochemistry underlying host selection and oviposition of *Mythimna unipuncta*
Genevieve Labrie	Feeding preference of squash bugs in cucumber greenhouses in Québec
Sam Luik	Economic implications of reducing monetary and time costs in testing for honeybee stressors through the framework of a stress-structured model for colony dynamics in a single hive
Mateus Pepinelli	Vitellogenin expression tracks age of honeybee workers
Mireia Sola Cassi	Effects of intensive crop management on the diversity and abundance of species in three fruit crop productions of Quebec
Aija White	Where's the baseline? Using DNA barcoding to inventory native pollinators in agroecosystems in Central British Columbia, Canada
Taeyoon You	The genomics of protein expression in honey bees

Wednesday, November 17, 2021

9:30 AM - 12:45 PM EST
New Vision in BioControl Symposium [Concurrent session]
Organizers and Moderators: Rosemarije Buitenhuis, Chris Macquarrie, Roselyne Labbe

Time	*Speaker*	*Title*
9:30 AM	Lucas Roscoe	Investigations into biological control for the hemock wooly adelgid in Eastern Canada
9:45 AM	Jon Sweeney	Feasibility of biological control of the beech leaf-mining weevil, *Orchestes fagi*, in Canada
10:00 AM	Francois Dumont	Efficacité d'une guilde de prédateurs généralistes indigènes dans la lutte aux ravageurs du concombre de serre
10:15 AM	Sandy Smith	Biological control of invasive plants in the restoration of forest ecosystems
10:30 AM	Rosemarije Buitenhuis	Anystis baccarum, a new Canadian predator for greenhouse IPM programs
10:45 AM	Noémie Gonzalez	Oviposition strategy of the American hoverfly *Eupeodes americanus* (Diptera : Syrphidae) and comparison with the commercialized *Aphidoletes aphidimyza* (Diptera: Cecidomyiidae) : Effect of aphid density and plant type
11:00 AM	Break	
11:15 AM	Serena Leo	Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil (*Anthonomus eugenii*) on greenhouse pepper crops
11:30 AM	Chris Macquarrie	Impact of biological control agents on Canadian emerald ash borer populations
11:45 AM	Paul Abram	Unsuccessful attack by native parasitoids and unintentional biocontrol by exotic parasitoids: the story of brown marmorated stink bug parasitoids in Canada
12:00 PM	Michelle Franklin	A first step: exploration of biocontrol agents for the newly established strawberry blossom weevil, *Anthonomus rubi*
12:15 PM	Brian Van Hezewijk	The role of native generalist predators in controlling populations of forest pests
12:30 PM	Chandra Moffat	Rethinking biological control programs as planned invasions

9:30 AM - 12:45 PM EST
General talks: Ecology and Evolution [Concurrent session]
Moderators: Carolyn Davies & Kathleen Dogantzis

Time	*Speaker*	*Title*
9:30 AM	Marie D'Ottavio	Landscape effects on *Trichomalus perfectus*, a key parasitoid of the cabbage seedpod weevil (*Ceutorhynchus obstrictus*) in canola in Quebec (Canada)
9:45 AM	Carlos Barreto	Experimental warming decreases carbon and nitrogen fluxes in soil food webs of boreal peatlands
10:00 AM	Amanda Roe	Host plant and environmental structuring of forest tent caterpillar genomic variation
10:15 AM	Sarah MacKell	Assessing the impacts of urban beehives on wild bees using individual, community, and population-level metrics

(Wednesday, November 17 – continued)

10:30 AM	Michael McTavish	First explorations of the distribution and life history of tumbling flower beetles *Mordellina ancilla* (Coleoptera: Mordellidae) on invasive garlic mustard (*Alliaria petiolata*) across southern Ontario
10:45 AM	Break	
11:00 AM	Sarah French	The risks of crop exposure to honey bee colonies
11:15 AM	Shayla Storozuk	Potential of carabidae and lycosidae predators to consume flea beetles and reduce canola damage
11:30 AM	Maxime Damien	Landscape mediates flea beetle infestation levels in canola crops across Canadian prairies
11:45 AM	Rob Bourchier	Development of rearing and release methods for biological control agents of introduced Phragmites in Ontario.
12:00 PM	Break	
12:15 PM	Break	
12:30 PM	Break	

9:30 AM - 12:45 PM EST
General talks: Pest Management [Concurrent session]
Moderators: Ida Conflitti

Time	*Speaker*	*Title*
9:30 AM	Christine Noronha	Surveillance Of Click Beetle (Coleoptera: Elateridae) Populations Across Prince Edward Island, Canada
9:45 AM	Cyrane Pouet	Mating disruption to control two major cranberry pests in Quebec - Lutte par confusion sexuelle pour lutter contre deux ravageurs principaux de la canneberge au Québec
10:00 AM	Alice De Donder	Impact of novaluron and chlorantraniliprole on the aphidophagous guild of the green apple aphid in an apple orchard
10:15 AM	Daniel Peck	Insecticidal Peptides: Primer on a New Technology Yielding Novel Tools for Pest Management
10:30 AM	Susan Willis Chan	Evaluating dispenser design for delivery of biocontrol agents by honey bees (*Apis mellifera*)
10:45 AM	Break	
11:00 AM	Jacob Basso	The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops
11:15 AM	Vincent Hervet	Development of stored product insects on canola seeds
11:30 AM	Daniel Wiens	Using black soldier fly larvae to reclaim and concentrate nutrients from Fusarium head blight infected wheat
11:45 AM	Sharavari Kulkarni	Functional response of generalist predators on diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae)
12:00 PM	Tyler Wist	Field Heroes: the crop protectors standing firm against the invaders
12:15 PM	Break	
12:30 PM	Break	

(Wednesday, November 17 – continued)

12:45 PM - 1:00 PM EST
Break.

1:00 PM PM - 2:00 PM EST
Career Panel 1 - PhD Students
Panelists: Sarah Jandric, Jeremy deWaard, Lauren Timms, Andrew Young.
Moderators: Marlee-Ann Lyle, Aleksandra Dolezal

2:00 PM - 2:15 PM EST
Break

2:15 PM - 3:15 PM EST
Keynote Lecture
Dr. Claire Kremen, UBC
Pollinators as ambassadors for diversifying farming systems
Moderator: Amro Zayed

3:15 PM - 3:30 PM EST
Break

3:30 PM - 4:30 PM EST
Town Hall with ESC EDI committee
Panelists: Sebastian Ibarra Jimenez, Catherine Scott, Boyd Mori & Kyle Bobiwash
Moderator: Amro Zayed

4:30 PM - 4:45 PM EST
Break

4:45 PM - 5:00 PM EST
ESC Award Ceremony
Moderators: Felix Sperling & Bill Riel

5:00 PM - 5:45 PM EST
Gold Medal Lecture
Michael Cusson, National Resources Canada
The challenges and rewards of pursuing parallel paths of entomological enquiry

Moderator: Bill Riel

5:45 PM - 6:15 PM EST Break

6:15 PM - 7:15 PM EST **JAM Social**

Thursday, November 18, 2021

9:30 AM - 12:45 PM EST
Biodiversity of Pests Symposium: How to monitor and manage them? [Concurrent session]
Organizers and Moderators: Julien Saguez & Tyler Wist

Time	*Speaker*	*Title*
9:30 AM	Shaun Dergousoff	Expansion into new geography by migration of dog and deer ticks
9:45 AM	Douglas Hume	Two adventive species of European Chrysomelidae (Coleoptera) new to North America and where do non native leaf beetles come from?
10:00 AM	Jeremy McNeil	Can stable isotopes data help develop more effective management programmes for migratory pest species?
10:15 AM	Julien Saguez	Insect pest monitoring using automated and connected traps
10:30 AM	Ian MacRae	Of aphids, PVY and suction (traps that is)
10:45 AM	Emily Lemke	Investigating mechanisms of reproductive isolation between *Limonius congeners* (Coleoptera: Elateridae) and testing of "catch-all" click beetle pheromone lures
11:00 AM	Break	
11:15 AM	Kendal Singleton	Identification of sex pheromones of two Nearctic *Agriotes* species (Coleoptera: Elateridae)
11:30 AM	Richard Hamelin	BioSurveillance of Alien Forest Enemies: the BioSAFE initiative
11:45 AM	Karolina Pusz-Bochenska	Genetics of a perennial invader. Aster leafhoppers and their yearly migration
12:00 PM	Meghan Vankosky	The role of the Prairie Pest Monitoring Network in biovigilance: Annual monitoring and model development for invasive insects
12:15 PM	Tracey Baute	The Great Lakes and Maritimes Pest Monitoring Network; Collaboration Across Borders to Strengthen Surveillance of Shared Pest Issues
12:30 PM	John Gavloski	Predator turns pest: A multispecies aphid invasion into Manitoba and response of the multicoloured Asian lady beetle

9:30 AM - 12:45 PM EST
Symposium. Recent Progress in Insect Physiology [Concurrent session]
Organizers and Moderators: Jean-Paul Paluzzi

Time	*Speaker*	*Title*
9:30 AM	Leena Thorat	Role of a heterodimeric glycoprotein hormone receptor on *Drosophila* excretory system in response to desiccation stress
9:45 AM	Heath MacMillan	Does basal cold tolerance constrain plasticity in individual *Drosophila*?
10:00 AM	Marshall Ritchie	Physical transformation of microplastics ingested by a cricket, *Gryllodes sigillatus*
10:15 AM	Serita Fudlosid	Developmental Effects of Microplastic Ingestion on the Tropical House Cricket *Gryllodes sigillatus*

(Thursday, November 18 – continued)

10:30 AM	Patricia Okpara	Investigating microbial effects on the life-history traits and waste reduction capability of the black soldier fly Linnaeus (Diptera: Stratiomyidae)
10:45 AM	Simon Legault	Diapause induction in two exotic parasitoids of the invasive spotted wing *Drosophila*: Could they survive our cold Canadian winters?
11:00 AM	Break	
11:15 AM	Andrea Durant	Ammonia transport in the excretory organs of the disease-vector mosquito *Aedes aegypti:* functional characterization using RNAseq, RNAi, and electrophysiology
11:30 AM	Jimena Leyria	Role of insulin/ToR signalling in female reproduction of *Rhodnius prolixus*, a vector of Chagas disease
11:45 AM	Farwa Sajadi	The role of the V-type H+-ATPase in Malpighian tubule secretion in the female mosquito, *Aedes aegypti*
12:00 PM	Rhonda Thygesen	The Blueberries and the Bees: Assessing Honey Bee Health Stressors Using Proteomics
12:15 PM	Sam Meraj	Time- and tissue-specific antimicrobial activity of common bed bugs in response to blood feeding and immune activation by bacterial injection
12:30 PM	Q&A	

9:30 AM - 12:45 PM EST
Symposium. General talks: Behaviour [Concurrent session]
Moderators: Carolyn Davies & Kathleen Dogantzis

Time	Speaker	Title
9:30 AM	Gard Otis	Defensive behaviours of Asian honey bees (*Apis cerana*) against attacking murder hornets (*Vespa soror*)
9:45 AM	James Mesich	Effect of Social Status on Aggression in a Facultatively Social Bee (*Xylocopa virginica*)
10:00 AM	Samm Reynolds	Investigating the effects of local natural habitats on the abundance and diversity of native fly and bee pollinators in Norfolk County, Ontario
10:15 AM	Lyllian Corbin	Mate competition and territoriality in male eastern carpenter bees (*Xylocopa virginica*)
10:30 AM	Jean-Philippe Parent	Are cozy aphids less likely to be disrupted by substrate-borne vibrations?
10:45 AM	Break	
11:00 AM	Lyndon Duff	Maternal investment patterns in a facultatively social bee showing that socially dominant females forage more than solitary females
11:15 AM	Berenice Romero	One or too many choices? Oviposition, development, and settling of Aster leafhoppers on a variety of plant hosts
11:30 AM	Franklin Dubon Garcia	Natural enemies associated with *Grapholita molesta* (Busk) (Lepidoptera: Tortricidae) in Ontario, Canada
11:45 AM	Olav Rueppell	Hygiene-eliciting brood semiochemicals as a tool for assaying honey bee (Hymenoptera: Apidae) colony resistance to *Varroa* (Mesostigmata: Varroidae)
12:00 PM	Syed Asad	Field trapping bumble bee wax moths (*Aphomia sociella*) to help protect bumble bee colonies

(Thursday, November 18 – continued)

12:15 PM Break

12:30 PM Break

12:45 PM - 1:30 PM EST
Break

1:30 PM - 2:30 PM EST
Keynote Lecture
Dr. Amanda Moehring, Western University
Sorry, not sorry: the neural basis of aggression in *Drosophila* females
Moderator: Amro Zayed

2:30 PM - 2:45 PM EST
BreaK

2:45 PM - 3:30 PM EST
Student Awards and Closing Ceremonies

Abstracts / Résumés

Speaker: **Abram, Paul**, Agriculture and Agri-Food Canada

Co-authors: Jacques Brodeur, Josee Doyon & Tara Gariepy

Title: **Unsuccessful attack by native parasitoids and unintentional biocontrol by exotic parasitoids: the story of brown marmorated stink bug parasitoids in Canada**

Abstract: From soon after the introduction and spread of brown marmorated stink bug (Hemiptera: Pentatomidae) in North America and Europe, biological control research focused on evaluating native and exotic parasitoid wasps that attack its eggs. In invaded areas, these evaluations began with a peculiar observation: native egg parasitoids would readily attack the eggs of the invasive pest but their offspring usually would not develop. However, some of the pest's eggs would die as a result of this attack. In addition, while the potential of native natural enemies was being evaluated, an exotic egg parasitoid appeared on the scene as a result of 'unintentional biological control'. I will discuss what this BMSB case study can tell us about the complexity and importance of evaluating the potential of native natural enemies to contribute to biocontrol of invasive pests in a time when unintentional introductions of exotic agents seems to be common.

Speaker: **Allison, Jeremy**, Canadian Forest Service

Title: **Origami, Trap Development and Survey and Detection of Forest Insects**

Abstract: Semiochemical-baited intercept traps differ in their performance among species and habitats for sampling forest insects and the mechanisms driving this variation in performance are not understood. This is significant as it can delay both the development of new and optimization of existing survey and detection tools and result in the use of sampling tools with low sensitivity. This presentation will provide an overview of factors known to affect the performance of intercept traps for forest Coleoptera and field experiments designed to identify mechanisms driving these effects. Field trials have demonstrated that intercept panel and multiple-funnel traps differ in their performance for Cerambycidae but the number of Cerambycidae approaching to within 3 m downwind does not differ among these two trap designs. Differences in the number of beetles contacting the two trap designs were observed. Studies with carbon dioxide observed differences in plume structure downwind of these same trap designs but the differences observed were not consistent with differences in trap performance. Field trials that manipulated visual stimuli associated with intercept traps found support for the hypothesis that differences in visual stimuli associated with different trap designs contributes to differences in performance among taxa. These results suggest that both differences in the odour plumes and visual stimuli associated with different trap designs may contribute to differences in trap performance for Cerambycidae.

Speaker: **Andrade, Maydianne**, University of Toronto Scarborough

Title: **Bia & Inclusion in Practice**

Abstract: Assessing others is a central feature of most professional careers. Our judgement of the achievements and potential of students, job applicants, trainees, and colleagues can affect their opportunities, progress, compensation, and retention at a range of different career stages. I use a

data-centred approach to illustrate how (unconscious) biases in the assessment of women, racialized persons, and persons from other marginalized identity groups can lead to unfair assessment, with cumulative negative effects, and review indications that these problems may be particularly acute in STEM (Science, Technology, Engineering and Mathematics). I then suggest practical ideas for culture change that can interrupt these effects, and make clear how progress hinges on individual actions, embedded in equitable structures.

Speaker: **Andrade, Samara**, University of Toronto

Co-authors: Sandy M. Smith & Jeremy Allison

Title: **The influence of sex pheromones in the reproductive isolation of *Monochamus* spp. In Ontario**

Abstract: The role of long- and short-range pheromones in the reproductive isolation of two sympatric populations of *Monochamus* spp. (*M. scutellatus* and *M. mutator*) in Ontario was characterized. The presence of long-range sex pheromone compounds from males and females was investigated in the laboratory by analyzing volatile extracts with GC-MS. The role of short-range pheromones in mate recognition was investigated using cross-attraction bioassays in the laboratory. Females were manipulated to produce three treatments: 1) fresh dead; 2) fresh dead with cuticular compounds removed; 3) fresh dead with cuticular compounds removed and extracts of individual heterospecific female cuticular compounds applied. These female cadavers were individually introduced to con- and hetero-specific males to assess behavioural responses. Once the male touched the female cadaver with his antennae or made antennal contact with the female, mounted, and attempted copulation, the bioassay was ended. Volatile collections of M. scutellatus confirmed the identity of the previously reported pheromone monochamol. This study is the first to detect monochamol in the effluvia of male *M. mutator*. No differences were observed in male aeration extracts of these two species. Cross-attraction bioassays demonstrated that males only recognized conspecific females after antennal contact when cuticular profiles were intact or when conspecific female extracts were applied to heterospecific female cadavers.

Speaker: **Armistead, Jocelyn**, Brock University

Co-authors: Cory Sheffield & Miriam Richards

Title: **A comparison of *Bombus* collection methods for detecting trends in species abundance**

Abstract: In recent decades factors such as climate change, habitat destruction, intensive agricultural practices and pathogens have caused changes in bumble bee (*Bombus*) populations across Canada. Individual species have responded differently to these changes, some increasing in abundance, and some remaining stable, but there are a concerning number of species that appear to be in decline. In order to accurately track changes in Bombus species abundance, we need to be sure we are using the most effective sampling methods. The objective of my research was to outline the strengths and weaknesses of three commonly used collection methods; targeted netting, photographs and blue vane traps. Surveys of *Bombus* were conducted in the Niagara Region from late June to September in order to target workers and avoid catching spring queens. Blue vane traps were placed at survey sites in the morning on Day 1 and the contents were checked in the evening of the same day, as well as the evenings of Day 3 and Day 7. This schedule was used to determine if a full week was necessary for blue vane trap placement to be effective, or if a shorter time period would be sufficient. Thirty-minute netting and photographic

surveys were also conducted at the sites on the same days traps were checked. Despite the fact that blue vane traps were on site continuously for a week, it became clear that the netting and photographic surveys were collecting more *Bombus* specimens. This was surprising as blue vane traps have been effective in other studies in different regions of North America. Due to the fewer specimens collected by blue vane traps, I expect the *Bombus* community composition produced by that method will be different compared to the photographic and netting surveys. It is important to understand the differences between survey methods, as this will better help us to decide which methods are the most effective in a particular region and how they can complement each other. Ultimately the methods that produce the most accurate data, at the lowest cost, will be the best choice for future surveys targeting *Bombus* species.

Speaker: **Asad, Syed**, Simon Fraser University

Co-authors: Tiia Haapalainen, David Holden, Laura Luo, Regine Gries & Gerhard Gries

Title: **Field trapping bumble bee wax moths (*Aphomia sociella*) to help protect bumble bee colonies**

Abstract: bumble bee wax moths (*Aphomia sociella*) are an invasive species in North America that heavily parasitize bumble bee colonies. Wax moth females lay eggs on bumble bee comb, resulting in complete destruction of the bumble bee hive by the wax moth larvae. This suggests that the wax moths are attracted to bumble bee comb scent. Therefore, we aim to trap wax moths by determining what bumble bee scents they can detect and seeing if these kairomones paired with previously identified wax moth pheromones can significantly trap moths in the field.

Speaker: **Balzer, Zach**, University of Western Ontario

Co-authors: Graham Thompson

Title: **A novel anti-social response to CO^2 narcosis in a subterranean termite: implications for studies of kin recognition**

Abstract: Patients recovering from anesthesia can suffer a form of delirium ('emergence delirium') that renders them temporarily anxious or agitated, and in some cases patients may show anti-social behaviour towards their care givers. A comparable reaction upon emergence from anesthetic coma may be present in insects as seen by increased aggression in *Bombus* impatiens queens towards conspecifics following CO^2 narcosis, among other comparable examples of seemingly maladaptive delirium. In this study we test for evidence of emergence delirium in a population of Eastern subterranean termites (*Reticulitermes flavipes*) as they recover from a concentrated dose of carbon dioxide. Following exposure to 30 scfh of CO^2 for 15 s, recovering soldier and worker termites were consistent in their recovery behaviour, which included an up-tick of anti-social behaviours (e.g., biting, lunging) directed towards nestmates, relative to no-treatment and non-toxic control treatments. We present these peculiar observations for the first time and speculate that narcosis alters the threshold response that normally regulates aggression, lowering it such that delirious nestmates now aggress each other. Our assay may present a new tool to study kin recognition in termites and possibly other social insects.

Speaker: **Barreto, Carlos**, Western University

Co-authors: Robert Buchkowski, Brian A. Branfireun, James McLaughlin & Zoe Lindo

Title: **Experimental warming decreases carbon and nitrogen fluxes in soil food webs of boreal peatlands**

Abstract: Food web models represent feeding relationships and can be used to trace the flow of energy, nutrients and mass. Only a handful of energetic soil food web models exist and how soil food webs will respond to warming is not yet well understood. Here, and for the first time, we characterized soil food webs in high carbon storage boreal peatlands. We created energy-flux models for two peatland sites in Northern Ontario differing in nutrient status, water table level and plant community composition, and under three warming scenarios (ambient, passive and active warming): the Sphagnum-dominated fen (SF) and the Carex-dominated fen (CF). We collected biomass data from the sites and grouped species in 18 trophic nodes. We calculated carbon and nitrogen fluxes for the six food webs, and we found that 1) fluxes were higher in the SF than in the CF, 2) warming-induced changes in biomasses are important drivers of fluxes, 3) warming decreased the biomasses of all invertebrates and microbial groups with consequent decreased C and N fluxes in both sites. While preliminary, the approach and results presented here provide a way forward in understanding soil community trophic interactions to carbon and nitrogen dynamics in boreal peatlands under warming.

Speaker: **Basso, Jacob**, University of Guelph

Co-authors: Roselyne Labbe & Cynthia Scott-Dupree

Title: **The sterile insect technique as a novel tool for control of pepper weevil (*Anthonomus eugenii* Cano) in greenhouse and field pepper crops**

Abstract: The pepper weevil (PW; *Anthonomus eugenii* Cano) is a significant pest of pepper (*Capsicum*) crops in North America, with occasional outbreaks occurring internationally. Yield losses can reach 50-100% in severe infestations, resulting in millions of dollars in economic damage annually. Larvae develop entirely within pepper buds and fruit causing premature fruit abortion. Consequently, insecticide sprays are generally ineffective for managing PW, insecticide resistance development is a concern, and biocontrols for PW are not yet commercialized. Sterile insect technique (SIT) is a novel approach to PW management. This foundational study focuses on producing high-quality sterile male insects for a PW-SIT system. Results show that a high percentage (83-100%) of late-stage PW pupae of both sexes irradiated at 90-110Gy of gamma radiation failed to produce offspring, compared to unirradiated weevils (0-25%). Longevity of irradiated weevils was generally shorter (median=8-22days) than unirradiated weevils (median=28-68days) though may be sufficiently long enough for a feasible PW-SIT system. Together with ongoing research assessing the quality of sterilized male PW including their flight ability, sperm production and transfer, mating behaviour, and competitiveness, this study lays the groundwork for a new tool for sustainable PW suppression in both field and greenhouse pepper crops, or on an area-wide scale.

Speaker: **Baute, Tracey**, Ontario Ministry of Agriculture, Food and Rural Affairs

Co-authors: Jennifer Birchmore, Christina DiFonzo, Jocelyn Smith, Julien Saguez, Brigitte Duval, John Gavloski, Amy Raudenbush, Ken Wise, Marion Zuefle, Chris Maund, Peter Scott, Jason Wells, Steven Hamill, Sebastian Ibarra, Suqi Liu, Caitlin Congdon, Leah Madore & Jane White

Title: **The Great Lakes and Maritimes Pest Monitoring Network; Collaboration Across Borders to Strengthen Surveillance of Shared Pest Issues**

Abstract: The Western Bean Cutworm Trap Network was established more than 10 years ago, to monitor for this pest as it expanded its range from the Great Plains region into the Great Lakes region. Based on the success of the network and improvements in GIS mapping programs, the network evolved to include several jurisdictions with shared pest issues including Ohio, Michigan, New York, Ontario, Quebec, Manitoba, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador. The Great Lakes and Maritimes Pest Monitoring Network (GLMPMN) has more than 1000 pheromone traps monitored in any host crop of Lepidopteran pests including black cutworm (*Agrotis ipsilon*), corn earworm (*Helicoverpa zea*), European corn borer (*Ostrinia nubilalis*), fall armyworm (*Spodoptera frugiperda*), true armyworm (*Mythimna unipuncta*) and western bean cutworm (*Striacosta albicosta*). Using ArcGIS Survey123, trap participants enter trap site information and weekly trap counts which are then visualized through interactive maps and dashboard analytics in near real-time. Through the sharing of information, the network has been able to monitor these pests across all host crops grown in the region, enabling more timely pest alerts for growers and crop consultants. This collaboration has also identified gaps and misconceptions in pest knowledge and a need for improvement in pest monitoring techniques and equipment.

Speaker: **Bouchard, Patrice**, Agriculture and Agri-Food Canada

Co-authors: Yvés Bousquet, Rolf L. Aalbu, Miguél A. Alonso-Zarazaga, Ott Merkl & Anthony E. Davies

Title: **Review of genus group names in the family Tenebrionidae (Insecta: Coleoptera**)

Abstract: We present a review of genus group names for darkling beetles in the diverse family Tenebrionidae (Insecta: Coleoptera). A catalogue of nomenclaturally available genus-group names is given. Genus group names in this family are also recorded in a classification framework, along with data on the distribution of valid genera and subgenera within major biogeographical realms.

Speaker: **Boudreau, Denis**, Université de Moncton

Co-authors: Gaétan Moreau & Nada Hammami

Title: **Niche and metacommunity dynamics of sympatric Calliphoridae species competing for animal necromass**

Abstract: Sarcosaprophageous calliphorids, also known as blow flies (Diptera: Calliphoridae), rapidly colonize cadavers and carcasses and thus provide clues about the circumstances of death in criminal investigations. Hence, many species from this family apparently occupy similar niches. Furthermore, the phenology and occurrence of these insects, as well as the effect of environmental and evolutionary factors on these variables are largely unknown. Thus, an empirical study was conducted to document the sarcosaprophagous fauna of Calliphoridae in southeastern New Brunswick, Canada, and to test Hutchinson's hypothesis that each sympatric species responds differently to a variety of environmental factors to promote their competitive coexistence. To do this, sarcosaprophageous calliphorids were trapped for a year in urban, periurban and forest habitats. 20,576 calliphorid specimens distributed amongst 14 different species were collected. The composition of species assemblages changed with seasons, abiotic

factors, habitats and was related to the evolutionary history of species. When species response to these factors was illustrated in canonical space, each species had a distinct centroid, suggesting that their ecological niches differed. These results support our hypothesis and highlight the importance of accurately determining the niche of forensic insect species to optimize their use in forensic investigations.

Speaker: **Bourchier, Rob**, Agriculture and Agri-Food Canada

Co-authors: Michael McTavish, Patrick Haefliger & Sandy Smith

Title: **Development of rearing and release methods for biological control agents of introduced Phragmites in Ontario.**

Abstract: Introduced *Phragmites australis* (common reed) is one of the most invasive plants in North America and a leading threat to wetland ecosystems. Classical biological control is a promising tool to supplement existing management practices. This project is developing the first biological control program for introduced Phragmites in North America using the stem-boring noctuid moths *Archanara neurica* and *Lenisa geminipuncta*. Insects were approved for release in Canada in 2019. Progress to date has included the successful laboratory rearing of *Archanara neurica* on artificial diet, a comparison overwintering survival of eggs and testing of alternate release methods including: seeding larvae on cut Phragmites stems, open larval releases and caged vs open pupal releases. Over 4000 larvae and 160 pupae were released in 2021. We will report of early results and monitoring from release sites in southern Ontario.

Speaker: **Brewster, Adrienne**, Cambridge Butterfly Conservatory

Co-authors: Jessica Linton, Ryan Norris & Nusha Keyghobadi

Title: **Collaborative Efforts to Recover the Endangered Mottled Duskywing Butterfly in Ontario**

Abstract: The Ontario Butterfly Species at Risk Recovery Team made history in July 2021 by conducting Ontario's first-ever reintroduction of an endangered butterfly, the mottled duskywing. This monumental step in butterfly conservation was made possible by the cooperation and collaboration of a large network of organizations that make-up the recovery team. In this talk I will speak to the formation of the recovery team, and will touch on the conservation efforts that are currently underway for this species, including habitat restoration, population monitoring and the development of a captive rearing protocol.

Speaker: **Brownoff, Ferf**, University of Alberta

Co-authors: Jaime Pinzon & Carol Frost

Title: **New taxonomic records for the spider fauna of New Caledonia, including families, genera, and a species description**

Abstract: The current state of New Caledonian spider fauna is likely a gross underestimate of the diversity that exists within its borders. This contrasts with the extensive amount of taxonomic reference material for spiders in nearby locations, such as Australia and New Zealand. Unfortunately, very few keys exist for a limited number of New Caledonian spider taxa and more comprehensive taxonomic literature is lacking in detail for identification. From fieldwork carried out in late 2015, I identified specimens to the lowest taxonomic level possible. From this, I am in

the process of describing a new species in the family Zodariidae Thorell,1881, provisionally assigning it to the genus *Neostorena* Rainbow, 1914. I have also provided six additional records for genera (*Episinus* and *Phycosoma*) and families (Hahniidae, Mimetidae, Theridiosomatidae, and Symphytognathidae) previously unreported in New Caledonia. I will also discuss several interesting specimens in this same collection, though their taxonomic placement requires further study. This dataset offers many opportunities to increase our knowledge of the spider fauna in New Caledonia.

Speaker: **Buitenhuis, Rosemarije**, Vineland Research and Innovation Centre

Co-author: Taro Saito

Title: ***Anystis baccarum*, a new Canadian predator for greenhouse IPM programs**

Abstract: *Anystis baccarum* (L.) (Acari: Anystidae) is a globally distributed generalist predatory mite that preys on a broad range of pests, including some of the most challenging species like western flower thrips, foxglove aphids, spider mites, echinothrips, and mealybugs. It can also survive on supplemental foods like pollen, *Artemia* cysts and *Ephestia* eggs. Although the mass rearing of *A. baccarum* was once deemed not economical due to the high cannibalism rate, we have succeeded in developing a cost-effective prototype process. This makes *A. baccarum* a viable option for use in augmentative biological control programs.

To demonstrate the efficacy and compatibility of *A. baccarum* in greenhouse IPM programs, we performed several laboratory and greenhouse trials. We found that *A. baccarum* had a much higher predation rate than either *Neoseiulus cucumeris* or *Amblyseius swirskii*, and that it attacked all motile stages of western flower thrips (larvae and adults). It also readily consumed all foxglove aphid life stages, and was particularly effective against first instars. In greenhouse trials, significantly better control of thrips and two-spotted spider mites was obtained on chrysanthemums when *A. baccarum* was used together with *N. cucumeris* sachets, compared to either predator alone. On greenhouse sweet peppers, combined releases of *A. baccarum* and *Aphidius ervi* effectively eliminated foxglove aphids, and higher fruit yields were obtained compared to plants protected by the parasitoids only. The mite also fed on thrips, leading to significantly less thrips feeding damage on the fruits in the treatments with *A. baccarum*.

We conclude that *A. baccarum* will be a useful addition to greenhouse IPM programs. This year, we transferred the predator to our project partner, Applied Bio-nomics Inc., where a production line is currently under development.

Speaker: **Bush-Beaupré, Allen**, Université de Sherbrooke

Co-authors: Jade Savage, Marc Bélisle, Francois Fournier & Anne-Marie Fortier

Title: **Comparing the Reproductive Behavior and Life-History Strategies of the Seedcorn Maggot's (*Delia platura*) H- and N-lines**

Abstract: Efficient and sensible control of agricultural pests requires a profound understanding of the pests in question. Many control methods target pests reproductive traits and so, knowledge of these traits is crucial. The seedcorn maggot, *Delia platura* (Diptera: Anthomyiidae), is reported as a cosmopolitan polyphagous pest species which may be found in high numbers in numerous crops. Two morphologically identical genotypes of *D. platura* (H- and N- lines) with distinct distributions were recently discovered. While many biological traits have been described for *D. platura*, no study to date has been conducted on the life history strategies and reproductive

behaviors of its two genotypes. Using laboratory-reared colonies originating from the Montérégie region in Québec, this project investigates the effect of group composition (sex-ratio and density) on mating success of the two *D. platura* genotypes. We found a substantial increase in mating success with increasing proportion of males within mating groups for the N-line while this effect appeared to be present only at high densities for the H-line. These results corroborate reports of *D. platura* high-density swarms in which sex ratios are usually male-biased. We also describe reproductive traits of the genotypes along with their implications in integrated pest management and future studies.

Speaker: **Carcamo, Hector**, Agriculture and Agri-Food Canada

Co-author: Brandall Randt

Title: **Parasitism of lygus and alfalfa plant bugs by *Peristenus* wasps in southern Alberta, Canada**

Abstract: Mirid plant bugs of the genus *Lygus* and *Adelphocoris* (alfalfa plant bug) are common pests of seed alfalfa and other crops. At least 3 species of native *Peristenus* wasps (Braconidae) attack this plant bug complex, but the local parasitoid-host relationships and timing of parasitism are poorly known. Our objective in this study was to rear parasitoids from the two generations of these plant bugs and to quantify levels of parasitism in the spring and summer in alfalfa and sainfoin. Alfalfa plant bugs had very high levels of parasitism in late spring/early summer and higher than those observed for lygus during the same period. High levels of parasitism (over 50%) were restricted to a cohort of nymphs indicating that wasps had a short successful attack period in late spring or early summer (mid to late June in 2021). Levels of parasitism were much lower for lygus later in the season and absent from alfalfa plant bugs. This study will be expanded to other crops in the future with the aim to collect more baseline data in consideration of neo-classical biological control of lygus bugs with the multivoltine, *P. digoneutis*.

Speaker: **Chalissery, Jaime Mathew**, Simon Fraser University

Co-authors: Regine Gries, Santosh Kumar Alamsetti, Madison Jean Ardiel & Gerhard Gries

Title: **Identification of the Trail Pheromone of the Pavement Ant *Tetramorium immigrans* (Hymenoptera: Formicidae)**

Abstract: Four species of *Tetramorium* pavement ants are known to guide foraging activities of nestmates via trail pheromones secreted from the poison gland of worker ants but the trail pheromone of *T. immigrans* is unknown. Our objectives were to (1) determine whether poison gland extract of *T. immigrans* workers induces trail-following behavior of nestmates, (2) identify the trail pheromone, and (3) test whether synthetic trail pheromone induces trail-following behavior of workers. In laboratory no-choice bioassays, ants followed poison-gland-extract trails farther than they followed wholebody-extract trails or solvent-control trails. Gas chromatographicelectroantennographic detection (GC-EAD) analyses of poison gland extract revealed a single candidate pheromone component (CPC) that elicited responses from worker ant antennae. The CPC mass spectrum indicated, and an authentic standard confirmed, that the CPC was methyl 2-methoxy-6-methylbenzoate (MMMB). In further laboratory no-choice bioassays, ants followed poison-gland-extract trails (tested at 1 ant equivalent) and synthetic MMMB trails (tested at 0.35 ant equivalents) equally far, indicating that MMMB is the single-component trail pheromone of *T. immigrans*. Moreover, in laboratory two-choice bioassays, ants followed

MMMB trails ~21-times farther than solvent-control trails. In field settings, when *T. immigrans* colonies were offered a choice between two paper strips treated with a synthetic MMMB trail or a solvent-control trail each leading to an apple bait, the MMMB trails recruited nestmates to baits faster and more efficiently than solvent-control trails. Our field data provide incentive to field test synthetic trail pheromone formulations leading to lethal food baits as a control tactic for major invasive ant pests.

Speaker: **Conflitti, Ida**, York University

Co-authors: Leonard Foster & Amro Zayed

Title: **BeeCSI: tools for assessing bee health**

Abstract: The health of honey bees is declining, with beekeepers losing more than a quarter of their colonies every winter. Left unchecked, these declines will threaten a $5.5 billion/year sector of Canada's agroeconomy, which depends on bees for pollination. The causes of honey bee declines are complex, variable over space and time, and often difficult to identify. Here we plan to improve the health of honey bees by developing BeeCSI: 1) a new health assessment and diagnosis platform powered by stressor-specific biomarkers; and 2) guidelines for using these diagnostic tools to manage bee health. This talk will provide an overview of the project, including the main aims and objectives, current status, and future goals.

Speaker: **Corbin, Lyllian**, Brock University

Co-authors: Lyndon Duff & Miriam Richards

Title: **Mate competition and territoriality in male eastern carpenter bees (*Xylocopa virginica*)**

Abstract: Territoriality is a costly reproductive strategy displayed by male eastern carpenter bees. In spring, males emerge before females, hold territories near nest entrances, and compete for access to females through male-male chase interactions. We aimed to determine the intensity of male-male competition for access to mates and the influence of female availability on male behaviour. We hypothesized that when the operational sex ratio is more strongly skewed towards males, male-male competition should increase. This in turn should create stronger selection for larger male body size. From 2016 to 2021, X. virginica males were caught, measured and marked to observe territorial behaviours and chase interactions. More males chased when the sex ratio of active males and females was skewed towards males. Therefore, males faced higher male-male competition when access to females was limited. Larger males performed more chases than smaller males. This suggests that body size influences territorial behaviour in males and likely determines a male's success in competing for access to mates.

Speaker: **Cusson, Michel**, Canadian Forest Service

Title: **The challenges and rewards of pursuing parallel paths of entomological enquiry**

Abstract: Either by choice or as a result of fortuitous events arising in one's personal or professional life, many of us, insect enthusiasts, develop a career with a life-long focus on one particular area of entomology. However, my own professional trajectory has been far more sinuous, now precluding easy slotting of my scientific identity into one of the usual categories (e.g., insect systematist, behavioral ecologist, biocontrol specialist, etc.). Although such a career

path comes with significant challenges, the rewards usually make up for them. This presentation will take you through the meanders of my entomological research adventure, with a focus on the decisions that led me to bifurcate into new areas while maintaining efforts in older ones, highlighting the important roles played by mentors, colleagues and students at each of these branching points.

Speaker: **Damien, Maxime**, University of Manitoba

Co-authors: Tharshi Nagalingam, Hector A. Cercamo, Jennifer Otani, Tyler Wist, Jordan A Bannerman, John Gavloski & Alejandro C Costamagna

Title: **Landscape mediates flea beetle infestation levels in canola crops across Canadian prairies**

Abstract: Canola fields are a major component of agricultural landscapes across the Canadian prairies and seedlings are highly susceptible to crucifer-feeding flea beetles, requiring farmers to apply foliar insecticides in addition to seed treatments. Herbivore abundance and plant damage are affected by landscape complexity, but this has not been investigated for flea beetles feeding on canola. In this study, we sampled flea beetle populations in canola across four regions of the Canadian prairies using sticky cards, during the seedling stage, from 2015 to 2017. By using digital land-use maps, landscape variables were calculated in four circular sectors every 500 meters radius, and their association with flea beetle abundance was explored through their relative importance, using Information-Theoretic approach. The two main flea beetle species were the Crucifer (cfb) and Striped flea beetles (sfb). The abundance of sfb was relatively low and highly variable, and no landscape predictors were consistently associated with it across the regions studied. Conversely, regardless of spatial scale, cfb abundances decreased as the proportion of host crops increased. Relative importance values identified a positive effect of both woodland and grass border proportion, and a negative effect of grassland proportion, at 500, 1000 and 2000m respectively. Mean host crop size had positive effect on CFB abundances up to 1500m. Further studies should be conducted to determine landscape factors affecting sfb in areas where this species is more abundant in order to develop pest management strategies effective for both flea beetle species.

Speaker: **Daniels, Jaret,** Florida Museum of Natural History, University of Florida

Title: **At-Risk Butterfly Recovery Efforts: A look at the big picture of small organism Conservation**

Abstract: Butterfly populations continue to decline worldwide. The drivers of loss are complex and often attributable to multiple, interacting factors, several of which may be incompletely understood. In the face of this uncertainty, effective at-risk species recovery efforts require a comprehensive toolkit of diverse options to help stabilize, reestablish, and ultimately increase wild populations. A growing number of species recovery plans specifically mention ex situ components (i.e. head-starting, captive breeding, or translocation) as part of the recommended actions that may be necessary for recovery.

With a growing number number of species requiring attention, the development of robust best practices and experimentally testing questions in an a priori manner is essential to advancing the field. Only then can we disentangle why some efforts fail and others succeed.

Speaker: **De Donder, Alice**, Université du Québec à Montréal

Co-authors: Daniel Cormier, Marcela Rodriguez & Eric Lucas

Title: **Impact of novaluron and chlorantraniliprole on the aphidophagous guild of the green apple aphid in an apple orchard**

Abstract: In North America, the primary pest in apple orchards is the codling moth *Cydia pomonella* (L.) (Lepidoptera: Tortricidae). Two reduced-risk insecticides recommended in integrated pest management to suppress this pest are novaluron and chlorantraniliprole. The lethal or sublethal effects of an insecticide on natural enemies can disrupt important processes like the biological control of other pests. Several studies have shown that the use of pesticides can negatively impact the diversity or abundance of natural enemies which may result in secondary pest outbreaks. This study is a two-year field experiment conducted to determine the impact of novaluron and chlorantraniliprole on the aphidophagous guild and the repercussions on the biological control on the most common secondary pest in apple orchards, green aphids *Aphis* spp. (Hemiptera: Aphididae). Results indicate that the use of chlorantraniliprole did not impact the abundance or diversity of the aphidophagous guild. While most aphidophagous species were not impacted by novaluron, a significant decrease of one of the more abundant predators, the predatory mirid bugs *Pilophorus perplexus* Douglas & Scott (Hemiptera: Miridae) was observed after its use. The biological control of green aphids was not impacted by either insecticide.

Speaker: **Dearborn, Kenneth**, University of Toronto

Co-authors: Sandy Smith, Chris MacQuarrie & Daegan Inward

Title: **Fraxinus foliage: does host species for maturation feeding alter the fecundity of emerald ash borers?**

Abstract: Emerald ash borers are an invasive wood boring species that quickly overwhelm naïve North American ash trees. Once adults emerge they must feed on foliage to reach sexual maturity. We compared four ash species present in North America; black, green, tropical, and white, to better understand if oviposition potential is impacted by host foliage. This experiment assesses differences across maturation feeding treatments for 1) female longevity, 2) percentage of viable eggs, 3) hatching success, and 4) average egg development time. Reared in a walk-in growth chamber at 25 Â°C, 55% RH, and 16:8h light:dark photoperiod, each of the four foliage groups consisted of 34 females. Tropical ash had the longest living females, 33.2 Â± 0.7 days, and other foliage groups averaged below 30 days. The green ash group laid the most viable eggs, 1749, and had the highest viability percentage, 71.6%, for all oviposition attempts. Viable eggs following green ranked as tropical, black, then white (1361, 659, and 559) and viability percentage as black, white, then tropical (65.6%, 65.2% and 64.0%). These data suggest that green ash, the most widespread and abundant North American ash, is the most useful foliage for emerald ash borer maturation feeding to produce offspring.

Speaker: **deHaan, Jessie**, Brock University

Co-author: Miriam H. Richards

Title: **The ecological and physiological consequences of sun vs. shade nesting for the small carpenter bee, *Ceratina calcarata*, and their offspring**

Abstract: *Ceratina calcarata* mothers choosing to nest in the shade may face increased rates of parasitism leading to nest failure or abandonment, while those nesting in the sun may experience

competition and expose their offspring to higher developmental temperatures. High developmental temperature reduces an insect's body size; a phenomenon called the Temperature-Size Rule. The temperature-size relationship is straightforward in larvae that acquire their own food (self-feeding) but may be more complicated in insects whose mothers' provision their food for them (adult-fed). Mass-provisioning bees are an example of adult-fed insects, since all the food an offspring needs to complete development is provided ahead of time by the mother. In this thesis I used *C. calcarata* to investigate the ecological and behavioural consequences of nest location choice (Sun or shade) on mothers, as well as the physiological consequences of developmental temperature on their offspring.

I found that nests randomly allocated to the shade treatment were more likely to be empty when opened (Chi-Square: 2019: X2=5.14, df=1, p=0.023; 2020: X2=9.00, df=1, p=0.003), indicating that shaded nesting locations were not preferred. Mothers nesting in the sun foraged more often for nectar than shade mothers (Chi-Square: X2=4.557, df=1, p=0.033), but provisioned similar sized pollen masses (ANOVA: $F(1,12) = 0.80$, $p = 0.388$). I also found that offspring from sunny nests experienced significantly higher temperatures than offspring from shaded nests (Linear mixed model: Treatment: $F(1, 511) = 61.76$, $p < 0.001$), and even more so if the sunny nests were oriented on an angle. Offspring from sunny nests were smaller than shade bees (Linear mixed model: Females: $F(1,52.36)= 3.85$, $p = 0.055$; Males: $F(1,49.60)= 7.32$, $p = 0.009$) because they had smaller cells, in agreement with the Temperature-Size Rule. The metabolic rates of pupal and adult offspring expectedly increased in response to higher acute temperature, and adult C. calcarata offspring from sunny nests had less frequent CO2 bursts when using discontinuous gas exchange at 25Â°C compared to shade bees (Linear Model: $F(1,24)=14.27$, $p<0.001$), suggesting a lower metabolic rate. Finally, offspring from sunny nests had a higher thermal tolerance than those from the shade (Linear model: $F=19.26$, df=1, $p<0.001$).

Speaker: **Demarse, Angela**, University of Guelph

Co-authors: Jessica Linton, Adrienne Brewster, Nusha Keyghobadi, Emily Trendos & Ryan Norris

Title: **Lepidoptera Marking Methods: A matched pair experiment examining nail polish and acrylic paint durability**

Abstract: Marking and re-sighting animals is a common method for answering important ecological questions about population demography and individual movement. A common technique for marking Lepidoptera is to use a fine-tipped permanent marker on the wing, but for species with dark pigmentation, densely packed scales, or small wings, this method can be ineffective. Two alternatives are acrylic paint or nail polish but the durability of these marking methods has not been formally tested. Using a matched pair design, we present results from a marking experiment that examined the durability of acrylic paint and nail polish markings on butterfly wings. Markings were randomly assigned to one of three positions on the dorsal side of each forewing, then subject to abrasion and humidity challenges to observe the frequency of mark loss for different mark types (acrylic: 43%, nail polish: 6%) and positions (on the cell: 20%, between termen 3-4: 39%, between termen 5-6: 64%). Finally, we will present the frequency of acrylic and nail polish mark loss in situ through a mark-resighting study on a Hesperiid butterfly, the Mottled duskywing. Our results will provide insight on the development of effective marking techniques for Lepidoptera.

Speaker: **Demers, Natali**, Agriculture and Agri-Food Canada

Co-authors: Paul Abram & Jean-Philippe Parent

Title: **Slug-like aphids, the disruptive effect of vibrations on the offspring of the green peach aphid *Myzus persicae***

Abstract: The green peach aphid, *Myzus persicae* (Hemiptera: Aphididae), is a pest that can be found in a variety of crops of agronomic interest in North America. Its impressive reproduction and dispersal abilities make it a difficult foe to vanquish in a wide variety of crops. While searching for physical control methods to disrupt insect pest as alternative to chemical control, previous experiments investigated the effect of non-specific substrate-borne vibration on the behaviour of aphids placed on vibrating plants. On these occasions, a repellent effect, characterized by individuals leaving the plant, was observed after 24h and 48h of vibrations. It is in this context that our project takes place, aiming this time to observe the effect of vibrations on the offspring of the adults exposed to vibrations. Nearly reproductive individuals (either N4 or adults) were thus isolated in groups of five and subjected to vibrations for 48h. The morphology and quantity of the juveniles born during and after treatment were subsequently observed. Preliminary results obtained show that juveniles of some adults exposed to vibrations give birth to proportion of aborted embryos and to slug-like aphids with very short lifespan. Moreover, viable juveniles of treated adults did not develop wings later in life, which can occur when exposed to stress factors. These recent observations highlight a complementary and interesting side-effect to non-specific vibration exposure on aphids by inducing the birth of non-viable juveniles.

Speaker: **Dergousoff, Shaun**, Agriculture and Agri-Food Canada

Co-authors: Neil B. Chilton, Kateryn Rochon, Tim J. Lysyk, Patrick Leighton & Camille Guillot

Title: **Expansion into new geography by migration of dog and deer ticks**

Abstract: Ticks endemic to Canada present multiple issues, from a disgusting nuisance those spending time outdoors to serious threats to human and animal health. The American dog tick, *Dermacentor andersoni* (Acari: Ixodidae) can transmit human pathogens, such those that cause Rocky Mountain spotted fever and tularemia in humans and anaplasmosis in cattle. The deer tick, Ixodes scapularis, is commonly discussed in the news and by the general public because it is the vector of *Borrelia burgdorferi*, the cause of Lyme disease. This tick is capable of transmitting additional pathogens, such as those that cause babesiosis, anaplasmosis, and Powassan encephalitis in humans. Thus, an understanding of the current geographic distribution of each tick species is crucial to assess the risks associated with them.

The feeding behavior of ticks present opportunities for movement and dispersal. This has important implications for expansion of their geographic range and, therefore, expansion of the health threats associated with them. Based on our studies of the American dog tick, it is clear that this species has undergone significant range expansion at the northern and north-western limits in Manitoba and Saskatchewan over the last few decades. Results of a large active sampling project throughout the four western provinces will be presented, along with early results from predictive models describing the current distribution. The deer tick provides an even more dramatic example of range expansion in Canada. In the 1970's, this tick was only known to occur in the southernmost part of Ontario. Since then, it has expanded into Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Manitoba. A nationwide surveillance network has been established to describe the current distribution of deer ticks and pathogens they can

transmit. Results from the first year of the project will be presented. These provided a baseline picture of tick abundance and pathogen prevalence at select sentinel sites across Canada.

Speaker: **Desloges Baril, Paige**, University of Windsor

Co-authors: Lauren Des Marteaux & Sherah Vanlaerhoven

Title: **Exploring Native Predatory Hemipteran Species for Use as Biological Controls in Canadian Vegetable Production**

Abstract: Insect pests, invasive species introductions, and increasing insecticide resistance are among the various challenges faced by Canadian tomato growers. Native predaceous insects are appealing biocontrol agents (BCAs) due to reduced ecological risk and fewer regulatory hurdles compared to non-native species, however few native species have been developed as BCAs to date. From our recent insect survey in Ontario we identified and established colonies of two native predatory *Dicyphus* species. To develop these species as BCAs for tomato, we must first assess their ability to displace and establish future generations in field tomato, and determine their maximum prey consumption in the lab. To determine the predators' ability to reach and consume prey at different levels of the tomato plant (displacement), each predator will be released in a cage with prey adhered to different strata of the tomato plant and allowed four days to predate. Then, prey will be tallied from each strata. Population establishment will be measured by introducing mating pairs to field tomatoes and allowed 7 weeks to oviposit, followed by enumerating all nymphal stages. To determine the maximum prey consumption, we will quantify prey consumption per adult over 24 hours in laboratory arenas with large densities of various prey. These evaluations will provide the foundation necessary to develop these new native BCAs for commercial use by Canadian tomato growers.

Speaker: **Desroches, Claudine**, Université du Québec à Montréal

Co-authors: Genevieve Labrie & Eric Lucas

Title: **Ceutorhynchinae assemblage in canola agroecosystem of Quebec**

Abstract: Ceutorhynchinae are a highly diverse and phytophagous group of weevils. Some are biological control agents against weeds and others, like the invasive canola seedpod weevil (CSW), *Ceutorhynchus obstrictus*, are important pests of cultivated Brassicaceae. The seedpod weevil is present across Canada in canola agroecosystems and its effects on the assemblage of Ceutorhynchinae are not known. This study aims to characterize Ceutorhynchinae assemblage in such ecosystems and evaluate the impact CSW may have on it.

Ceutorhynchinae were sampled in a total of 24 borders of canola fields (12) and other cultures (12) in three regions of Quebec during summer 2019-2020. Canonical analysis and multivariate regression tree analysis were carried out on abundance of Ceutorhynchinae species and environmental variables. Our results highlight important associations between plant hosts and weevil species. The native weevil *Ceutorhynchus neglectus* is associated with marsh yellow cress and the exotic *Ceutorhychus typhae* is associated with sherperd's purse. Canonical analysis also reveals that assemblage variation of Ceutorhynchinae species is in part explained by the close presence of canola in the area sampled. Moreover, assemblage variation occurred regionally, and assemblage is either dominated by the native weevil *Ceutorhynchus neglectus* or by the CSW. These results suggest that the abundance of the invasive pest *C. obstrictus* may influence the composition of Ceutorhynchinae assemblage in canola agroecosystem.

Speaker: **Dogantzis, Kathleen**, York University

Co-authors: Tanushree Tiwari, Alivia Dey, Ida Conflitti & Amro Zayed

Title: **The adaptative radiation of the European Honey bee (*Apis mellifera*)**

Abstract: The honey bee, *Apis mellifera*, is natively distributed through Africa, Europe, and parts of Asia. Consequently, the species occupies ecologically diverse areas, which has resulted in the diversification of many morphologically and geographically distinct subspecies. Though many genomic studies have provided invaluable research on honey bee origins, the genetic basis of the species' adaptive radiation have not been fully explored. Expanding on this topic is important for understanding how the honey bee genome diverged to facilitate adaptation across its distribution. Here, we used an extensive population genomic dataset, which consists of over 200 individual genomes from at least 14 subspecies with an emphasis on newly sequenced individuals from Asia and Africa; including *A. m. lamarckii* and *A. m. unicolor*. Our study aims to identify the genomic patterns associated with positive selection that may be responsible for the honey bee's adaptation across distinctive ecological space.

Speaker: **Dolezal, Aleksandra**, University of Guelph

Co-authors: Ellen Esch &Andrew MacDougall

Title: **Re-designing agricultural landscapes: The effect of habitat on arthropod communities**

Abstract: Arthropods are critical components in agricultural landscapes, representing most of the biodiversity and providing important ecosystem services. Nevertheless, we have an incomplete understanding of how arthropod communities are assembled in agroecosystems. We conducted a comprehensive survey of arthropod communities within three major habitat types of Southern Ontario farmed landscapes, including prairie grasslands, crop fields and woodlots. Previous studies have focused on impacts of habitat at one scale, for one trophic level, and quantitatively document diversity without measuring functional implications. In this study, we used a spatially nested design to examine how factors occurring at the regional, farm and local scale filter arthropod communities in agroecosystems. Importantly, we also investigate how this applies to the ecosystem function of pest control and how changes in on-farm habitat cover may impact function through increased arthropod biodiversity. Results at the regional-scale show that arthropods utilized farmed landscapes, as similar numbers of arthropod families were seen in semi-natural areas surrounding farms compared to within our agricultural field sites. The farm-scale results showed a strong relationship between habitat and arthropod abundance, richness, and functional group composition. Each habitat contributed to different community composition, which resulted from tissue quantity and quality factors at the local scale. Overall, prairie grassland habitat had the greatest arthropod abundance and richness, contributing to crop damage reduction in adjacent crop fields. Understanding how habitat influences arthropod community assembly and processes will help manage, design, and plan our agroecosystems to best support biodiversity and ecosystem services.

Speaker: **D'Ottavio, Marie**, Université du Québec à Montréal

Co-authors: Genevieve Labrie & Eric Lucas

Title: **Landscape effects on *Trichomalus perfectus*, a key parasitoid of the cabbage seedpod weevil (*Ceutorhynchus obstrictus*) in canola in Quebec (Canada)**

Abstract: Since several years canola (*Brassica napus* L.) yield is negatively impacted by pests, such as the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham, Coleoptera : Curculionidae), native from Europe and mostly established in oilseed rape (Dmoch, 1965 ; Dosdall et al., 2001). In 1931 *C. obstrictus* was accidentally introduced in North America (Vancouver) (McLeod, 1962) and then it spread in Canada. It was found in Quebec in 2000 (Brodeur et al., 2001). In Europe, *Trichomalus perfectus* (Walker, Hymenoptera : Pteromalidae) was determined as a key parasitoid (Haye et al., 2015, KovÃ¡cs et al., 2013). In Canada, Quebec and Ontario, *T. perfectus* parasitizing the weevil was confirmed since 2009 (Mason et al., 2011). However, this parasitoid is absent from the Canadian Prairies.

The study objective is to evaluate how landscape features could promote the parasitism rate of *T. perfectus* on *C. obstrictus* in Quebec, in order to potentially introduce this parasitoid in the Canadian Prairies. Sampling was done in 140 canola fields of eight Quebec regions from 2015 to 2020. Results show that *T. perfectus* is negatively impacted by hedgerows length and distance from water, but positively impacted by landscape diversity, average perimeter/area ratio of crops and soybean proportion.

Speaker: **Dubon, Garcia Franklin**, Brock University

Co-authors: Justin Renkema

Title: **Natural enemies associated with *Grapholita molesta* (Busk) (Lepidoptera: Tortricidae) in Ontario, Canada**

Abstract: The oriental fruit moth (OFM) (*Grapholita molesta*) is an important pest of peaches, nectarines, cherries, and apples, in Ontario. Insecticides are frequently used to control OFM, and natural enemies were last assessed in 1970. Therefore, updated knowledge on OFM mortality rates due to natural enemies is needed to develop biological control strategies and reduce reliance on insecticides for management of OFM. To study the activity of predators, surveillance cameras with digital zoom and night vision, were placed over sentinel OFM eggs or larvae on peach leaves in plots in the Niagara region with or without insecticide applications. The main night-active predators were earwigs (Forficulidae), lady beetles (Coccinellidae), lacewings (Chrysopidae), and arachnids (Araneae), and day-active predators were soldier beetles (Cantharidae), ants (Formicidae), shield bugs (Pentatomidae), lady beetles, arachnids, and lacewings. Larval parasitism was determined by sampling peach and apple shoots in the Niagara region and Essex county for the 1st and 2nd OFM generation, and by collecting fruit for the 3rd OFM generation. The parasitoids *Macrocentrus ancylivorus* and *Hymenochaonia delicata* achieved rates of 18-25% and 30-40%, respectively. Egg parasitism rates of sentinels placed under peach and apple leaves during each OFM generation averaged 6.5% in sprayed and unsprayed orchards due to the generalist parasitoid *Trichogramma minutum*.

Speaker: **Duff, Lyndon**, Brock University

Co-authors: Miriam Richards

Title: **Maternal investment patterns in a facultatively social bee showing that socially dominant females forage more than solitary females**

Abstract: In general, comparisons between solitary and social groups should reveal advantages and disadvantages of group living. *Xylocopa virginica* is a facultatively social bee, and therefore facilitates comparisons between individuals that nest solitarily or in groups. Solitary females do all the foraging and egg-laying in their nests and exclude others from nesting with them. In social nests, dominant, primary females, do all the work and egg-laying, whereas subordinate secondaries wait to replace or usurp the primary position, or they join new nests to move up the reproductive queue. The objective of this study is to determine whether there is an advantage of being social or solitary in terms of flights and number of pollen trips. We hypothesize that there is no difference between solitary females and social primaries and that both will out-work social secondaries because of high ergonomic skew in social nests. Thus, we should see similar numbers of pollen trips in solitary and social primaries, and social secondaries should make very few pollen trips. We observed foraging *X. virginica* females at nesting aggregations from 2016-2020 in St. Catharines, Ontario. We caught bees using plastic cup traps on nest entrances and marked them individually with enamel paints. We counted flights and pollen trips of arriving and departing bees, using these to calculate an estimate of each female's maternal investment in brood (the seasonal number of flights and pollen trips as the product of the average number of flights or pollen trips per day, activity rate, and the number of suitable foraging days). Solitary females flew fewer seasonal flights and pollen trips than social primaries, but both solitaries and social primaries flew far more seasonal flights and pollen trips than social secondaries. The order of pollen provisioning significantly influenced the total number of seasonal pollen trips, meaning that bees that started foraging earlier, had longer pollen provisioning seasons. Since social primaries invested in more flights and pollen trips than solitaries, this suggests that social females produce more brood than solitaries, or that social females feed their adult nestmates in addition to provisioning brood and therefore fly more seasonal pollen trips. Finally, secondaries in the first few positions of the reproductive queue likely produce some brood but fewer or smaller brood than produced by solitaries and primaries.

Speaker: **Dumont, Francois**, Mirabel Agri-Food Research Center

Co-authors: Genevieve Labrie

Title: **Effectiveness of a guild of generalist pests in the fight against greenhouse cucumber pests**

Abstract: Greenhouse cucumbers are afflicted by a succession of pests throughout the production season. Tetranychids, whiteflies and aphids are among the most important. Significant yield losses are noted each year relative these pests. The use of biological control agents in greenhouses is well known and various alternatives are available for the pests mentioned. However, the control agents used are mainly specialists, thus targeting one pest at a time. The generalist predators therefore are an interesting alternative to fight against multiple pests. In this study, we test the efficiency, compatibility (intraguild predation) and synergy of two generalist predators, *Orius insidiosus* and *Nabis americoferus*. Results of laboratory and greenhouse tests will be presented.

Speaker: **Durant, Andrea**, University of Toronto Scarborough

Co-author: Andrew Donini

Title: **Ammonia transport in the excretory organs of the disease-vector mosquito Aedes aegypti: functional characterization using RNAseq, RNAi, and electrophysiology**

Abstract: Metabolic ammonia is typically destined for elimination from the body because the toxicological consequences of systemic ammonia accumulation are severe. Specialized ammonia transporters regulate ammonia excretion by moving it across biological membranes. The role of the mosquito excretory organs (Malpighian tubules, MT and hindgut, HG) in ammonia transport, as well as expression and function of the Rh protein ammonia transporters within these organs, was examined in the disease-vector mosquito, Aedes aegypti. Of the two Rh proteins present in A. aegypti (AeRh50-1 and AeRh50-2), we show that AeRh50-1 is the predominant Rh protein expressed in the excretory organs of larvae and adult females. An examination of AeRh50-1 function in larvae and adults using RNAi revealed significantly decreased [NH4+] levels in the urine secreted from the MT, as well as significantly decreased NH4+ flux rates across the HG of adult females. We employed RNA sequencing to identify the expression of key ion transporters in the rectum of larvae, of which limited information currently exists for this important osmoregulatory organ. Finally, the modulation in excretory organ function and/or Rh protein expression was examined in relation to high ammonia challenges (HEA rearing of larvae and blood-feeding of adult females). Relatively high Rh protein immunostaining persists within the hindgut of females at 24-48 hours post blood meal corresponding with previously demonstrated peak levels of ammonia formation.

Speaker: **Evenden, Maya**, University of Alberta

Title: **Semiochemical recruitment of parasitoids to ash trees infested with *Caloptilia fraxinella* (Lepidoptera: Gracillariidae)**

Abstract: *Caloptilia fraxinella* Ely (Lepidoptera: Gracillariidae), is a pest of horticultural ash trees (Oleaceae, Genus *Fraxinus*) in prairie communities across Canada. *Apanteles polychrosidis* Vierek (Hymenoptera: Braconidae), is the primary parasitoid of *C. fraxinella* in Edmonton, Alberta, Canada. To increase parasitism of *C. fraxinella*, we tested lures releasing methyl salicylate and two green leaf volatiles, ((Z)-3-hexenol, and (Z)-3-hexenyl-acetate), at both low and high release rates, to assess attraction and retention of *A. polychrosidis* in infested ash trees. More male and female *A. polychrosidis* were captured on yellow sticky traps positioned in trees baited with the low dose of both methyl salicylate and green leaf volatiles than to unbaited, infested ash trees. Increased attraction of wasps did not correlate with an increase in parasitism of *C. fraxinella*. High release rate lures did not enhance attraction of *A. polychrosidis* to infested ash trees. Parasitism rate was negatively correlated with host density in both experiments. There was no evidence of close-range attraction to lures in an olfactometer assay.

Speaker **Evenden, Maya**, University of Alberta

Title: **A new Massive Open Online Course (MOOC): Bugs 101, Insect-Human Interactions**

Abstract: Bugs 101 is a Massive Open Online Course (MOOC) that was launched on the Coursera platform in June 2019. The content of the course focuses on insect-human interactions, and also introduces learners to insect evolution, biology and ecology. The course has 12 modules each containing several lessons and culminating in a quiz on the material at the end. The first four modules introduce insect diversity, morphology, biology and locomotion. The next four modules focus on ecosystem functions provided by insects including decomposition, herbivory, pollination and disease vectors. Each module has lots of examples on how these functions directly impact human society. The final group of four modules focuses on ways that humans directly interact with insects through sustainable management of insects considered to be

pests, conservation of threatened insect populations, and insects as inspiration in music, art, science and literature. Throughout the course, there are 26 interviews with experts on a range of topics from forensic entomology to insects in art. Several interactive learning objects are incorporated into the course so that students can actively interact with the course material. The course is available for free to a wide range of learners from around the world. Here, we explain the process of building a MOOC, highlight the course content and delivery methods and introduce the learning tools that are used to reinforce and assess student learning.

Speaker: **Faraone, Nicoletta**, Acadia University

Title: **Chemical ecology of ticks: olfaction, behaviour, chemistry and control**

Abstract: Ticks vector the widest array of disease-causing organisms of all hematophagous arthropods and are second only to mosquitoes in their capacity to transmit disease agents of importance to human and veterinary health. Being almost totally blind, ticks rely on chemosensation to identify and locate hosts for a successful blood meal, and the tick chemosensory system represents a new frontier compared with that of insects. The lack of antennae, the presence of very few olfactory sensilla, the development of a distinctive organ (Haller's) used for volatile detection, the multimodal role of sensilla located on mouth parts, make ticks an ideal system for understanding how acarines detect chemicals. We identified key odorants/blends by collection and chemical characterization of volatile compound (VOC) from hosts (e.g., humans, cats, dogs, etc.). Because no studies have investigated potential long-term disruption and inhibition of tick abilities to detect hosts, we assessed the effects on tick chemosensory system of long-term exposure to repellents, and investigated whether pre-exposure to repellents impact the chemosensory system of ticks. Through a novel electrophysiological approach, we recorded tick responses to host VOCs alone and to butyric acid pre- and post-exposure to repellents using gas chromatography linked electrotarsography. Understanding the mechanisms behind tick host selection/acceptance and chemical cue perception will provide means to prevent tick bites and thus infections in humans and animals and to develop effective tick repellent products.

Speaker: **Fernandez, Catalina,** University of Windsor

Co-authors: Sherah VanLaerhoven, Brent Sinclair & Roselyne Labbe

Title: **Cold tolerance of the pepper weevil (*Anthonomus eugenii*) in non-acclimated and acclimated laboratory populations**

Abstract: Winter temperatures in temperate regions limit the distribution of non-native insect species, especially those from tropical and subtropical origin. The pepper weevil, *Anthonomus eugenii* is a pest of cultivated pepper plants distributed in North America with populations extending their range northwards and occurring during the pepper growing season in southern Canada. Here, we determine the ability of the pepper weevil to survive below zero temperatures and the potential for spreading and establishment northwards. We used non-acclimated and acclimated laboratory populations to determine the cold tolerance strategy, the effects of acute and long exposure, and winter survival at two outdoor and one indoor site. Acclimation treatment did not improve the cold tolerance of the pepper weevil and both stages died after freezing temperatures. However, mortality also occurred at low temperatures even before ice formation. Adults and larvae only survived after one month experiencing winter temperatures and all individuals were dead by the end of the experiment. Although the results confirm that the pepper

weevil cannot survive winter outdoor temperatures in Canada, caution is recommended in artificial environments.

Speaker: **Fischer, Andreas**, Simon Fraser University

Co-authors: Sula Fernando, Sarah Moniz de Sa, Jamie-Lynn Varney, Regine Gries & Gerhard Gries

Title: **Intrasexual conflict - female false black widow spiders sense, and behaviorally and physically respond to, female conspecific sex pheromone**

Abstract: Studies on intra-sexual conflict focused on the mate-seeking sex, with little attention paid to the signalling sex. Females of cob-web spiders, such as the false black widow *Steatoda grossa*, can alter the architecture of their webs in relation to external cues to upturn prey-capture, safety, or mating opportunities. Here, we tested the hypothesis that female *S. grossa* respond to mate competition in that they change the web-architecture and pheromone amount on it, in response to the number density of webs in a microhabitat. In experiment 1, three females (low-number density) built their webs in the same room for two days. Following a 12-day intermission, the same three females then built a new web for two days, together with 27 other females (high-number density) present in the same room. The design of experiment 2 was similar except that females first built their webs in the high-number density setting and then in the low-number density setting. The females' web architecture and pheromone titer in both density settings were measured. Our data support the hypothesis that females adapt web architecture and pheromone amount, in response to the number density of webs in a microhabitat.

Speaker: **Flaherty, Leah**, MacEwan University

Co-author: Lisa Lumley & Melissa Hills

Title: **Impact of an invasive and allelopathic weed on below-ground oribatid mite communities**

Abstract: Garlic mustard is an invasive and allelopathic weed in the North American forest understory that can affect soil mycorrhizae and other soil microbial communities. In this study, we examine the impact of garlic mustard invasion on the dominant microarthropod taxa in forest soils, oribatid mites, which are important bioindicators of soil disturbance and may be affected directly or indirectly by garlic mustard invasion and associated allelopathy. Oribatid mite communities in forest soils invaded by garlic mustard were compared to uninvaded forest soils near Edmonton, Alberta, across two years. Over 1400 oribatid mites from 39 species and 25 families were collected and identified to species. Impacts of garlic mustard invasion on belowground oribatid mite community composition and structure will be discussed.

Speaker: **Fleming, Kaitlyn**, Trent University

Co-authors: James A. Schaefer & David V. Beresford

Title: **Range updates and extensions of Carabidae (Coleoptera) in Ontario's Boreal Forest**

Abstract: Understanding species distributions is becoming more important with the threats of climate change, habitat fragmentation, and invasive species. However, we lack basic biogeographic information for many species, in particular, those in northern and remote regions. Using ground beetles collected during 2008-2015 from across northern Ontario and Akimiski

Island, Nunavut, we present new information on ground beetle distribution in this eastern Nearctic boreal forest, including 2 first Canadian records, 9 first provincial and 48 first territorial records, as well as 74 new records that extend the known range of many large and common ground beetles several hundred kilometres.

Speaker: **Franklin, Michelle**, Agriculture and Agri-Food Canada

Co-authors: Jade Sherwood, Paul Abram, Tracy Hueppelsheuser, Gary Gibson & Tim Haye

Title: **A first step: exploration of biocontrol agents for the newly established strawberry blossom weevil, *Anthonomus rubi***

Abstract: The Eurasian, strawberry blossom weevil, *Anthonomus rubi* (Coleoptera: Curculionidae) has established in southwestern British Columbia (BC), Canada. This is the first occurrence of this species in North America. This weevil is a pest of Rosaceae, including berry crops such as strawberries and raspberries. Female weevils oviposit into closed buds, clipping the stem to facilitate larval development inside the buds. Infested buds were collected between 2020-2021 in the introduced range from host plants in the genera Rubus and Fragaria. In the summer 2021, the first foreign exploration for candidate biocontrol agents was initiated with the collection of over 14,000 infested buds from five plant genera (*Fragaria*, *Rosa*, *Rubus*, *Geum*, and *Potentilla*) from locations in Switzerland and Germany. Parasitoids have been identified using a combination of morphological and molecular methods and species composition compared. Parasitoids from the genera *Bracon* and *Pteromalus* have been identified from Switzerland and Germany and two species of *Pteromalus* from British Columbia. Evidence to date indicates that the dominant *Pteromalus* species found in BC is native and distinct from the European species. These exploration efforts are a key first step to determining the potential for a classical biological control programme to be developed for *A. rubi* in Canada.

Speaker: **Fraser, Jessica**, Université Laval

Co-authors: Paul K. Abram & Martine Dorais

Title: **Manipulating parasitoid behaviour with LED greenhouse lighting to improve biocontrol of aphids**

Abstract: Supplemental lighting in vegetable greenhouses is important for maintaining yields when sunlight is inadequate. LEDs are a promising new technology for crop lighting, offering energy-efficiency and spectral customizability. Greenhouse lighting is designed to benefit plants, but greenhouse insects, including pests and their natural enemies, are also sensitive to light conditions. Different guilds—such as mobile, visually-oriented parasitoids, and phloem-feeding herbivores—might respond differently to the same lights, allowing for a configuration that benefits plants and biocontrol agents over pests. To test this hypothesis, we examined the responses of the parasitoid biocontrol agent *Aphidius matricariae* (Hymenoptera: Braconidae) and its pest aphid host *Myzus persicae* (Hemiptera: Aphididae) to artificially-extended days in growth chambers. We exposed insects to varying long-day photoperiods and mid-length days extended with different polychromatic LED lights. We assessed the movement patterns of wasps in infrared activity monitors and the fecundity of aphids on bell pepper (Capsicum annuum) leaves. Aphids did not respond to the different light regimes, while female wasps increased their total activity under some day extensions, and adjusted their activity magnitude and timing

according to the photoperiod. Ongoing research is examining how these organisms respond to LED day extensions in a tri-trophic community context in a greenhouse.

Speaker: **French, Sarah**, York University

Co-authors: Amro Zayed & the BeeCSI Consortium

Title: **The risks of crop exposure to honey bee colonies**

Abstract: Managed honey bees are invaluable pollinators but are susceptible to multiple stressors that originate from surrounding landscapes. Determining how these stressors co-occur is vital for predicting how agricultural landscapes impact honey bee health. In order to assess crop-specific risks to honey bees, we exposed 122 experimental apiaries to six focal crops, which were located across five provinces in Canada. The apiaries were sampled before, during, and after seasonal exposure to crops, for stressors known to impair honey bees. In general, apiaries located in regions with soybeans accumulated the least risky levels of pesticides ($P < 0.002$), mites were less abundant in canola oil regions ($P < 0.03$), and European foulbrood disease was less likely to occur in canola oil, corn, and soybean regions ($P < 0.02$), whereas parasites were not affected by crop type. 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.

Speaker: **Fudlosid, Serita**, Carleton University

Co-authors: Matthew Muzzatti & Heath MacMillan

Title: **Developmental Effects of Microplastic Ingestion on the Tropical House Cricket *Gryllodes sigillatus***

Abstract: Microplastic (MP) is a growing concern as an environmental contaminant as it is now considered ubiquitous in our ecosystems. Microplastics have been confirmed to be present in terrestrial environments, yet the majority of studies have focused on the adverse effects of MPs on aquatic biota. We tested the effect of prolonged dietary microplastic exposure on the growth of the tropical house cricket *Gryllodes sigillatus*. Freshly hatched crickets were fed concentrations of fluorescent polyethylene MP beads (75-105µm) or untreated polyethylene terephthalate microfibers mixed into their diet until adulthood. Weight and body length were measured weekly and MP ingestion was confirmed through fluorescence microscopy and visual inspection of frass. Surprisingly, we found no effect of polyethylene MP ingestion on growth rate or final body size of *G. sigillatus*, yet females experienced a reduction in size and weight at high concentrations of polyethylene terephthalate microfibers in their diet. These results suggest that high concentrations of polyethylene MP beads can be passed through the cricket's gut without a substantial negative effect on their growth and development time, but high concentrations of polyethylene terephthalate microfibers cannot. Although we report the effects of MP ingestion on the growth of *G. sigillatus*, it remains uncertain what threats microplastics pose to other insect life history traits, such as fecundity.

Speaker: **Galang, Kathryn**, York University

Co-author: Amro Zayed

Title: **The molecular basis of altruistic and selfish aggression in honey bees**

Abstract: The aggressive behaviour of the Western honey bee, *Apis mellifera*, is prototypically characterized by stinging. A worker bee will sting intruders to defend her hive. This behaviour is frequently categorized as altruistic as workers sacrifice themselves to protect their sisters and queen. In sharp contrast, a virgin queen bee selfishly stings to obtain reproductive control of the colony. A newly emerged virgin queen will seek out and kill her sister queens to ensure she is the sole egg layer in the colony. The genetic and molecular bases of altruistic worker aggression in honey bees have been extensively studied on its own, or via comparisons with aggression in other solitary insects. The molecular bases of queen aggression has never been studied, and we think it provides a more appropriate control for understanding the molecular biology of altruistic aggression in worker bees. Here, we test the hypothesis that altruistic aggression is transcriptionally different from that of selfish aggression by comparing the brain gene expression profiles of aggressive worker bees against that of aggressive queen bees. Our study provides a more in-depth understanding of how situational context (altruistic vs selfish) affects aggression in insects.

Speaker: **Gavloski, John**, Manitoba Agriculture and Resource Development

Title: **Predator turns pest: A multispecies aphid invasion into Manitoba and response of the multicoloured Asian lady beetle**

Abstract: Multicoloured Asian lady beetle (*Harmonia axyridis*) was first found in Manitoba in 2000. Although a predator of aphids, they can be good at getting into structures, such as homes, to overwinter. Some years levels are low and their presence barely noticed, but there have been some years with quite high populations, resulting in very large overwintering clusters in homes. One such year in Manitoba was 2017. There were high populations of aphids in both cereals (from late-June through July) and soybeans (late-July through August). There were also widespread economic populations of pea aphids in peas. After aphid predators indulged in a summer-long buffet of aphids, there were extension challenges dealing clusters of multicoloured Asian lady beetle that had moved into peoples' homes in the fall. Homeowners often had their own beliefs on why the lady beetle populations were so high, and where they came from. Some were convinced this would be an annual problem. Some blamed the government, believing the beetles were purposely released for biological control. This presentation deals with an invasive aphid predator, responding to both invasive and native aphid populations, and the extension challenges created as they become a pest in homes.

Speaker: **Gervais, Amalie**, Université Laval

Co-authors: Sabrina Rondeau, Maxim Larrivee & Valerie Fournier

Title: **Combining citizens' passion and scientists' knowledge: the winning story of Abeilles citoyennes**

Abstract: Although bees and hoverflies are essential contributors to terrestrial ecosystems, the portrait of their diversity in the Province of Quebec is still patchy. Abeilles citoyennes is a community science project that aims to monitor the diversity of these pollinating insects in rural Quebec and to document landscape features that may contribute to this diversity. Over three seasons (2019-2021), 107 participants sampled insects with pan traps at 131 different sites. These insects were sent to the Universite Laval (Quebec City) where they were identified to species. Participant retention was higher than expected, with 91% of the participants having contributed data for at least two consecutive years. By the end of the project, Abeilles

citoyennes will issue recommendations for the protection of wild bees and hoverflies in Quebec and will help consolidate our knowledge on the diversity of insect pollinators across the province. Through its participatory nature, the project is also raising awareness among a large number of citizens who are, in turn, able to promote the importance of pollinating insects.

Speaker: **Gibson, Joel**, Royal BC Museum

Co-authors: Henry Choong, Nina Pak & Stephanie Wu

Title: **New perspectives on Marine Insects**

Abstract: The tide line is often perceived as a hard barrier separating terrestrial arthropods, including insects, from marine arthropods. As such, the conventional definitions exclude insects, with only a few exceptions, from being marine. We present data from a pair of new papers that re-evaluate this convention. A detailed analysis of published trait data and rigorous order-wide phylogenies expose interesting patterns of coastal and salt-tolerant life histories across the Fly Tree of Life. Ancestral state reconstructions propose numerous shifts from terrestrial or freshwater habitats to marine or salty habitats in no fewer than twenty different families of Diptera. These shifts are not related to one another and may be linked to species radiations in some lineages. This finding raises questions about the ecological costs and benefits to lineages that adapt to life in coastal ecosystems. A separate analysis reveals a number of Diptera and Coleoptera species associated with barnacles along the coast of the Pacific Ocean. These species demonstrate trophic interactions that cross the usual marine/terrestrial barrier. These findings suggest that many species already known may, in fact, be reliant upon coastal or salty environments. Both studies indicate that more detailed analysis of life history and natural history collection data is necessary to reveal the presence of insect species intimately associated with coastal ecosystems. In many cases, an entire insect community may exist on the tide line, completely separate from the insect community only a few metres from the beach.

Speaker: **Glasgow, Emily**, University of Guelph Ridgetown Campus

Co-authors: Rebecca Hallett & Jocelyn Smith

Title: **A genetic analysis of the distribution of pheromone races of the European corn borer, *Ostrinia nubilalis* (Hubner), in Canada**

Abstract: European corn borer, *Ostrinia nubilalis* (Hubner), is a major corn pest in Canada primarily managed using transgenic corn (*Zea mays* L.) expressing insecticidal proteins from *Bacillus thuringiensis* (Bt) since 1996. However, the first case of field-evolved resistance to a Bt protein was discovered in NS in 2018. To mitigate Bt resistance in *O. nubilalis*, distribution of pheromone races and host crops must be considered. There are two pheromone races of *O. nubilalis*, denoted E and Z for the ratio of 11-tetradecenyl acetate isomers in the pheromone blend. Z-race primarily infests corn, while E-race will develop on many vegetable crops. Genetic material was extracted from *O. nubilalis* collected mainly from corn in 2018 and 2019 in ON, QC, NS, NB, and PEI, and amplification and restriction enzyme digests were completed. Preliminary results indicate all samples collected from ON, NS, NB, and PEI are Z-race, while some E-race and hybrids were collected in QC. If Bt resistance is linked to Z-race, mitigation efforts could focus on controlling resistant populations in corn. If resistance is also present in EÂ¬-race populations, mitigation efforts would also need to include other crops. Mating experiments will also be conducted to better understand Cry1F resistance in *O. nubilalis*.

Speaker: **Glaus, Valentine**, Université Laval

Co-authors: Audrey Nisole, Abdelmadjid Djoumad, Michel Cusson, Valérie Fournier & Véronique Martel

Title: **Host-parasitoid communities in spruce budworm endemic stages of two long-term studied sites**

Abstract: The spruce budworm (*Choristoneura fumiferana* (Clemens)) is one of the most important forest defoliators in North America, affecting 13 million hectares of forest in the province of Quebec (Canada) in 2020. Its outbreaks have economic impacts on the forest industry and on the ecosystem services provided by forests. However, there is a lack of knowledge about the composition of its food web. Its parasitoids, which play an important role in the population dynamics, have alternative hosts that are still unknown. To help fill this gap, more than 1,500 lepidopteran larvae were sampled in summer 2020 in the province of Québec (Canada) in two sites where the SBW is endemic and with different habitats: mixed and boreal forest and disturbed and undisturbed sites. These larvae were analyzed using a molecular approach that combines TaqMan technology and quantitative PCR. This method identified the parasitized larvae and then the developing parasitoid within these larvae. The samples from parasitized larvae were then sequenced to identify the species. This information on parasitoids - hosts interactions according to the type of forest and the presence of disturbances will allow us to have a better understanding of the factors that influence these interactions. These results will be discussed in the context of the spruce budworm population dynamics and will help understand the contribution of alternate hosts during and between outbreaks.

Speaker: **Gonzalez, Noémie**, Université de Québec à Montréal

Co-authors: Marc Fournier, Rose Buitenhuis & Eric Lucas

Title: **Oviposition strategy of the American hoverfly *Eupeodes americanus* (Diptera : Syrphidae) and comparation with the commercialized *Aphidoletes aphidimyza* (Diptera: Cecidomyiidae): Effect of aphid density and plant type**

Abstract: The selection of oviposition site is one of the major factors determining the success of hoverflies in a biological control strategy. In this study, the oviposition strategy of *E. americanus* is compared with *A. aphidimyza*, a predator already marketed in Canada. Oviposition was evaluated at 0, 2, 5, 10 and 50 aphid densities, on Aphis gossypii on cucumber and on *Myzus persicae* on pepper. The minimum density inducing oviposition of *E. americanus* is 5 aphids in cucumber and only 2 aphids in pepper. For *A. aphidimiza*, it is 10 aphids on pepper and also 5 aphids on cucumber. For a higher aphid density on pepper, the hoverfly lays twice the number of eggs laid by *A. aphidimyza*. In addition, the American hoverfly prefers to lay on pepper than on cucumber and this pattern is the reverse for *A. aphidimyza*. The host/prey system therefore appears to influence the egg-laying of the two predators. This study demonstrates the potential of the American hoverfly, as a biocontrol agent able to detect aphids.

Speaker: **Gries, Gerhard**, Simon Fraser University

Co-author: Elana Varner

Title: **Semiochemicals for detection of foes and guidance of friends**

Abstract: Semiochemicals (message-bearing chemicals) can be utilized to manipulate the behaviour of pest insects and to support beneficial insects like pollinators. In my presentation, I will highlight the identification and development of the common bed bug (*Cimex lectularius*) aggregation pheromone, and the deployment of natural and synthetic rodent odor to guide bumble bee (*Bombus* spp.) queens to nest sites in early spring.

Speaker: **Hallett, Rebecca**, University of Guelph

Title: **Pheromone-based management of the swede midge**

Abstract: An overview of progress made, and the successes and challenges encountered, in developing pheromone-based management strategies (including action thresholds and mating disruption) for the swede midge, *Contarinia nasturtii* (Diptera: Cecidomyiidae), will be shared.

Speaker: **Hamelin, Richard**, University of British Columbia

Title: **BioSurveillance of Alien Forest Enemies: the BioSAFE initiative**

Abstract: The world's forests face unprecedented threats from invasive insects and pathogens that can cause large irreversible damage to the ecosystems. This threatens the capacity to provide long-term fibre supply and ecosystem services that range from carbon storage, nutrient cycling, water and air purification, soil preservation and maintenance of wildlife habitat. The key to reduce this threat is via vigilant biosurveillance to increase preparedness and facilitate early interventions. This requires collecting and sharing data that can be used to rapidly and accurately identify samples from various life stages and assign them to taxa and sources so that pathways of introduction can be discovered. Assessing the risk that is posed by alien species also requires a better understanding of the traits underlying invasiveness. Genomics provides a toolbox that can address some of these challenges. The BioSAFE (BioSurveillance of Forest Alien Enemies) project is developing a pipeline to generate genomic tools that will provide accurate identification of pests and pathogens, assign unknown samples to putative sources to identify pathways of spread and assess risk based on traits that impact the outbreak outcome. These next generation biosurveillance tools will augment the toolbox for preventing forest pest and disease outbreaks.

Speaker: **Handler, Sa**ge, University of Guelph

Co-authors: Dirk Steinke & Nigel E. Raine

Title: **Studying the backyard bee-cosystem: using community science to investigate cavity-nesting bees across Canada**

Abstract: Studying ecological interactions is often very challenging as they are complex and difficult to observe. Many interactions provide essential services to the environment and to humans. For instance, solitary bees are essential pollinators of many fruit, vegetable, nut, and animal feedstock crops and sustain the diversity of terrestrial plant ecosystems. However, habitat loss and fragmentation threaten their populations across Canada.

Bees@Schools is a community science program aimed at educating students about the importance and diversity of Canada's bees while collecting data on cavity-nesting bee distributions. Each year, nest boxes are distributed to elementary and high schools across Canada and installed on school grounds or teachers' home properties in May. In September, nest boxes

are returned to the University of Guelph, and all occupants and their food sources are identified using DNA metabarcoding.

Bees@Schools is in its 3rd year, and so far, nest boxes have been distributed to over 250 schools allowing us to better understand the distribution of cavity-nesting hymenopterans and their interactions with the environment and other species. These results will aid management decisions in supporting their populations and the essential ecosystem services they provide.

Speaker: **Hanuschuk, Emily**, University of Manitoba

Co-author: Jason Gibbs

Title: **Diverse and edgy landscapes support wild bee pollinators and plant-bee networks in an agriculturally dominated region of Manitoba**

Abstract: Human-driven habitat loss caused by activities like large-scale monocropping is one of the main drivers of wild bee declines and changes to plant-pollinator networks worldwide. Factors such as land cover diversity and amount of edge habitat can also influence bee communities and networks, but published effects are mixed and often depend on location, community composition, and scale of disturbance. I investigated the effects of local landscape level disturbance on bee communities and plant-bee networks across southern Manitoba, Canada, with the goal of informing policies aimed at conserving wild bee populations and network functionality. Over two years, I collected 21,000 bees using coloured pan traps and blue vane traps and 2,189 using targeted aerial netting. Using linear modelling, I found that areas with diverse land cover types and high amounts of edge habitat supported bee communities and enhanced network size and stability, while simple landscapes dominated by crop cover decreased bee abundance and richness and reduced network stability. Introduced plant species in field margins enhanced bee community functional dispersion without negatively affecting bee abundance or richness, suggesting a benefit of introduced plant species in disturbed landscapes. Land management policies that promote diverse landscapes with high amounts of edge are needed to maintain an abundant and diverse assemblage of bees and to enhance plant-bee network size and stability, and policies aimed at removing introduced plant species from field margins should be reconsidered.

Speaker: **Henault, Justis**, University of Winnipeg

Co-author: Richard Westwood

Title: **Endangered *Oarisma poweshiek* butterfly larval host foraging and adult behaviour microhabitat requirements in Canada**

Abstract: The Poweshiek skipperling (*Oarisma poweshiek*) is endemic to the tall grass prairie in North America, and is now critically endangered globally. Existing populations are scattered amongst tall grass prairie remnants, however the host food plants eaten by Poweshiek skipperling larvae and microhabitat attributes that support adult behaviours in Manitoba are unknown. I predicted that adults would lay eggs or nectar feed where activity-specific requirements were provided along a soil moisture gradient. Also that larvae would locate food species in specific miniature-environments. To address these ideas, I followed *O. poweshiek* adults in natural habitat to locate microhabitats. I then observed larval foraging in the field using an enclosure and measured microhabitat attributes. During my research, I observed individual larvae eating ramets of several graminoid species, travelling to new species throughout their development. Adults

attempted to lay eggs in wet sections of the soil moisture gradient within the prairie, laid eggs in dry-mesic sections, rested in drier sections and consumed nectar mostly in dry to mesic sections but occasionally in wet sections. These discoveries may guide conservation disturbances to create suitable microhabitats and provide crucial habitat components to choose reintroduction prairies to help facilitate the Poweshiek skipperling's successful recovery!

Speaker: **Heron, Jennifer**, British Columbia Ministry of Environment and Climate Change Strategy

Title: **Taylor's Checkerspot: successes, challenges and future work for an endangered butterfly in British Columbia, Canada**

Abstract: Taylor's Checkerspot butterfly (*Euphydryas editha taylori*) is Endangered in Canada and listed under the federal Species At Risk Act. Historically, the species was found at approximately 20 sites throughout southeastern Vancouver Island. Cumulative threats from urbanization, agricultural conversion, invasive species and pesticides have reduced the species to two known subpopulations, one on Denman Island and the other outside of Oyster River on Vancouver Island. A group of dedicated biologists have been collaborating on recovery actions for this species for the past 17 years, including inventory, habitat restoration, outreach and stewardship, research and a captive rearing program. Most recently, the recovery team has been working on habitat restoration within Helliwell Provincial Park, a formerly occupied site on Hornby Island. In March 2020, the recovery team released Taylor's Checkerspot larvae into Helliwell Provincial Park on Hornby Island, with the goal to establish a third self-sustaining subpopulation. Ongoing habitat restoration, public outreach, and ongoing captive rearing by are some of the initiatives led by members of the team. A summary of the recovery team's ongoing efforts, challenges, collaborations, and future work will be outlined in this talk.

Speaker: **Hervet, Vincent**, Agriculture and Agri-Food Canada

Co-authors: Paul Fields, Kelsey Jones & Fuji Jian

Title: **Development of stored product insects on canola seeds**

Abstract: Canola production is important to the Canadian economy, contributing $27 billion each year. Approximately 20 million tonnes are harvested annually in Canada, with 90% destined for export. Insects often attack stored cereals and pulses but we do not know if insects can also attack stored canola. The purpose of this study was to assess whether stored product pest species, commonly found on cereal products, are able to develop from egg to adult (one generation) on canola at 25°C. Two tests were conducted. The first test assessed the ability of 10 species to develop onto seven treatments: (1) wheat flour with 5% brewer's yeast (control), (2) whole canola at 8% m.c. (moisture content), (3) canola with 10% broken seed at 8% m.c., (4) whole canola at 12% m.c., (5) canola with 10% broken seed at 12% m.c., (6) pure dockage, and (7) dockage with broken canola seeds. The second test (ongoing) has assessed so far the ability of four species to develop onto three treatments at 8% m.c.: (1) whole canola seeds, (2) broken canola seeds, and (3) control (same as previous). Preliminary results show that the confused four beetle (*Tribolium confusum*), the red flour beetle (*Tribolium castaneum*) (Tenebrionidae), the sawtoothed grain beetle (*Oryzaephilus surinamensis*), the merchant grain beetle (*Oryzaephilus mercator*) (Silvanidae), the drugstore beetle (*Stegobium paniceum*), and the cigarette beetle (*Lasioderma serricorne*) (Ptinidae) are able to develop on canola seeds. Presence of dockage, broken seeds, and different moisture contents had little or no effects. Except for the cigarette

beetle, which produced more adults when dockage was present. The merchant grain beetle was the only species to have significantly more individuals developing to adulthood on canola seeds than on the control diet. The cigarette beetle, the drugstore beetle, the sawtoothed grain beetle, and the rusty grain beetle (*Cryptolestes ferrugineus*, Laemophloeidae) displayed longer development time on canola seeds than on the control diet. Very few individuals of the rusty grain beetle developed to adulthood on the canola treatments. The hide beetle (*Dermestes maculatus*), the warehouse beetle (*Trogoderma variabile*) (Dermestidae) and the Mediterranean flour moth (*Ephestia kuehniella*, Pyralidae) did not appear to be able to develop on canola seeds.

Speaker: **Hillier, N. Kirk**, Acadia University

Co-authors: Nicoletta Faraone, Kayla Gaudet, Sarah Hobbs, Michael Light, Varun Dhunna & Dave Shutler

Title: **Development of natural products for management of acarine pests**

Abstract: Acari (mites and ticks) are economically and medically important arachnids with significant impacts on human health and agriculture. For example, black-legged ticks, Ixodes scapularis, are of significant medical concern due to vectoring of Lyme disease throughout North America. Other parasites, such as Varroa mites, *Varroa destructor*, are of veterinary and agricultural concern, because they cause considerable damage to honey bee colonies by direct feeding and disease transmission. *Tetranychus urticae*, the red-spotted spider mite, is a major global pest of many plant species, ranging from houseplants and horticultural products to greenhouse vegetables. It is of paramount importance that we discover new, environmentally sustainable technologies for managing these acarine pests. One promising avenue is to investigate using plant and mite-derived chemicals to modify behaviour of these pests. This includes identifying chemicals (pheromones or plant cues) which may be used in attractant-trapping, monitoring, and direct mass-trapping; or the use of essential oils and other natural materials that can repel mites from crops to be protected. This presentation will outline several pioneering studies investigating chemical ecology of these acarines, using combined approaches of chemical analyses, electrophysiology, and behavioral assays. Over the long-term, these studies will permit new investigations of the unique olfactory systems of Arachnids, comparing multiple acarine species, and possibly their close relatives, Order Araneae (spiders).

Speaker: **Hume, Douglas**, Agriculture and Agri-Food Canada

Co-authors: Stephane Dumont, Karine Savard & Claude Chantal

Title: **Two adventive species of European Chrysomelidae (Coleoptera) new to North America and where do non native leaf beetles come from?**

Abstract: First North American records are presented for *Cryptocephalus moraei* (Linnaeus, 1758) (Coleoptera: Cryptocephalinae) and *Psylliodes dulcamarae* (Koch, 1803) (Coleoptera: Galerucinae: Alticini), as confirmed by morphology and DNA barcoding. *Cryptocephalus moraei* is expected to have no ecological impact on its host, the adventive *Hypericum perforatum* Linnaeus (Hypericaceae). However, *P. dulcamarae*, the second recently discovered flea beetle associated with the adventive *Solanum dulcamara* Linnaeus (Solanaceae), probably does harm that host. Both species are hypothesised to have arrived from Europe with woody plant material imported with soil during 1960-1965. A literature review of introduced Chrysomelidae found that Canada and the United States of America are together home to 68-78 species of adventive

Chrysomelidae. The native and non-native ranges of the accidentally introduced species were surprisingly uniform.

Speaker: **Hung, Emmanuel**, Simon Fraser University

Co-authors: Nelson Lee & Gerhard Gries

Title: **Conductive and convective heat, but not infrared radiation, mediates stable fly alighting and probing response on thermally different targets**

Abstract: In order to survive and reproduce, stable flies must recognize and locate blood sources. To do so, stable flies should respond to host-characteristic cues which differentiate host animals, such as cattle, from their surrounding environment. As with mosquitoes and many other hematophagous insects, the body heat emitted by a warm-blooded host may serve as one such cue. Using temperature-controlled heat plates, we tested whether the alighting and probing responses of starved stable fly females differed with thermally different targets. We compared the attractiveness of room-temperature controls against heat plates set at 30, 40 and 50°C. We further compared the responses of flies to a 40°C plate against their responses to 35, 45, 50 and 60°C plates. By presenting flies with heat plates housed in convection- and conduction-heat-occluding columns, we further determined whether infrared radiation (IR) alone elicits the same stable fly host-seeking behaviours. Using thermography, we confirmed the temperatures of our treatments and additionally measured the thermal emittance of beef cattle body surfaces in the field. We found that flies significantly preferred heat plates with a temperature of 40°C over all other tested temperatures, with the exception of 45°C. When convected and conducted heat were decoupled from IR, flies did not respond to either the 40°C or room-temperature heat plate. Our findings demonstrate that host-seeking stable flies prefer substrates bearing surface temperatures within the range of 40-45°C, and that IR sensitivity does not appear to play a role in this response.

Speaker: **Imrit, Mohammad Arshad**, York University

Co-authors: Bandele Morrison, Sapna Sharma, Sheila Colla & Amro Zayed

Title: **Bees in the six: Determinants of bumblebee habitat quality in urban landscapes**

Abstract: With growing urbanization, it is becoming increasingly important to design cities in a manner that sustains and enhances biodiversity and ecosystem services. Native bees are critical pollinators that have experienced substantive declines over the past several decades. These declines have captured the attention of the public, particularly urbanites, prompting a large interest in protecting pollinators and their habitats in cities across North America and Europe. Unfortunately, we currently lack research about specific features of urban environments that can enhance the fitness of pollinators. We carried out an intensive study of *Bombus impatiens*, the Common Eastern Bumblebee, in the City of Toronto (Canada's largest city) to better understand landscape parameters that provide high-quality habitat for this species, and likely other generalist bees. We divided the city into 270 grid cells and sampled a total of 760 worker bees, which were then genotyped at twelve hyper-variable microsatellite loci. The genetic data allowed us to quantify the effective number of colonies and foraging distance for this species. We then asked how the city's landscape and human population demography and income is associated with the availability of high-quality habitat for *B. impatiens*. Several aspects of Toronto's landscape influenced colony density and foraging range. Urbanization had a clear negative effect on both

colony density and foraging distance of workers. On the other hand, functional (i.e. not cosmetic) green space was often associated with higher quality habitats for bumblebees. Our study suggests several planning strategies to enhance habitat quality for bumblebees and pollinators in cities.

Speaker: **Isitt, Rylee**, University of New Brunswick

Co-authors: Bjorn Okland, Paal Krokene, Jon Sweeney, Stephen B. Heard & Deepa S. Pureswaran

Title: **Using semiochemicals to predict invasion potential of exotic bark beetles**

Abstract: Invasive insects are a considerable global issue, causing economic damage and contributing to biodiversity loss. Allocating limited resources towards management of invasive insects requires assessments of relative risk, which depend in part on predictions of ecological interactions that might influence the establishment success of introduced species. We used semiochemical-based trapping experiments to make such predictions for two economically important spruce bark beetles in possible invasive ranges *Ips typographus* in North America, and *Dendroctonus rufipennis* in Europe. Our results show that *I. typographus* is likely to face predation and competition in North America like that of native *Ips* spp., while *D. rufipennis* may escape some predation and competition in Europe. Furthermore, *I. typographus* and *D. rufipennis* may facilitate each other by cooperating in mass attacks against healthy trees, possibly aiding in establishments and outbreaks of either species. We propose that similar methods will be useful for predicting ecological interactions that may influence the invasion risk for other species.

Speaker: **Ivey, Victoria**, Acadia University

Title: **Molecular and neural plasticity in the sex pheromone response of the corn earworm (*Helicoverpa zea*)**

Abstract: Larvae of the corn earworm (*Helicoverpa zea*) cause billions of dollars in crop damages in the Americas each year. Sex pheromones emitted by adult females are detected by adult males when they bind to olfactory receptors (ORs) on their antennal trichoid sensilla, with each sensillum containing two olfactory sensory neurons (OSNs). Research suggests that pre-exposure of adults to high concentrations of pheromone components could alter the expression of their corresponding ORs, and consequently alter OSN sensitivity. Our research investigates if such alterations are induced by pre-exposure to different concentrations of conspecific or heterospecific pheromone components over different time periods. Isolated, 2-4-day-old moths were exposed to a set concentration of a pheromone component or a hexane control for 1 or 24 hours. Antennae were then removed and used for electroantennograms (to measure OSN sensitivity) or quantitative PCR (to detect differences in OR gene expression between conditions). Our research will provide insight into mechanisms underlying insect olfaction and potentially improve pheromone-based pest control methods.

Speaker: **Jackson, Morgan**, McGill University

Co-author: Catherine Scott

Title: **Are More Eyes Better? The Faunistic Advantages of Canada's iNaturalist Community**

Abstract: Social media and internet-connected technology are revolutionizing much of modern life, including natural history research. Through rapidly expanding social networks, naturalists of

all expertise are connecting with and supporting one another every day, and in the process making unique and important contributions to our shared knowledge of the natural world. At the centre of this network is iNaturalist, a resource for naturalists to share observations, crowd-source identifications and biologies, and learn more about the natural environment around them, while enabling our most complete picture of Canadian biodiversity ever. This emerging fount of biodiversity data has been increasingly used by researchers to discover new species, track expanding ranges and new introductions, and for assembling detailed ecological interactions across time and space. But there are other dimensions to these data that we can and should be exploring, among them the behaviour of the people currently contributing, and the species which continue to be overlooked. By exploring trends in iNaturalist observations and recorded biodiversity, we can better understand how we as scientists can increase our connections to this growing naturalist community, while simultaneously facilitating access to Canadian biodiversity for all.

Speaker: **Jamieson, Aidan**, York University

Co-author: Amro Zayed

Title: **Development of diagnostic tools for neonicotinoid exposure in the western honey bees (*Apis mellifera*) using transcriptomics**

Abstract: Pollination is vital in agriculture as it is a key process in the reproduction of flowering plants. The eusocial western honey bee, *Apis mellifera*, is the only honey bee in North America and is the most commonly 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 insecticides used in agriculture. This has resulted in increasing rates of overwintering mortality worldwide. In particular, Canadian beekeepers have been losing more than a quarter of their colonies annually since 2006. Neonicotinoids are a specific class of insecticides that have been linked to decline in pollinator health. Exposure results in neural dysfunction leading to changes in behaviour, altered development, or death. It can be difficult to disentangle and identify specific stressors that affect a particular colony. Our research aims to solve this problem by conducting field and laboratory studies to develop biomarkers specific to two common neonicotinoids based on differential gene expression in response to exposure.

Speaker: **Jimenez, Pilar**, University of Alberta

Co-author: Carol Frost

Title: **Local effects of herbaceous versus treed field margins on abundance and movement of ground beetles and spiders into and out of canola fields in Aspen Parkland**

Abstract: Spiders (Araneae) and predatory ground beetles (Carabidae) contribute positively to agricultural ecosystems by consuming herbivores. Different field margin types can increase predator abundance by the provision of suitable habitat. I investigated the effects of field margin type (herbaceous versus treed) on spider and ground beetle diversity, abundance and movement between canola fields and their non-crop margins. I installed paired directional pitfall traps along transects adjacent to and within canola fields at both herbaceous and treed margins on eleven canola fields. The pitfall traps had plastic shields that allowed me to measure movement in the margin-to-crop direction and in the crop-to-margin direction. I collected trapped arthropods

every two weeks between May - October 2021 in the Aspen Parkland Region around Edmonton, Alberta. Preliminary results show that the abundance of spiders was higher than carabids early in the growing season across all sites in both types of margins (herbaceous and treed), being the most abundant in herbaceous margins. Carabid abundance was highest in treed margins. Early in the season, spiders tended to move from the canola crop towards the herbaceous margin, while carabids moved most from the treed margin to the crop. Knowledge about how different types of margin vegetation support ground dwelling predators and how they move into canola fields will allow us to provide the most beneficial arthropods to crops.

Speaker: **Judge, Kevin**, MacEwan University

Co-authors: David McFadyen, Kyle Blacher, Alexandre Caouette, Erin Bayne & Julian Dupuis

Title: **Tracking an invader: Roesel's katydid in Alberta**

Abstract: Species' ranges are likely in a constant state of flux as populations respond (or fail to respond) to changes in the environment. Monitoring for, and studying, these range changes is enormously important for a host of applications, from managing invasive species to understanding the effects of global climate change. Roesel's katydid (*Roeseliana roeselii*, Orthoptera, Tettigoniinae) is a native of Europe and western Russia that has become a model for studying the effects of climate and on range changes due to its well-documented northward expansion in Europe and Scandanavia. Naturalized in eastern North America (NA) since its discovery in the early 1950s in Montreal, we discovered Roesel's katydid just outside of Edmonton in 2017 - approximately 2000km west of its naturalized range. Since then, we have been animated by a number of obvious questions including: is the NA range actually disjunct, and if so, how did Roesel's katydid get to Alberta and from where? We have employed, and continue to employ, a variety of methods to answer these questions - from using passive acoustic monitoring to search for additional populations in Alberta, to genotyping individuals from populations across NA and Europe to measure relatedness, to staying up way too late sifting through unidentified Orthoptera observations on iNaturalist. This presentation will survey the preliminary results so far, offer some tentative answers to the above questions, and suggest directions for future research.

Speaker: **Keyghobadi, Nusha**, University of Western Ontario

Title: **Genetics to inform conservation of at-risk butterflies**

Abstract: Assessing patterns of genetic variation in species-at-risk can be critical to effective conservation action. Small populations, and populations experiencing rapid decline, are vulnerable to loss of genetic diversity and the negative consequences of inbreeding. Genetic data can quantify this risk, and uncover key ecological processes and factors that may be exacerbating the risk. Furthermore, genetic data can contribute to resolving taxonomic uncertainties, delineating management units, and determining the best source populations for re-introduction and translocation efforts. Here, I will present case studies from a variety of rare and threatened North American butterflies to illustrate the conservation insights that can be gained by evaluating patterns of genetic variation within and among populations of at-risk species.

Speaker: **Khan, Sara**, Carleton University

Co-author: Jayne E. Yack

Title: **Vibration mediated predator avoidance in the eastern tent caterpillar (*Malacosoma americanum*)**

Abstract: Caterpillars face a wide variety of predators and parasitoids, and consequently have evolved numerous defense strategies. While chemically and visually mediated defenses are well recognized, research on acoustic defenses (i.e. sounds and vibrations) are poorly understood. As caterpillars have limited vision and are substrate-bound, vibroacoustic sensing could be important in assessing their environments. My M.Sc. research tests the hypothesis that eastern tent caterpillars (*Malacosoma americanum*) use their silk tent to detect predators, and to communicate the presence of a predator to conspecifics. Results to date show that live predators (e.g. stink bugs) and sound playbacks of predators (e.g. wasp flight, flies, bird calls) are transmitted by the silk tent, as recorded by a laser-doppler vibrometer, and that the caterpillars respond behaviourally to these stimuli by flicking, freezing and crawling away. These behavioural responses of early responders to stimuli are also transmitted by the silk tent and there is evidence that conspecifics respond to these vibrations, in a chain-like reaction. My results to date show that the silk tent can function in both detecting predator vibration cues, and communicating information about predators to conspecifics. These results contribute novel insights into the functions of silk in shelter-building larvae.

Speaker: **Koerte, Sarah**, Acadia University

Co-author: N. Kirk Hillier

Title: **Investigating the semiochemistry underlying host selection and oviposition of *Mythimna unipuncta***

Abstract: Throughout North America, the true armyworm, *Mythimna unipuncta* (Haworth) (Lepidoptera: Noctuidae), occurs in sporadic large outbreak populations. As a generalist herbivore, the enormous numbers of emerging larvae cause considerable economic damage to cereal and forage crops such as barley, oats, corn, and alfalfa during such infestations. While work has been done on the host preference of the armyworm females, little is known on how the moths synchronize oviposition timing and mechanisms which cause females to oviposit their egg clusters in close vicinity to each other, initiating mass outbreaks. In this study, we want to learn more about the host plant odors attracting the armyworm females, their oviposition preference between infested and unoccupied plants, and possibly identify putative host marking pheromones. We are collecting extracts and the headspace of various host plants which are either intact, infested (eggs) or damaged (larvae) and measure the electrophysiological response of the armyworm females using Gas Chromatography-Electroantennographic detection (GC-EAD). Furthermore, we will look at the preference of females to oviposit on host plants in various conditions (intact, infested, damaged) during two-choice behavioral assays in wind-tunnel experiments and free-flight screen cages. Single compounds of interest identified during preliminary experiments will be tested for their behavioral activity in Electroantennograms (EADs) and future wind-tunnel or free-flight cage bioassays.

Speaker: **Kremen, Claire**, University of British Columbia

Title: **Pollinators as ambassadors for diversifying farming systems**

Abstract: Pollinating insects especially bees and flies are vital for human survival because they pollinate key crops that are nutritionally important for human health and well-being. This talk

will explore how diversifying farming systems -- within the field through crop diversity, around the field with non-crop plantings, and in the larger landscape through conservation and restoration of natural habitat elements -- are all needed to maintain the diversity of pollinators in agroecosystems and assure resilience of crop pollination services. While many economic and structural factors act as barriers for the adoption of diversification practices, pollinating insects could provide an uncontroversial entry point ("What's not to like?") for farmers and eaters towards the concept of diversified, agroecological farming systems.

Speaker: **Kroeze, Shayla**, Western University

Co-authors: Nusha Keyghobadi & Gard Otis

Title: **Using conservation genetics to inform reintroduction of the Mottled Duskywing**

Abstract: Fragmentation, degradation, and loss of suitable habitat paired with climate change have caused declines in species diversity and abundance across the globe. This pattern is clearly shown across butterfly species, which are important components of many ecosystems. Species re-introduction through translocation is increasingly used as a strategy for restoring biodiversity. Early re-introductions of butterfly species were largely unsuccessful due to a lack of established protocols and insufficient background knowledge. Previous research has proven that using genetic information in reintroduction protocols can help improve success of establishing healthy populations. We have developed a set of microsatellite loci, and we have characterized them to compare genetic diversity across extant populations to inform planned re-introductions of an endangered species of butterfly in Ontario, the Mottled Duskywing (Erynnis martialis). Importantly, we have discerned the genetic status of Mottled Duskywing populations, and informed source population selection for current and future planned reintroductions. My research forms part of a larger, collaborative effort to achieve the overall recovery goal of the species in Ontario and will potentially support a locally sourced model for insect species-at-risk recovery planning. Our work provides the first information on genetic diversity and structure in this species and will be directly relevant to its conservation and re-introduction in Ontario.

Speaker: **Kulkarni, Sharavari**, University of Alberta

Co-authors: Hector Carcamo & Maya Evenden

Title: **Functional response of generalist predators on diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae)**

Abstract: Diamondback moth (DBM), *Plutella xylostella* L. is a serious pest of cruciferous crops globally. In western Canada, moth influx with wind currents from the United States can result in significant economic damage to canola. Studies focusing on biological control of DBM have focused mainly on different parasitoid species, however; studies quantifying mortality of DBM caused by predators in canola agroecosystem are lacking. In the current study, we evaluated the functional response of four generalist predator species, *Pterostichus melanarius*, *Coccinella septumpunctata*, *Nabis* sp., and *Chryospa carnea* at different life stages (egg and larvae) of DBM under laboratory conditions. The types of functional response curves differed with predator species and prey (DBM) stage. Our results indicate the potential role generalist predators play in DBM biological control.

Speaker: **Labrie, Genevieve**, Centre de recherche agroalimentaire de Mirabel (CRAM)

Co-authors: Caroline Provost & Steve Lamothe

Title: **Feeding preference of squash bugs in cucumber greenhouses in Québec**

Abstract: Squash bugs *Anasa tristis* and *A. armigera* (Heteroptera: Coreidae) are sporadic pests in Québec (Canada) cucumber greenhouses. They can cause significant cucumber damage and the only control method is manual removal of individuals. The dominant species of squash bug observed in cucumber greenhouse in Quebec was *A. armigera*. This project aims to identify the feeding preference of both species to develop IPM strategy adapted to cucumber in greenhouses. Experiments have been conducted in small cages in laboratory in 2019 and 2020. One plant of cucumber and of squash were enclosed in a muslin cage with one 4th or 5th larval stage of A. tristis or *A. armigera*. The position of the bug was noted each day for 7 days. This experiment was replicated 16 times in both years. Both years, *A. armigera* demonstrated a strong preference for cucumber than for squash. The other bug species, A. tristis, demonstrated a preference for squash in 2019 but not in 2020. *Anasa armigera* was observed more frequently in the middle of the cucumber plant, on the stem or under leaves, while A. tristis was observed more frequently on top of cucumber, with no preference for its position on leaves. Those observations will help to develop a monitoring method for both pest species in greenhouses.

Speaker: **Lee, Seung-Il**, University of Alberta

Co-authors: Ellen Macdonald, Anne McIntosh, Samuel Bartels, Jaime Pinzon, Linhao Wu, David Langor & John Spence

Title: **Trends in recovery of beetles and spiders after variable retention harvesting in boreal forests: evidence from the Ecosystem Management Emulating Natural Disturbance (EMEND) experiment**

Abstract: Retention harvesting is often advocated as a better alternative to intensive timber harvesting, such as clear-cutting, due to its anticipated desirable ecological benefits, including biodiversity maintenance. However, it is unclear at what level and intensity do retention harvests facilitate biodiversity recovery. We investigated the trends in biodiversity recovery based on species for various invertebrate groups (carabid beetles, staphylinid beetles, and spiders) using long-term data from the EMEND experiment, located in northern Alberta, Canada. Specifically, we utilized a broad range of dispersed retention harvest treatments (2% [clear- cut], 10%, 20%, 50% and 75% retention compared with an unharvested control [100% retention]) at 1, 2, 6, 11, and 16 years post-harvest in four dominant forest cover types (deciduous-dominated, deciduous-dominated with conifer understory, mixed of broadleaf and conifer, and coniferous-dominated). We developed biodiversity recovery curves based on Chao-Jaccard dissimilarity indices calculated for each harvest treatment relative to the unharvested control treatment, and evaluated recovery over time using generalized additive models. Preliminary results indicate variable recovery trajectories among the different taxa with harvesting intensity up to 16 years after-harvest (e.g., faster recovery for staphylinid beetles and bryophytes but relatively weak negative trends for carabid beetles and spiders), while the patterns reveal an initial lag in response to harvesting for most biotic groups. Thus, our study suggests, at least in the short-term, that increased forest retention may not have the anticipated benefits of biodiversity maintenance for some taxa.

Speaker: **Legault, Simon**, Institute for Research and Development in Agro-environment (IRDA)

Co-authors: Ariane Vossen, Paul K. Abram, Jacques Brodeur & Annabelle Firlej

Title: **Diapause induction in two exotic parasitoids of the invasive spotted wing drosophila: Could they survive our cold Canadian winters?**

Abstract: Climatic matching is a fundamental aspect of classical biological control programs as it informs if successful establishments of released agents are possible at a given location. In this study, we determined the conditions necessary for diapause induction in *Ganaspis brasiliensis* Ihering and *Leptopilina japonica* Novkovic (Hymenoptera: Figitidae), two larval parasitoids of the invasive spotted wing drosophila, *Drosophila suzukii* Matsumura (Diptera: Drosophilidae). For both parasitoid species, two immature stages (eggs and prepupae) were exposed to three constant temperature (22, 18, and 14°C) and two photoperiods (16L:10D and 10L:16D). When parasitoid eggs were exposed to experimental conditions, diapause induction at the prepupal stage was observed at 18°C and 14°C for L. japonica, but only at 14°C for *G. brasiliensis*. We discuss these results in the context of releasing these potential biological control agents in different regions of Canada.

Speaker: **Lemke, Emily**, Simon Fraser University

Co-authors: Wim van Herk, Gerhard Gries & Kendal Singleton

Title: **Investigating mechanisms of reproductive isolation between *Limonius congeners* (Coleoptera: Elateridae) and testing of 'catch-all' click beetle pheromone lures**

Abstract: Wireworms, the larvae of click beetles (Elateridae), are significant pests of agricultural crops worldwide. In North America, four *Limonius* species cause severe crop damage, notably *L. californicus, L. canus* and *L. infuscatus* in western regions, and *L. agonus* in eastern regions. Recently, (E)-4-ethyloct-4-enoic acid (limoniic acid) has been identified as the major sex pheromone component of female *L. californicus* and *L. canus* and as a sex attractant for male *L. infuscatus* and *L. agonus*. With the three western *Limonius* congeners often co-inhabiting the same region, and with limoniic acid attractive to all three congeners, we investigated whether *L. californicus, L. canus* and *L. infuscatus* maintain reproductive isolation by partitioning sexual communication channels through non-overlapping seasonal occurrence or divergent diel periods of communication. Moreover, as wireworm heterogeners such as *Agriotes* spp. and *Limonius* spp. co-occur and inflict similar crop damage in western North America, we further investigated whether the sex pheromones of *Agriotes* spp. and *Limonius* spp. can be combined in a single lure without reducing trap captures of all target species.

Speaker: **Leo, Serena**, University of Guelph

Co-authors: Cynthia Scott-Dupree, Catalina Fernandez, Rebecca Rizzato, Dana Gagnier & Roselyne Labbe

Title: **Evaluating the parasitoid *Jaliscoa hunteri* as a biological control agent for the pepper weevil (*Anthonomus eugenii*) on greenhouse pepper crops**

The parasitoid wasp *Jaliscoa hunteri* Crawford, is a natural enemy of the pepper weevil (PW) (*Anthonomus eugenii* Cano) and is a potential biological control agent for PW on greenhouse pepper crops. Native to Mexico but also recorded in Canada, the wasp attacks the larval instars of PW, which are otherwise protected within the pepper fruit. Disseminating *J. hunteri* for PW biological control could revolutionize how this pest is managed. We investigated the PW suppression potential of *J. hunteri* by releasing wasps onto infested ornamental pepper plants.

We found that *J. hunteri* significantly reduced adult PW emergence compared to untreated plants. The effect was greatest when the exposure period was longer (7 vs 4 days), and when released to control 3rd larval PW instars. Commercial greenhouse pepper trials with *J. hunteri* also showed that releases onto PW infested crops reduced the incidence of PW infestation. Finally, our study of the searching behavior of the wasp demonstrated that mated adult females orient themselves towards infested over uninfested host fruit in Y-tube assays. Together, these results deepen our understanding of *J. hunteri* and its potential to reduce PW emergence and support its utilization as a PW biological control agent in Canada.

Speaker: **Leyria, Jimena**, University of Toronto Mississauga

Co-authors: Ian Orchard & Angela Lange

Title: **Role of insulin/ToR signalling in female reproduction of *Rhodnius prolixus*, a vector of Chagas disease**

Abstract: In insects, insulin-like peptide (ILP) signalling along with the target of rapamycin (ToR) are involved in detecting and interpreting nutrient levels. In the blood-sucking *Rhodnius prolixus*, a vector of Chagas disease, the nutrients incorporated by a blood meal have a high epidemiological impact since in adult mated females, each meal results in a bout of egg laying, and thereby the production of hundreds of offspring. By means of RNA-Sequencing we have examined how a blood meal influences mRNA expression of the ILP/ToR signalling pathway in key tissues involved in reproduction (central nervous system, fat body and ovaries). Although there is an up-regulation of the genes involved in ILP/ToR signalling in unfed insects, western blot analysis reveals that this signalling is only activated in tissues of fed insects, i.e. phosphorylation of proteins. Immunofluorescence and RNA interference (RNAi) studies suggest that during the unfed condition, FoxO signalling may be responsible for the up-regulation of transcripts involved in the ILP/ToR signalling cascade. Moreover, insulin stimulates protein phosphorylation in the fat body and ovaries form unfed insects, suggesting that those females are in a sensitized state and respond to food by rapidly activating ILP signalling. Also, by RNAi and ex vivo assays we show that ILP/ToR pathway is involved in juvenile hormone (JH) synthesis and release, coordinating in turn the synthesis of yolk protein precursors by the fat body, thus influencing the numbers of eggs laid. Our study reveals a network of regulatory pathways implicated in reproductive performance. These analyses serve as a starting point for new investigations that increase the chances of developing novel strategies for vector population control by translational research, with less impact on the environment and more specificity for a particular organism.

Speaker: **Loureiro, Alexandre**, University of Guelph

Co-author: M. Alex Smith

Title: **Beetle diversity and elevation: what do we really know?**

Abstract: Even though mountains comprise no more than 25% of terrestrial land mass, they host nearly 87% of the world's vertebrate species. Despite this density, a mechanistic explanation of why mountains are such hotspots for biodiversity is still lacking. In most cases the negative or mid-elevation peak that diversity exhibits along elevation may be due to abiotic factors (area, temperature, precipitation) or biotic factors (competition, evolutionary history). However, while these are the predominant trends for vertebrates, estimations for more diverse taxa, such as

insects, are less frequent. For example, while beetles (Coleoptera) are the most diverse animal taxa, there is no current synthesis highlighting the common patterns of beetle diversity and elevation. Therefore, we are conducting a global data aggregation analysis of studies that reported beetle diversity along elevation to answer the following questions: 1) Do the same common trends that exist for vertebrates also exist for beetles? 2) How are these trends affected by abiotic variable such as temperature and precipitation? 3) Does incorporating evolutionary history into our estimate of diversity alter our understanding of the diversity/elevation relationship compared to when we have estimated it taxonomically (i.e., how coupled are phylogenetic and taxonomic estimates of diversity)? We predict that negative and mid-elevation peaks will be the most common trends, that temperature and precipitation will correlate with diversity on a family level, and that phylogenetic diversity will be correlated with taxonomic diversity. Departures from these predictions will yield interesting areas of future research on the relationship between elevation and diversity.

Speaker: **Luik, Sam**, York University

Co-authors: Amro Zayed & Jane Heffernan

Title: **Economic implications of reducing monetary and time costs in testing for honeybee stressors through the framework of a stress-structured model for colony dynamics in a single hive**

Abstract: Honeybees are agriculturally important through their pollination work and production of honey. Due to being eusocial, honeybees are also particularly vulnerable to the accumulation of pesticides and the spread of diseases and parasites. It has been modeled by Aizen and Harder that the global stock of honeybees will be outpaced by the agricultural demand for pollination, so there is an incentive to prevent colonies from dying out. As an obvious measure for this, beekeepers need to be able to diagnose the ailments affecting their colonies and then to prescribe a treatment before the problem results in more losses. There are tools beyond simple initial judgements of bee colonies to test for pesticides and disease. However, these tests can take weeks and could discourage beekeepers if they cost too much. It would then be necessary to assess the potential benefit of lowering costs and time required for a test. To do this would require insight gained from models focused on the dynamics of honeybee colonies with stressors. The model presented here is a stress structured model: a compartmental ODE model in which bees move between levels of stress depending on their recovery rate and interaction with stressors through mass action. Higher levels are associated with higher mortality rates and the reduced ability of workers to perform their roles such as brood rearing and pollination. The goal of the model is to perform sensitivity analysis on the cost of diagnostic tests to observe what the implications of a marginal decrease would be.

Speaker: **Lyle, Marlee-Ann**, University of Guelph

Co-authors: Angela Gradish, Justin Renkema & Rebecca H. Hallett

Title: **Molecular Detection of Cyclamen Mite (*Phytonemus pallidus*) in Strawberry**

Abstract: Cyclamen mite, *Phytonemus pallidus* (Banks) (Trombidiformes: Tarsonemidae), is a widespread pest of strawberry, feeding on new growth, and causing stunted plants and damaged fruit. Because of its small size (~0.25 mm) and cryptic lifestyle, cyclamen mite is often

undetected until populations are high and damage is apparent. The objective of our research was to develop a PCR-based method for detecting cyclamen mite from strawberry leaf samples. Cyclamen mite was collected in Ontario and Quebec and a sequence library of the barcoding region of the cytochrome oxidase subunit I (COI) gene was created using the Lep F/R primer pair. A primer set for a 94 bp amplicon was designed and tested by amplifying cyclamen mite DNA that had already been successfully sequenced with end-point PCR and visualizing bands on a 5% agarose gel. Primer selectivity was determined by non-amplification of DNA from 30 arthropods that are known to occur on strawberry. Primer sensitivity was determined by amplifying decreasing concentrations of cyclamen mite DNA. Future experiments will be conducted to determine if these primers are compatible with direct PCR and qPCR methods. The outcome of this project will be a new method capable of detecting cyclamen mite at low population levels.

Speaker: **MacDonald, Caitlin**, University Of Guelph

Co-authors: Tara D. Gariepy, Hannah Fraser & Cynthia Scott-Dupree

Title: **Occurrence and Host Range of the Brown Marmorated Stink Bug Parasitoid *Trissolcus japonicus* in Ontario, Canada**

Abstract: *Trissolcus japonicus* (Ashmead) (Hymenoptera: Scelionidae), is an Asian egg parasitoid of *Halyomorpha halys* (Stal) (Hemiptera: Pentatomidae), the brown marmorated stink bug (BMSB). Brown marmorated stink bug is a serious invasive agricultural pest in Europe and North America, and insecticides appear to be of limited efficacy. *Trissolcus japonicus* is being considered as a classical biological control agent in many regions where BMSB has established. Given the recent discovery of adventive populations of *T. japonicus* outside of its native range, surveys to determine the establishment and spread of adventive populations in southern Ontario were conducted. Data collected in the summers of 2019 and 2020 demonstrated that *T. japonicus* populations continue to persist in London, Ontario, but have not yet been found in other areas of southern Ontario. Research was conducted to investigate *T. japonicus*' physiological host range with 9 non-target stink bugs, and one squash bug, native to Ontario. Results suggest 6 of these stink bugs are within *T. japonicus*' physiological host range. Choice test results such that *Podisus maculiventris*, *Thyanta custator accerra*, and *Chinavia hilaris* may be less likely to be attacked in the field. Further research is required to determine what might occur in the field.

Speaker: **MacDonald, Maggie**, University of Alberta

Co-author: Maya Evenden

Title: **Ground beetles: diversity and dimorphism in pulse agroecosystems**

Abstract: The pea leaf weevil (PLW), *Sitona lineatus* L. (Coleoptera: Curculionidae), is a significant pest of field pea, *Pisum sativum* L. (Fabaceae), and faba bean, *Vicia faba* L. (Fabaceae), that has recently invaded the Canadian Prairie Provinces. Semiochemical-based monitoring can detect PLW population spread and local movements but trap capture includes non-target arthropod bycatch that can be used to identify the presence of predatory arthropods in the system. Various species of ground beetles are opportunistic generalist predators that form an important component of natural enemy communities for conservation biological control (CBC). The objective of this study is to assess the community diversity of ground beetles captured as bycatch in monitoring traps that target PLW, and compare differences in ground beetle

assemblages between crop type, trap treatment, and region. We further examine the morphology of the wing dimorphic *Pterostichus melanarius* (Ill.) (Coleoptera: Carabidae) from different regions in Alberta to determine the proportion of long and short wing morphs and make inferences about spread and dispersal of this non-native species.

Speaker: **Macdonald, Zachary**, University of Alberta

Co-authors: David C. Deane, Calyton T. Lamb, Fangliang He, Felix A. H. Sperling, John H. Acorn & Scott E. Nielsen

Title: **Messages from island butterflies: distinguishing effects of habitat area and isolation from the sample-area effect**

Abstract: The island species area relationship (ISAR) is an important tool for measuring variation in species diversity in variety of insular systems, from true-island archipelagoes to fragmented terrestrial landscapes, and has been widely utilized in conservation planning. However, it suffers from several limitations. For example, due to the sample-area effect, positive relationships between species and area cannot be directly interpreted as evidence for deterministic effects of area per se. Additionally, richness-based analyses may obscure species-level responses to area and isolation that may better inform conservation practice. Here, we use random placement models to control for variation in abundance, occupancy, and richness associated with the sample-area effect, allowing deterministic effects of area and isolation, and how they vary with species' functional traits, to be resolved using linear mixed effects models. We demonstrate the utility of this approach using a butterfly assemblage persisting on a naturally fragmented landscape of lake islands. The ISAR did not significantly deviate from random placement in relation to island area, isolation, or habitat diversity, supporting stochastic assembly consistent with the sample-area effect. Such inferences support the habitat amount hypothesis, which prioritizes preserving the maximum amount of habitat irrespective of its fragmentation. However, species-level analyses demonstrated that butterfly abundances were significantly lower for both smaller and more isolated islands than what is predicted by the sample-area effect. Moreover, effects of area per se were significantly greater for smaller, less mobile, and rare butterfly species. Butterfly occurrences also significantly deviated from predictions of the sample-area effect in relation to island isolation. Thus, our approach illustrates that richness-based analyses not only result in incorrect inferences on mechanisms underlying ISARs, but also obscure important effects of area per se and isolation on individual species that vary with functional traits. We therefore suggest that these effects should not be solely inferred from richness-based analyses, but rather evaluated on a species-by-species basis.

Speaker: **MacKell, Sarah,** Wildlife Preservation Canada

Co-authors: Hadil Elsayed & Sheila Colla

Title: **Assessing the impacts of urban beehives on wild bees using individual, community, and population-level metrics**

Abstract: Several species of wild bees are in decline globally and the presence of managed honey bees is one of many proposed stressors on wild bee populations. However, there is limited knowledge of the impacts of honey bee hives on wild bees, especially in urban landscapes. We performed a field study to assess the associations between honey bees and wild bees within the Greater Toronto Area in Ontario, Canada. We measured relative abundance of honey bees, wild

bee metrics (abundance, community composition, functional diversity, and body size), and floral resources (floral density and richness); we also calculated impervious surface at 500m and 1km for each of our sites. Our main findings were that increasing honey bee abundance was associated with decreases in the abundance of certain wild bee species, as well as reduced species richness and functional diversity. This research adds to the growing body of literature aiming to evaluate whether honey bees are a stressor on wild bees in urban landscapes, which will be valuable for informing conservation management practices and future research.

Speaker: **MacMillan, Heath**, Carleton University

Co-author: Hannah E. Davis

Title: **Does basal cold tolerance constrain plasticity in individual *Drosophila*?**

Abstract: Thermotolerance is a major determinant of ectotherm geographic distribution, but the physiological mechanisms underlying cold tolerance remain poorly understood. A critical uncertainty is whether basal thermotolerance constrains plastic thermotolerance, such that animals with greater basal tolerance have a lower capacity for acclimation. To address this question, a trade-off between basal and plastic thermal tolerance has been tested at several levels in insects (e.g. lineage, species, and population), often with conflicting results. If basal tolerance constrains plasticity through shared mechanisms of tolerance, however, it should be evident at the level of the individual over multiple trials, provided the trait measured is repeatable. Here, we used chill-coma onset temperature and chill coma recovery time (CCO and CCRT, respectively) to quantify cold tolerance of individual *Drosophila melanogaster* across two trials (pre- and post-acclimation). Overall, cold acclimation significantly improved cold tolerance, as expected. However, measurements of CCO and CCRT in control flies (that were not cold-acclimated) were not repeatable and yet, surprisingly, degree of plasticity was still related to basal tolerance. We argue that this relationship is an artefact of the most common method for testing for such trade-offs and does not reflect a true trade-off or physiological constraint. More broadly, our data suggests that cold tolerance traits may lack the intraindividual repeatability necessary to test for thermal plasticity constraints.

Speaker: **MacPhail, Victoria**, York University

Co-authors: Rich Hatfield, Leif Richardson, Shelby Gibson & Sheila Colla

Title: **Community science in action - Bumble Bee Watch program is fun and educational for participants, helps to fill knowledge gaps, and supports conservation efforts**

Abstract: Community science is a fast growing field that involves members of the public collecting and/or analyzing scientific data. It has the potential to increase the scale and scope of data beyond that researchers could accomplish alone, leading to improved conservation efforts and policies, amongst other positive outcomes. Here we compared data collected by volunteers with the Bumble Bee Watch (BBW) program (launched 2014) to data collected or collated by researchers (dating back to the 1800s) on a per-species, province/state, and grid basis. While the BBW program made up a small amount of the overall dataset (8.5% of 519,294 records) it represented a quarter of the records for the last decade (44,135 of 176,136). Forty-one out of 48 species, and all 63 provinces, territories, and states of Canada and the United States, were represented, with more records for ten species and more grids with records in the last decade as compared to the researcher data. Additionally, BBW users provided new locations of rare

species, confirmation of changes in distribution, new forage plant information, and more, particularly when compared over the last decade. While not a replacement for traditional research, community science complements it and improves our knowledge of these pollinators.

Speaker: **MacQuarrie, Chris**, Natural Resources Canada, Canadian Forest Service

Co-authors: M. Gray, G. Jones, T. Ladd, S. Butler, V. Martel & J. Sweeney

Title: **Impact of biological control agents on Canadian emerald ash borer populations**

Abstract: Three biological control agents have been released in Canada for the control of emerald ash borer. These species were released as part of the US-lead effort to reduce the impact of the pest on ash trees in North America. The first releases of *Tetrastichus planipennisi* were made in 2013 with *Oobius agrili* and *Spathius galinae* following in 2015 and 2017. Beginning in 2018 we initiated experiments to examine the impact and dispersal of these parasitoids in the Canadian ash ecosystem. These experiments were intended to determine if the parasitoids were contributing to population regulation, and to determine if and how far the insect has spread. To examine the impact of the parasitoids on population dynamics we used a series of sequential caging studies to partition the attack of parasitoids on resident emerald as borer in some of the oldest release sites. In our dispersal experiment we used pan traps established at 2-30 Km from the oldest release sites to examine dispersal in southwestern and northern Ontario. The results of these experiments will be used to estimate the contribution of these biological control agents to regulation of emerald ash borer in Canada.

Speaker: **MacRae, Ian**, Northwest Research and Outreach Centre

Title: **Of aphids, PVY and suction (traps that is)**

Abstract: The aphid vectored disease, Potato Virus Y is a significant factor in the availability of certified disease free seed in North American potato production systems. In most provinces and states, certification for a seed lot can be lost when more than 0.5% of sampled plants test positive for the virus. In addition, PVY is a non-persistent virus that can be acquired and potentially transmitted by aphid vectors in minutes. In such a system a wide-area vector monitoring system can facilitate and enhance vector management. For the past 12 years, the seed potato producing areas of Minnesota and North Dakota have used an integrated system of wind-event monitoring, in-season vector trapping, and relative efficiency factors to provide spatio-temporal risk of PVY vector presence. These long term regional data have also provided insight into the efficacy and application of tactics for vector management.

Speaker: **Maisonhaute, Julie-Eleonore**, University of Quebec at Trois -Rivières

Co-author: Shari L. Forbes

Title: **Diversity of Arthropods Associated with Human Remains during the Summer and Fall Seasons in Quebec**

Abstract: The study of necrophagous arthropods is of prime importance in forensic entomology, because it can provide significant information about the time elapsed since death (minimum post mortem interval) or the circumstances surrounding death. However, very little is known about the diversity and ecology of necrophagous arthropods found in the Quebec province. The purpose of our research was to acquire the first data about arthropods associated with decomposed human bodies in Quebec. It represents the first study of its kind in Canada using

donated human cadavers. Our objective was to document the diversity and succession of the entomofauna associated with human cadavers throughout the decomposition process. The decomposition of four human cadavers was followed during the Summer and/or Fall seasons of 2020, at the site for Research in Experimental and Social Thanatology, REST. Arthropods were regularly sampled by visual observations, insect collection on the cadavers, and using an entomological net and pitfall traps. Results allowed us to evaluate the overall arthropod diversity and succession, and highlighted important seasonal differences in the diversity and structure of the arthropod communities. Such results could provide more accurate information about the circumstances surrounding death, in order to help medico-legal death investigations.

Speaker: **McNeil, Jeremy**, Western University

Co-author: Keith Hobson

Title: **Can stable isotopes data help develop more effective management programmes for migratory pest species?**

Abstract: A number of important insect pests are seasonal migrants that do not overwinter in Canada. Currently we have very little knowledge about the natal origin of immigrants, other than ""somewhere south of here"" and management decisions f are generally based on trap catch data of immigrants, which may not leave a great deal of time to intervene if control measures are required. However, if immigrants always originated from the same site, then it might be easier to better predict the size of spring populations than if the site of origin differed from year to year.

As there are distinct H-isotope (Î´2H) latitudinal gradients in precipitation and surface waters in North America, the Î´2H value of insect wings, formed during metamorphosis at the natal site but metabolically inactive thereafter, provides insight into the geographic origin of individuals captured at a given site. Similarly, as C3 and C4 plants differ isotopically the Î´13C values of wings may provide insight into host plant use.

We will present the findings of multi-year studies on several moth species. Our findings clearly show that this approach can add to our understanding of their migratory biology, it will be necessary to refine the approach to accurately determine sites of origin.

Speaker: **McTavish, Michael**, University of Toronto

Co-authors: Thomas Hall, Sandy Smith & Rob Bourchier

Title: **First explorations of the distribution and life history of tumbling flower beetles *Mordellina ancilla* (Coleoptera: Mordellidae) on invasive garlic mustard (*Alliaria petiolata*) across southern Ontario**

Abstract: Garlic mustard (*Alliaria petiolata*) is a widespread non-native invasive plant found in forest understories. Biological control is in development for garlic mustard but will require a better understanding of insects already associated with the target plant. Monitoring of a biocontrol release site in fall 2020 detected previously undocumented stem feeding of tumbling flower beetle *Mordellina ancilla* (Coleoptera: Mordellidae) larvae on garlic mustard. Based on this discovery, this project will survey woodlots across southern Ontario to document the prevalence and life history of this beetle and other insect taxa associated with garlic mustard. Preliminary monitoring in fall 2020 observed stem damage in 20% of senesced garlic mustard stems, 34% of which contained live *M. ancilla* larvae. In summer and fall 2021, further investigation will include a longitudinal study of *M. ancilla* life stages from field-collected

stems, a large-scale survey across southern Ontario to determine the geographic distribution of *M. ancilla* populations, and laboratory rearing to characterize feeding damage of *M. ancilla* on garlic mustard. This research will provide further insight into the ecology of a widespread forest invader and inform biological control through a better understanding of insects that may co-occur with introduced biocontrol agents.

Speaker: **Meehan, Matthew**, University of Western Ontario

Title: **From individuals to communities: The effect of climate change on ectothermic predators**

Abstract: Ecological systems exist within a nested hierarchy, consisting of individuals, populations, communities and ecosystems. Because of this nestedness, climate change can greatly impact ecological systems, as whole-organism metabolic and physiological demands increase for ectotherms under warming, the effects of which compound with every succeeding level. Therefore, a multi-level approach can better disentangle how climate change will reshape ecological systems. Here, I used feeding and mesocosm experiments to examine how climate change affects a functionally and taxonomically rich group, ectothermic predators, at the individual-, population-, and community-level, using mesostigmatid mites (Arachnida: Parasitiformes: Mesostigmata) as my model predator. With feeding experiments, I showed that the predator mite *Stratiolaelaps scimitus* increasingly fed on small-bodied, but not large-bodied prey, under warming, which lowered their energy intake. I hypothesize predators lowered their handling costs, associated with smaller prey, rather than maximize energy gain by feeding on larger prey, to offset higher metabolic demands. Furthermore, using predator mite (*Stratiolaelaps scimitus*) and collembolan prey (Folsomia candida) populations, I found that greater exposure of predators (and prey) to warmer temperatures increased the average size of their prey, and also strengthening predator-prey interactions, suggesting predators increasingly fed on smaller prey under warming. Finally, I observed that short-term intensive warming shifted soil Mesostigmata assemblages, which was primarily due to the increased abundance of a single asexual species, *Veigaia mitis*. Increased abundances of asexual species under warming have not been previously reported for microarthropod predators. To conclude, I address the broader implications of my research for ecological systems as a whole.

Speaker: **Meraj, Sanam**, Simon Fraser University

Co-authors: Sanam Meraj, Emerson Mohr, Negin Ketabchi, Anastasia Bogdanovic, Carl Lowenberger & Gerhard Gries

Title: **Time- and tissue-specific antimicrobial activity of common bed bugs in response to blood feeding and immune activation by bacterial injection**

Abstract: Unlike almost all hematophagous insects, common bed bugs, Cimex lectularius, are not known to transmit pathogens to humans. To help unravel the reasons for their lack of vector competence, we studied the time- and tissue-dependent expression of innate immune factors after blood feeding or immune activation through the intrathoracic injection of bacteria. We used minimum inhibitory concentration (MIC) bioassays and the Kirby-Bauer protocol to evaluate antimicrobial peptide (AMP) activity in tissue extracts from the midguts or ‘rest of body’ (RoB) tissues (containing hemolymph and fat body AMPs) against Gram-positive and Gram-negative bacteria. We compared AMP activity between blood-fed female bed bugs and yellow fever mosquitoes, Aedes aegypti and determined how female and male bed bugs respond to immune

challenges, and how long AMP gene expression remains elevated in bed bugs following a blood meal. Blood meal-induced AMP activity is 4-fold stronger in female bed bugs than in female mosquitoes. Male bed bugs have elevated AMP activity within 8 h of a blood meal or an intrathoracic injection with bacteria, with the strongest activity expressed in RoB tissue 24 h after the immune challenge. Female bed bugs have a stronger immune response than males within 24 h of a blood meal. The effects of blood meal-induced elevated AMP activity lasts longer against the Gram-positive bacterium, Bacillus subtilis, than against the Gram-negative bacterium Escherichia coli. Unravelling the specific immune pathways that are activated in the bed bugs' immune responses and identifying the bed bug-unique AMPs might help determine why these insects are not vectors of human parasites.

Speaker: **Mesich, James**, Brock University

Co-author: Miriam Richards

Title: **Effect of Social Status on Aggression in a Facultatively Social Bee (*Xylocopa virginica*)**

Abstract: Dominance hierarchies in many species are formed though behaviours, such as aggression, that are mediated by hormones including juvenile hormone (JH) in insects. The eastern carpenter bee (*Xylocopa virginica*) is a facultatively social species that displays dominance hierarchies when living in social groups but can also live solitarily. The dominant female in social nests must feed her nestmates, at the cost of time to prepare food for her own young, while nestmates wait for their own chance to reproduce. What allows some females to avoid this extra cost and live without nestmates is unclear, but higher levels of aggression could be important. To test if this was the case, I used circle tube assays to compare the levels of aggressive behaviours by unfamiliar solitary and social females. I found that there were higher levels of aggression displayed by solitary females, which supports that aggression is a driver for a solitary lifestyle. I found that aggressive behaviours such as biting and pushing were the lowest in dyads of two social females, compared to solitary-solitary and mixed solitary-social dyads. Moreover, in mixed dyads it was the solitary individual who were more likely to display these aggressive behaviours. High levels of aggression could be advantageous to solitary females because any other bee found in their nest is likely to be an intruder and should be addressed harshly. However, the proximate cause of this aggression is still unclear, future research should attempt to find the cause of this aggression, possibly by manipulating levels of JH.

Speaker: **Moehring, Amanda**, Western University

Title: **Sorry, not sorry: the neural basis of aggression in *Drosophila* females**

Abstract: Identifying the underlying genetic and neural basis of variation in complex behaviour remains a fundamental goal, and challenge, in behavioural biology. *Drosophila* is a powerful model system for exploring behavior genetics and neuroscience, and has been used to study traits that are critical for reproduction and survival, such as mating behaviour and aggression. The overwhelming majority of studies in these two behavioural traits have focused on the bases of these behaviours in males, and comparatively little is known about the genetic and neural bases of these essential behaviours in females. We have identified a small cluster of neurons that cause females to become hyper-aggressive. Interestingly, these same neurons cause courtship, not aggression, in males. I will present on our work identifying the key components necessary to trigger female aggression, and the upstream and downstream neural pathways that respond to these cues.

Speaker: **Moffat, Chandra**, Agriculture and Agri-Food Canada

Co-author: Paul Abram

Title: **Rethinking biological control programs as planned invasions**

Abstract: Biological control of pests with their natural enemies essentially consists of planned invasions, with the opportunity to select both the invader and the invaded environment. Recent advances in invasion science link ‘intrinsic invasion factors’ (life history and behavioral traits) with invader success; connect ‘extrinsic invasion factors’ (abiotic and biotic aspects of the invaded environment) with environmental invasibility; and demonstrate that their interaction leads not only to ecologically driven variability but also to rapid evolutionary change in biocontrol systems. However, current theory and empirical evidence from invasion science have not yet been extensively adopted into biological control research and practice. In this talk, I will provide an overview of how this 'rethinking' of biological control programs from an invasion ecology perspective can improve the efficacy of biocontrol across study systems.

Speaker: **Monckton, Spencer**, York University

Co-authors: Olivier Morin, Charles S. Eiseman, Catherine Beliveau, Michel Cusson & Stephan M. Blank

Title: **Elm zigzag sawfly: a case study in detecting species introductions using social media and community science**

Abstract: The Elm zigzag sawfly, *Aproceros leucopoda* Takeuchi (Hymenoptera: Argidae), was reported for the first time in North America during the summer of 2020. Characteristic zigzag defoliation was first reported on the community science website iNaturalist after it was observed in the province of Québec, Canada, near the region of Montréal. Field trips were conducted to the site to confirm the presence of this species in Canada and to collect live specimens - genetic data from which suggests a possible European origin. Additional observations were subsequently reported via iNaturalist, mostly as a result of outreach to naturalists in southern Québec and eastern Ontario via that platform. These observations - along with subsequent field excursions - led to the conclusion that the species is more widely distributed here than first though, having apparently spread as far west as Ottawa, Ontario. At least one observation has also been reported from the eastern U.S., potentially the result of an independent introduction there. Altogether, these reports provide an excellent example of how community science can be useful for rapidly detecting and tracking the spread of a new invasive species.

Speaker: **Mori, Boyd**, University of Alberta

Co-authors: David R. Hall, Steven J. Harte, Dudley I. Farman & Meghan A. Vankosky

Title: **Identification of the sex pheromone of *Contarinia brassicola*, a newly described canola pest**

Abstract: *Contarinia brassicola* Sinclair (Diptera: Cecidomyiidae) is a newly-described species found inducing galls on canola (*Brassica napus* L. and *B. rapa* L. (Brassicaceae)). Due to its cryptic lifecycle, *C. brassicola* is difficult to detect and monitor. Here, we report the identification and synthesis of the female-produced sex pheromone of *C. brassicola* and demonstrate its effectiveness in attracting males to traps in the field. Gas chromatography-

electroantennography (GC-EAG) of female-produced volatiles identified two peaks that elicited responses in male antennae. These peaks were characterised using gas chromatography-mass spectrometry (GC-MS) and synthesis as 2,7-diacetoxynonane (major component) and 2-acetoxynonane (minor component). All four stereoisomers of 2,7-diacetoxynonane were synthesised and the naturally-produced compounds were shown to be primarily the R,S-isomer. In initial field trials, none of the four isomers of 2,7-diacetoxynonane, tested individually or as a racemic mixture, were attractive to male *C. brassicola*. Dispensers loaded with a 10 µg:1 µg blend of (R,S)- and (R,R)-2,7-diacetoxynonane caught large numbers of male *C. brassicola* and significantly more than other blends tested. Addition of 0.5 µg of (R)-2-acetoxynonane to this blend further increased the number of males caught. This blend is highly attractive and we are currently optimizing the trapping system for use in monitoring and surveillance.

Speaker: **Murray-Stoker, Kelly**, University of Toronto

Co-authors: Shannon J. McCauley

Title: **Assessing effects of urbanization on caddisfly assemblages within a regional context using community science**

Abstract: Historical processes, landscape characteristics, and the distribution of biodiversity form the context in which local community interactions occur. Using caddisflies in lotic ecosystems, we are studying the influence of regional context on urban stream communities. We have characterized regional species pools in terms of taxonomic diversity and, in future work, will assess whether the variation in diversity across regions and can be predicted by landscape-level environmental and historical patterns. Additionally, with a community-science approach, we are sampling urban streams in various North American regions, evaluating whether caddisfly communities in certain areas are better equipped to tolerate the effects of urbanization because of the historical distribution of taxonomic, ecological, and phylogenetic diversity. So far, participants have collected adult caddisflies at 120 sites across the US and Canada. Studying this question will help researchers understand how much to consider the region-specific characteristics of a community to mitigate detrimental effects of urbanization and preserve the integrity of freshwater ecosystems.

Speaker: **Musso, Antonia**, University of Alberta

Co-authors: Colleen Fortier, Dezene Huber, Allan Carroll & Maya Evenden

Title: **Pine Wars - A New Host: the battle between mountain pine beetle and naïve pines in Alberta**

Abstract: The mountain pine beetle (MPB), Dendroctonus ponderosae, has expanded its range into Alberta where it is attacking evolutionarily naïve lodgepole and jack pines. Naïve pines are not adapted to MPB attack compared to pines in the historic range. During the epidemic population phase, MPB in sufficient numbers use pheromone-mediated mass attack to overwhelm vigorously defended trees. Our current understanding of MPB mass attack dynamics originates from studies performed in the historic range where the minimum density required to achieve mass attack is ≈40 beetles/square metre. The optimal attack density, where tree defenses are overcome and intraspecific competition is limited, is ≈60 beetles/square metre. We manipulated attack densities in lodgepole and jack pines in the Alberta to describe mass attack dynamics by measuring the number of parental, larval, and pupal galleries formed by MPB at

various densities. We also measured phloem monoterpenes prior to attack (constitutive), post-attack (induced) and postoverwintering (long-term). The mass attack threshold and optimal attack densities appear to be lower in Alberta pines compared to the historic range, however this result varied by year in lodgepole pine. Gallery characteristics in jack pine were markedly different than lodgepole pine so direct comparisons between the two are difficult to make. Phloem monoterpenes increase after attack and are significantly higher post overwintering. Understanding how mass attack dynamics and tree chemical defenses are different in Alberta pines will allow us to predict the long-term population dynamics of MPB in its expanded range and its potential for spread through Canada's boreal forest.

Speaker: **Myers, Lisa**, York University

Title: **Reinscribing Land: Mike MacDonald's Medicine and Butterfly Gardens**

Abstract: This presentation will consider the garden artworks of the late Mi'kmaw artist Mike MacDonald. His Butterfly Gardens and video installations Electronic Totem (1987) and Seven Sisters (1989) emerged from his work with Gitxsan and Wet'suwet'en peoples who challenged the British Columbia government to establish title to their ancestral territories. He documented testimony by Elders for use as evidence in court and worked with them on a medicine plant project. Through this work he began to learn more about butterflies and plant medicine. I discuss how his gardens are not just a land remediation project; they are spaces of contemplation that re-inscribe symbolic and material tensions and pressures that collide between Indigenous knowledge systems and extractive industries. In considering land as document, I theorize how MacDonald's work points to ecological degradation as a kind of redaction. As an artist/curator, my work on MacDonald involves researching former sites of his gardens and collaborative replanting of these spaces with Indigenous artists, collectives and community. Of particular concern are the relationships developed around these spaces. I further highlight how his video installations also convey relationship to land.

Speaker: **Nayani, Saif**, Simon Fraser University

Co-authors: Sam Meraj, Emerson Mohr & Gerhard Gries

Title: **Microbe-mediated attraction of stable flies to host cattle**

Abstract: Stable flies, *Stomoxys calcitrans*, are significant blood-feeding pests of livestock (cattle) but little is known about the cattle semiochemicals that attract the flies to their host. We tested the hypothesis that cattle skin microbiota and their semiochemicals, respectively, play a role in fly attraction. Cotton swabs were taken from the hide of a freshly slaughtered cow, and from a live calf, and plated on different types of agar. Microbial strains were then isolated by re-streaking and identified by Matrix Assisted Laser Desorption/Ionization-Time of Flight Mass Spectroscopy (MALDI-TOF MS) or genetic sequencing. In two-choice behavioral bioassays, flies preferred a number of single strains growing on agar to control agar. Follow-up research is underway to identify the semiochemicals that mediated the attraction of flies.

Speaker: **Noronha, Christine**, AAFC Charlottetown Research and Development Centre

Co-authors: Lorraine Mackinnon, Sebastian Iberra & Carol Banks

Title: **Surveillance of Click Beetle (Coleoptera: Elateridae) Populations Across Prince Edward Island, Canada**

Abstract: Increasing wireworm populations are a major economic threat to the potato industry worldwide. In PEI, three European species, *A. suptator*, *A. obscurus* and *A. lineatus* have been found damaging the potato crop. Increasing wireworm population in infested and previously non-infected fields prompted a province wide survey in 2009 and every 3 year thereafter. Pheromone traps, one per field, in (60(2009) 85(2012, 2016, and 2019)) fields were placed across the island each sampling year. Results showed higher number of beetles/trap in queens county in 2009 with none to very low numbers in the western and Eastern regions. In 2012 a six-fold population increase and spread into all regions of the province was detected with a further increase in 2016. However, survey results in 2019 showed a significant decrease in the population in all regions. *A. sputator* was the dominant species. The growers started implementing of a province wide IPM strategy since 2015 using wireworms suppressive rotation crops prior to the potato crop year, which is thought to have contributed to this decrease in click beetle numbers detected in 2019. Surveillance will continue in 2022 to verify these results and track click beetle population and movement within the province.

Speaker: **Okpara, Patricia**, University of Windsor

Co-author: Sherah L. VanLaerhoven

Title: **Investigating microbial effects on the life-history traits and waste reduction capability of the black soldier fly Linnaeus (Diptera: Stratiomyidae)**

Abstract: Within Ontario alone, approximately 3.7 million tonnes of organic food waste are generated yearly. This waste includes food scraps, wasted food, and greenhouse wastes such as leaves, plant stems, and fruits. Out of this, more than 55% of this waste is generated by the residential and municipal sectors, and most of it is transported to landfills for composting each year. The use of landfills as a method of waste management is not sustainable, creating strains on the environment by releasing harmful greenhouse gases and demanding landfill space. Based on the current trends in economic growth, it is projected that more than 16 landfills will be required by 2050 in Ontario if efforts are not made to reduce the use of landfills for organic waste disposal.

The black soldier fly, *Hermetia illucens* Linnaeus (Diptera: Stratiomyidae) reduces a wide range of waste, ranging from all-vegetable to all-meat wastes. The adults of this species have no functional mouthparts and are non-feeding, they survive on the fat reserves obtained as maggots. The goal of this research was to examine the potential for *H. illucens* as a sustainable waste management system for municipal waste in the Windsor-Essex region by evaluating life-history traits, waste reduction efficiency, and waste reduction index of larvae reared on municipal waste inoculated with effective microbes to promote waste decomposition and nutrient release. We predict larger *H. illucens* adults and higher survival in treatments inoculated with effective microbes. Additionally, we predict waste reduction efficiency and waste reduction index will be higher in treatments inoculated with effective microbes.

Speaker: **Otis, Gard W**., University of Guelph

Co-authors: Heather R. Mattila, Lien T.P. Nguyen, Hanh D. Pham, Ngoc T. Phan, Olivia M. Knight & Hannah G. Kernen

Title: **Defensive behaviours of Asian honey bees (*Apis cerana*) against attacking murder hornets (*Vespa soror*)**

Abstract: Giant hornets are major predators of honey bees and social wasps in Asia. We studied *Vespa soror* attacks on honey-bee colonies and the corresponding defensive behaviours of the bees in northern Vietnam. In addition to previously documented bee defenses (group shimmering, heat-balling of hornets), the bees reduced the intensity of the hornet attacks by collecting and smearing odiferous materials (animal dung, human urine) near hive entrances in behaviours that qualify as tool use. In addition, the bees generated at least four distinct vibro-acoustic signals within their colonies, one of which, a novel anti-predator pipe, was emitted specifically in response to *Vespa soror*.

Speaker: **Parent, Jean-Philippe**, Agriculture et Agroalimentaire Canada - CRD

Co-author: Paul K. Abram

Title: **Are cozy aphids less likely to be disrupted by substrate-borne vibrations?**

Abstract: A renaissance of physical pest control methods as an alternative to chemical control came about in the last few years, with a biotremology (science that studies the use of substrate-borne vibrations in animal communication) being one such emerging field of study. While most newly developed biotremology-based methods have targeted insects by disrupting their communication with specific signals, the potential for general behavioural disruption with non-specific vibrational signals is also being investigated. Recently, it has been shown that some aphid species are negatively impacted by non-specific substrate-borne vibrations. However, previous results suggest that aphids that have had longer periods of settling in on their host plant may be less affected than aphids that have recently colonized plants, suggesting that the timing of application of vibrations relative to aphid arrival on plants might be important for the method's efficacy. In this study, we directly investigated the impact of settling-in time on the response of both adults and juvenile aphids to vibrations, using two model pest species, the pea aphid *Acyrthosiphon pisum* and the green peach aphid *Myzus persicae*. We predicted that the longer the delay between colonization and initiation of vibration, the fewer aphids would cease feeding and leave the plants. Whole plants recently colonized by 20 adult aphids, and juveniles they subsequently laid, were subjected to different settling-in intervals (0h, 12h, 24h, 36h and a negative control) before being exposed to a continuous 24h non-specific substrate-borne vibration treatment. We then measured the number of remaining aphids on the plants after the vibration treatments and the equivalent negative control. Population reduction of *A. pisum* remained mostly stable at around 50% for adults and 75% for juveniles regardless of settling-in time, whereas it decreased sharply if *M. persicae* adults and juveniles were given 12 or more hours to settle in before vibrations started. Juveniles of both species reacted to vibrations like their adult counterpart but with increased responsiveness. Our results suggest that physical control of pests using disruptive substrate-borne vibrations may be more efficient as a preventative than a curative method for *M. persicae*, while they might feasibly achieve both goals for *A. pisum*. Further exploring the impact of application timing will be needed in order to optimize methods for applying substrate-borne vibrations as a pest control technique.

Speaker: **Peck, Daniel**, Vestaron Corp

Co-author: Marja Koivunen

Title: **Insecticidal Peptides: Primer on a New Technology Yielding Novel Tools for Pest Management**

Abstract: Naturally occurring insecticidal proteins, namely Bt, are the most widely used bioinsecticides. Resistance management is a concern after decades of use as spray-on products and as GM traits. The next generation of effective and safe bioinsecticides is now emerging as peptides originating from animal venom. The active ingredient GS-omega/kappa-Hxtx-Hv1a, branded as the SPEARÂ® technology by Vestaron Corporation, was classified as a new IRAC group 32 in November 2018 because it targets the nicotinic acetylcholine receptor in a different way than any existing class of insecticides. It is thereby an important new tool for insecticide resistance management. For this relatively large molecule, bioavailability via ingestion is achieved through co-application with a gut disruptor, such as Bt. The insecticide Spear-Lep was approved by the US EPA in 2018 and is now under regulatory review in both Canada and Mexico. Recent field research results will be shared to demonstrate Spear-Lep's versatility across cropping systems and lepidopteran pest species, and as a rotation partner with conventional products for season-long control programs. Two more peptide active ingredients, currently in field testing, will be introduced.

Speaker: **Pepinelli, Mateus**, York University

Co-authors: Nuria Morfin & Amro Zayed

Title: **Vitellogenin expression tracks age of honeybee workers**

Abstract: Vitellogenin (Vg) is an important protein involved in egg yolk formation and it has been suggested as a key player for caste development in honeybees - *Apis mellifera* Linnaeus, 1758. In honeybee queens, Vg is upregulated and high levels are maintained throughout the queen's life. In workers, however, Vg expression levels are variable with an increase in the Vg expression during the first 7 days when they become nurse bees and a decrease when they turn into foragers. In this study, we assessed whether Vg expression could be used as an indicator of the age of worker bees. We were interested in estimating the biological age of workers collected from open brood frames and we compared Vg expression in these bees to three sets of known-aged bees: 1-day old bees, nurses (workers observed nursing brood; 6-16 days old) and foragers (23-28 days old). For this study, we used quantitative PCR to measure the expression of a reference gene, rps5, and Vg in 12 pools of 5 abdomens per age group. As expected, the level of Vg significantly changed with age. One-day old bees showed the lowest levels with a sharp increase in nurses and a sharp decrease in foragers. Open brood workers showed similar Vg level as nurses, suggesting that most of the bees present in a frame with open brood are performing brood-rearing tasks.

Speaker: **Picq, Sandrine**, Natural Resources Canada

Co-authors: Yunke Wu, Vyacheslav Martemyanov, Esther Pouliot & Michel Cusson

Title: **Identifying the geographic origins of intercepted gypsy moth (*Lymantria dispar*) specimens using genotyping-by-sequencing (GBS)-derived SNPs**

Abstract: Forest invasive alien species are a major threat to ecosystem biodiversity and can have enormous economic, social and health impacts. The Asian gypsy moths (AGM; *Lymantria dispar asiatica* and *L. d. japonica*) is an important defoliator of a wide variety of hardwood and coniferous trees, and preventing its introduction into North America has been identified as a top priority by plant health regulatory authorities. Although molecular assays have been developed to help distinguish gypsy moth subspecies including the already established European gypsy

moth (*L. d. dispar*), these tools are not adequate for tracing the geographic origins of AGM samples intercepted on foreign vessels. Yet, this type of information would be very useful in characterizing introduction pathways and would help North American regulatory authorities in preventing introductions. Based on 1325 moths collected across GM range and genotyped for 2340 genotyping-by-sequencing (GBS)-derived SNPs, we were able to correctly assign â‰¥ 95% of the GMs to their original population with as few as 200 SNPs. This gives great hope for the development of an efficient molecular tool to identify GM geographic origins.

Speaker: **Pizante, Rachel**, University of Alberta

Co-authors: John Acorn & Carol Frost

Title: **Effects of canola bloom, floral availability, and field margin type on hover fly abundance, species richness, and species composition in canola crops in the Aspen Parkland**

Abstract: Hover flies (Diptera: Syrphidae) are important in flowering crops such as canola. However, crops cannot provide all the resources a hover fly will need during its life cycle. In agricultural landscapes, field margins are often the only non-crop habitats available, and they provide larval resources and floral resources when the crop is not in bloom. The objective of this study is to examine how hover fly abundance, species richness, and species composition change with canola bloom, field margin type, and floral availability. At ten sites, I established four 30m transects: one in a herbaceous margin, one in a treed margin, and two 100m into the canola field from each margin transect. Along with another observer, I walked each transect for 30 minutes and collected all insects that visited any flowers. We also counted and identified flowers along each transect. I found that hover fly abundance decreased during canola bloom and that flower availability and margin type affected hover fly abundance, species richness, and species composition. This research can provide canola growers with information regarding what they can do to promote hover flies near their crops. Also, this study will provide a better idea of which hover fly species are potentially pollinating canola and which species use which wildflowers, providing both an agricultural and conservation perspective on hover flies in canola in the Aspen Parkland.

Speaker: **Pouet, Cyrane**, L'Université du Québec à Montréal

Co-authors: Didier Labarre, Jonathan Bernardos-Santos, Daniel Chapdelaine, Daniel Cormier & Eric Lucas

Title: **Mating disruption to control two major cranberry pests in Quebec**

Abstract: The blackheaded fireworm (BHFW), *Rhopobota naevana* (Hubner) and the cranberry fruitworm (CFW), *Acrobasis vaccinii* Riley are the two main pests of cranberry in Canada. Mating disruption (MD) is a selective alternative method to insecticides. MD aims to control populations by using synthetic sexual pheromone to delay, reduce or prevent mating. Currently, there is no available efficient MD method to control BHFW and CFW populations, even if Steffan et al. (2019) and Labarre et al. (2019) obtained promising results with innovative dispensers. In this study, we assess the efficacy of a new granulated pheromone dispenser to control these two pests, developed to be easier to apply by growers. The granulated pheromone dispenser was applied on organic cranberry fields. BHFW and CFW males and larvae were respectively monitored via pheromone traps and visual search. We found that the granulated

pheromone dispenser did not significantly reduce the observation of BHFW larvae nor males. However, we observed a significant reduction of CFW male captures (trap shutdown), for a 7 to 10 days after the dispenser application. Thus, the dispenser had a MD effect on CFW but not on BHFW. Further work is needed to evaluate the new effective dispersers.

Speaker: **Proctor, Heather**, University of Alberta

Co-author: Alexandra Grossi

Title: **Variation in ectosymbiont assemblages of Rock Pigeons across Canada**

Abstract: When a species colonizes a new area, it has the potential to bring with it an array of smaller-bodied symbionts. Rock Pigeons (*Columba livia* Gmelin) have colonized most of Canada and are found in al- most every urban center. In its native range, *C. livia* hosts more than a dozen species of ectosymbiotic arthropods, and some of these lice and mites have been reported from Rock Pigeons in the United States. Despite being so abundant and widely distributed, there are only scattered host-symbiont records for rock pigeons in Canada. We sampled 162 Rock Pigeons from seven locations across Canada from the west to east (a distance of 4000 km) to increase our knowledge of the distribution of their ectosymbionts. Additionally, because ectosymbiont abundance can be affected by temperature and humidity, we looked at meteorological variables for each location to assess whether they were correlated with ectosymbiont assemblage structure. In total, we found eight species of mites (Arachnida: Acariformes, Parasitiformes) and five species of lice (Insecta: Phthiraptera) associated with different parts of the host's integument. All 13 species of ectosymbionts were found on birds from Vancouver (British Columbia) on the west coast and Halifax (Nova Scotia) on the east coast. Pigeons from the prairie provinces had the lowest prevalence and richness of mites. Some temperature and humidity variables were significantly associated with ectosymbiont assemblage structure. Our results suggest that milder climatic conditions may support greater richness and prevalence of ectosymbionts associated with Rock Pigeons in Canada.

Speaker: **Pusz-Bochenska, Karolina**, University of Saskatchewan

Title: **Genetics of a perennial invader. Aster leafhoppers and their yearly migration**

Abstract: Aster yellow (AY) is a phytoplasma (AYp) disease mainly transmitted by the migratory aster leafhopper *Macrosteles quadrilineatus*. Cicadellidae). AY disease can be devastating to Canada's 28-billion-dollar-per-year Canola industry, especially since this crop is highly susceptible to malformations caused by infection with AYp. AYp causes severe losses in plant production, and insecticide sprays are the main methods used to control the disease through control of the insect vector. As the inoculation of plants by the leafhoppers takes less than 24hrs, an early warning system for the arrival of South winds carrying potential migrating leafhoppers, would alert growers and agronomists of the potential of an AY threat that spring. Rapid molecular tools to detect the presence of AY in the migrating leafhoppers would also provide farmers and agronomists valuable information for spray decisions and timing. To ascertain the origin of the migrant aster leafhoppers that arrive in Western Canada we use wind trajectory monitoring and DNA-based methods. The reverse and forward trajectories commonly used to monitor diamondback moth movement is used to evaluate the origin of Southern winds. We are using DNA-based methods such as microsatellites as population markers to match leafhopper populations sampled in the Canadian prairies with those from various areas in the Southern USA.

Once this molecular tool is fully developed, my team will be the first to differentiate and detect the population structure of aster leafhoppers in North America.

Speaker: **Renyard, Asim**, Simon Fraser University

Co-author: Gerhard Gries

Title: **Good vibrations: the role of multimodal pheromone and vibratory communication in Western carpenter ants**

Abstract: When threatened, many social insects produce alarm signals to alert and recruit nest mates. Ants commonly communicate distress using both pheromonal and vibratory signals. Distressed *Camponotus* carpenter ants both secrete alarm pheromone and drum body parts against the substrate, thereby generating substrate-borne vibrations. We have previously shown that in Western carpenter ants, *Camponotus modoc*, alarm pheromone secretions and drumming signals elicit attraction and cause freezing responses in nestmates, respectively. Here, we tested the hypothesis that vibratory and pheromonal signals in combination elicit the strongest and fastest recruitment responses from nest mates. To test these hypotheses, we video-recorded the behaviour of groups of ants on wood veneer in response to (i) Laser-guided play-back recordings of vibratory signals, (ii) synthetic alarm pheromone, or (iii) both. Although there was no increase in attraction, we saw an increase in freezing behaviour in response to the multimodal signal compared to either modality alone. The functions of these behavioural responses are discussed.

Speaker: **Reynolds, Samm**, University of Guelph

Co-authors: Nigel Raine & Dr. Andrew Young

Title: **Investigating the effects of local natural habitats on the abundance and diversity of native fly and bee pollinators in Norfolk County, Ontario**

Abstract: To address the ever-growing problem of the decline in insect pollinators, this project will investigate the relationship between three different habitat types and their impact on species abundance and diversity of wild pollinators in Canada. I will focus primarily on agriculture-adjacent habitats most likely to support healthy populations of insect pollinators: hedgerow, forest patch and restored prairie grass. While the bulk of past pollination research has focused exclusively on the non-native honeybee, there is still much to understand when it comes to supporting wild pollinator populations particularly with regards to their nesting and foraging requirements. What we do know is that diversifying pollinators on agricultural land is imperative for improving seed quality and encouraging cross-pollination and prevents our food supply from being vulnerable to all the challenges facing the honeybee. This project will employ Malaise traps to collect insects in the summer months across farms in Southern Ontario, focusing on the aforementioned habitat types. Insects will be sorted to isolate target pollinators (wild bees and flower flies) which will then be pinned, labelled, DNA barcoded and/or morphologically identified and ultimately databased. These data will then be analyzed to detect patterns in species richness as well as overall abundance. I hypothesize that both the abundance and species diversity of pollinators will increase when all three habitat types are present in proximity, as well as in the presence of less fragmented woodlands. This project's findings will be used to create educational tools for farmers across Southern Ontario explaining how to best increase their local pollinator populations and associated pollination services and has potential to inform government policy for the future. Ultimately the hope is to inspire sustainable agriculture practices across

Canada and contribute to the efforts of native pollinator conservation, in turn will securing essential crops and nutrients for human consumption, profit, and survival.

Speaker: **Ritchie, Marshall**, Carleton University

Co-authors: Jennifer Provencher & Heath MacMillan

Title: **Physical transformation of microplastics ingested by a cricket, *Gryllodes sigillatus***

Abstract: Microplastics (MPs; plastics smaller than 5 mm in size) are a growing environmental concern but a poorly understood threat to biota. There has been a spike in research on MPs in recent years, but most of this work has focused on marine animals. The potential interactions with terrestrial organisms (e.g., insects) have with MPs have been minimal despite an estimated 4900 megatons of plastics to date being directed to terrestrial systems. We used a generalist insect (a cricket; *Gryllodes sigillatus*) to examine if individuals would ingest and transform MPs in their food to explore the fate of the MPs. By comparing plastic content and fragment size within regions of the gut, we sought to identify whether and where crickets can fragment ingested MP particles. We found that G. sigillatus can indeed ingest MPs, and we found that when fed 100 Âµm MPs, individuals egested much smaller pieces (equal to or smaller than 2 Âµm). This fragmentation occurs early in the digestive process of this insect. These findings suggest that when generalist insects encounter MPs, they can serve as agents of plastic transformation in the environment.

Speakers: **Rix, Rachel**, Dalhousie University

Co-author: G. Christopher Cutler

Title: **Phenotypic and molecular response in a beneficial insect predator stimulated by mild stress**

Abstract: Traditional models of toxicology have failed to capture the biological complexity of low dose effects of toxicological agents on organisms and the environment. The hormetic model, whereby low dose exposures to chemical or other stressors stimulate biological processes, has been shown to be a common occurrence in the toxicological literature. Stimulatory effects on life-history traits such as growth, reproduction, longevity, survival, and increased stress tolerance occur across the biological spectrum and are ubiquitous in insects. We examined the effects of low doses of imidacloprid on the beneficial insect predator, *Podisus maculiventris*, on survival and reproductive traits in insects exposed as nymphs or adults, and subsequent effects across generations. We also examined whether the same concentrations could induce hormesis on predatory behaviour and predation. Finally, we further explored how hormesis manifests in insects at the molecular level through a systematic literature review and through a more specific transcriptome analysis of *P. maculiventris*. Overall, we observed that reproduction may be stimulated in *Podisus*, without major effects on behaviour and predation, but effects vary with age, generation, sex, and bioassay design. Molecular responses associated with hormesis were largely dominated by expression of genes associated with chaperones, antioxidants, and detoxification. We also observed that while patterns in the molecular responses associated with hormesis are robust, coordination of molecular responses is influenced by such things as stressor, life stage, time and generation, and sex of the individual. I further provide discussion on the implications of hormesis for agricultural pest management and chemical risk assessment.

Speaker: **Roe, Amanda**, Canadian Forest Service

Co-authors: Zach MacDonald, Kyle Snape & Felix Sperling

Title: **Host plant and environmental structuring of forest tent caterpillar genomic variation**

Abstract: Forest tent caterpillar (*Malacosoma disstria*) is a common pest of deciduous trees throughout Canada. This species experiences cyclical irruptive population outbreaks every 10-12 years, causing significant defoliation and economic impact to hardwood forests. *Malacosoma disstria* shows substantial life history variation throughout its range, where it appears to show regional differences in host plant performance and temperature tolerance. Through adaptive and neutral selection, biotic and abiotic conditions can fundamentally structure the genomic diversity within a widespread species such as *M. disstria*. To evaluate the effects of host plant association, environmental conditions, and geographic isolation on genomic variation, we sampled genome-wide single nucleotide polymorphisms (SNPs) in caterpillars reared from four common host plants (sugar maple, *Acer saccharum*; trembling aspen, *Populus tremuloides*; red oak, *Quercus rubra*; white birch, *Betula papyrifera*) in Ontario and Quebec. Using reciprocal causal models and distance-based redundancy analyses we show that genomic variation within *M. disstria* is best explained by a combination of host plant association, temperature and Euclidean distance. This pattern of genomic structruing corroborates evidence of variable performance among *M. disstria* colonies from distinct natal hosts. Our results hint at processes of ecologically mediated selection driving genomic divergence among *M. disstria* populations and raises doubts in the assumptions of ecological and evolutionary uniformity within irruptive and widespread forest pests.

Speaker: **Romero, Berenice**, University of Saskatchewan

Co-authors: Chrystel Olivier, Tyler Wist & Sean M. Prager

Title: **One or too many choices? Oviposition, development, and settling of Aster leafhoppers on a variety of plant hosts**

Abstract: Aster Yellows (AY) Disease is caused by a group of obligate microorganisms known as phytoplasmas. Transmission of these organisms to new healthy plant hosts is mediated by leafhopper feeding, with Aster leafhoppers (*Macrosteles quadrilineatus* Forbes) as the primary vector in the Canadian Prairies. This species is migratory and is introduced by wind currents in spring and early summer. AY disease dynamics, in particular in relation to the vector's ecology (preferred plant species, development on multiple hosts, effect of phytoplasma infection) are understudied. This limits the recommendations for managing and controlling this disease, since all management is via vector control. We examined a variety of crop and non-crop plant species commonly found in the Canadian Prairies to understand the effects of the plant host on leafhoppers' development and host-choice selection. We additionally evaluated whether these factors are affected by phytoplasma infection. No-choice bioassays were conducted to examine leafhopper oviposition behavior and nymph development. To better characterize settling and probing behaviors when two food options are available, two-choice bioassays were performed.

Speaker: **Romero, Nora,** York University

Co-author: Laurence Packer

Title: ***Liphanthus* (Hymenoptera: Andrenidae: Panurginae): a South American bee genus with numerous undescribed species**

Abstract: *Liphanthus* Reed is a relatively poorly known genus of small bees with a mostly Chilean distribution. Until 2014 the group contained 27 species in 7 subgenera, and 5 species not assigned to a subgenus. Recently, by means of DNA barcoding and morphological scrutiny of new collecting and earlier collected material, 49 new species have been discovered. To date, 15 of the new species have been described but mostly lack subgeneric status. A preliminary phylogeny of *Liphanthus* based on morphology of exemplars from all subgenera and unassigned species groups will be presented.

Speaker: **Rondeau, Sabrina**, University of Guelph

Co-author: Nigel E. Raine

Title: **Sublethal effects of single and combined realistic exposure to pesticides used on squash crops on a ground-nesting solitary squash bee (*Eucera pruinosa*)**

Abstract: Mounting evidence supporting the negative impacts of neonicotinoids on bees has led to the registration of novel 'bee-friendly' insecticides for agricultural use. Flupyradifurone (FPF) is a butenolide insecticide that shares the same mode of action as neonicotinoids. FPF has been assessed to be practically non-toxic to adult honeybees using current risk assessment procedures. However, these risk assessments do not consider the many different routes of exposure specific to wild bees. For instance, solitary ground-nesting bees could be exposed to FPF residues in soil when nesting on farmlands. Combined exposure with other pesticides may also lead to detrimental synergistic effects. We used the hoary squash bee (*Eucera pruinosa*) as a model species to assess the possible effects of realistic exposure to FPF (Sivanto Prime, soil application) and the fungicide Quadris Top (azoxystrobin + difenoconazole, foliar spray application), alone or in combination, on the survival, foraging and motor activity, and reproductive output of ground-nesting bees. Squash bees exposed to squash plants sprayed with Quadris Top collected less pollen per single flower visit while those exposed to both pesticides in combination, but not individually, showed increased motor activity. The potential ecological implications of these effects will be discussed.

Speaker: **Roscoe, Lucas E**., Natural Resources Canada, Canadian Forest Service

Co-authors: Jeff Fidgen & Michael Stastny

Title: **Investigations into biological control for the hemock wooly adelgid in Eastern Canada**

Abstract: The hemlock woolly adelgid (*Adelges tsugae*, HWA) is a non-native invasive species in the northeastern United States. Since its introduction into the region in the mid-20th century, HWA has caused significant damage to hemlock forests in several states. In 2017 HWA was detected in southern Nova Scotia. Given the ecological importance of hemlock in this region, HWA threatens to cause tremendous damage to forests here and beyond. Several management strategies have been investigated, including classical biological control. Over the past 30 years, great strides in the development of this method for use against HWA have taken place in the United States. As one of several components of a large-scale management program, the Canadian Forest Service is investigating the feasibility of a classical biological control in Atlantic Canada. Here, I will present the theoretical basis, important challenges, and ongoing progress surrounding the possible implementation of a HWA biological control program for Atlantic Canada.

Speaker: **Rueppell, Olav**, University of Alberta

Co-authors: M. Spivak, J. Millar, J. Keller, P. Waiker & C. Schal

Title: **Hygiene-eliciting brood semiochemicals as a tool for assaying honey bee (Hymenoptera: Apidae) colony resistance to Varroa (Mesostigmata: Varroidae)**

Abstract: Despite numerous potential interventions, the ectoparasitic mite Varroa (*Varroa destructor* Anderson and Trueman) and the pathogens it vectors remain a primary threat to honey bee (*Apis mellifera* Linnaeus) health. Hygienic behavior, the ability to detect, uncap, and remove unhealthy brood from the colony, has been bred for selectively over two decades and continues to be a promising avenue for improved Varroa management. Although hygienic behavior is expressed more in Varroa-resistant colonies, hygiene does not always confer resistance to Varroa. Additionally, existing Varroa resistance selection methods trade efficacy for efficiency, because those achieving the highest levels of Varroa resistance can be time-consuming, and thus expensive and impractical for apicultural use. Here, we tested the hypothesis that hygienic response to a mixture of semiochemicals associated with Varroa-infested honey bee brood can serve as an improved tool for predicting colony-level Varroa resistance. In support of our hypothesis, we demonstrated that a mixture of the compounds (Z)-10-tritriacontene, (Z)-8-hentriacontene, (Z)-8-heptadecene, and (Z)-6-pentadecene triggers hygienic behavior in a two-hour assay, and that high-performing colonies (hygienic response to >60% of treated cells) have significantly lower Varroa infestations, remove significantly more introduced Varroa, and are significantly more likely to overwinter compared to low-performing colonies (hygienic response to <60% of treated cells). We discuss the relative efficacy and efficiency of this assay as a tool for facilitating apiary management decisions and selection of Varroa-resistant honey bees.

Speaker: **Runquist, Erik**, Minnesota Zoo

Title: **Butterflies across Borders: Fostering international conservation**

Abstract: Conservation requires fine scale and large scale efforts. While policies and approaches may differ regionally, the needs of imperiled species do not stop at political borders. Thus, international collaboration is required if we have any hope of achieving recovery goals. For example, the Poweshiek skipperling (*Oarisma poweshiek*) was once abundant and widespread across the prairies of central North America, but has declined rapidly in the last few decades and the only now known remaining populations in Manitoba and Michigan are in danger of extinction in the near term. Listed as Endangered in both Canada and the United States, an international partnership is being formed to support for in situ and ex situ research and conservation goals. Dr. Runquist will describe current efforts with Poweshiek skipperling, as well as for another prairie specialist - the Dakota skipper (*Hesperia dacotae*). International planning processes form the backbone of efforts for these endangered species.

Speaker: **Saguez, Julien**, Grain Research Centre

Co-author: Mathieu Neau

Title: **Insect pest monitoring using automated and connected traps**

Abstract: Every year, several insect pests infest fields and can induce damage and yield losses on crops. Insect pest monitoring is one of the most important step of integrated pest management. It helps to identify where and when outbreaks occur and is useful to determine if a control method

is required to protect the fields. It is notably the case for several moth species that migrate in Quebec. Classic monitoring is based on placing traps that are weekly checked by visiting the traps and counting the number of moths captured in the traps.

New technologies, including the artificial intelligence allowed the development of electronic traps for automated monitoring of insect populations, detecting, recognizing and counting the number of insects entering the trap.

Since 2017, we have compared classical traps and different models of automated traps, which have the potential to reduce the cost of pest monitoring by automating several operations and reducing travel. We will present the design of these traps, their advantages and disadvantages and we will report the results of field tests that were performed in crop fields in the province of Quebec.

Speakers: **Sajadi, Farwa**, York University

Co-author: Jean-Paul Paluzzi

Title: **The role of the V-type H+-ATPase in Malpighian tubule secretion in the female mosquito, *Aedes aegypti***

Abstract: Active ion transport in adult *Aedes aegypti* Malpighian tubules (MTs) is driven by the V-type H+-ATPase (VA), serving as the primary energizer for transepithelial secretion of electrolytes and water. CAPA neuropeptides are hormones derived from the nervous system that inhibit diuretic hormone-stimulated fluid secretion of MTs through a NOS/cGMP/PKG pathway; however, the downstream cellular targets remain unclear. Given the vital role of the VA in driving ion and fluid secretion, the objective of this study was to examine the activity of this pump in CAPA-mediated anti-diuresis. Bafilomycin, a VA inhibitor, inhibits fluid secretion stimulated by diuretics 5HT and DH31, whilst both CAPA and bafilomycin treatment led to alkalinization of the secreted fluid. Moreover, VA activity was increased in DH31-treated MTs, while CAPA-treatment resulted in lower VA activity. V1 complex expression was higher in membrane fractions of MTs treated with DH31 while higher levels were seen in cytosolic fractions of CAPA-treated MTs, suggesting V1 and Vo (VA holoenzyme) dissociation. Lastly, immunohistochemical techniques revealed both V1 and Vo apical localization in DH31-incubated MTs, whereas V1 immunoreactivity was observed in both the apical membrane and cytosolic region of CAPA-incubated MTs. These results indicate CAPA anti-diuretic hormone activity involves VA inhibition that hinders secretion.

Speaker: **Schell, Justin**, University of Michigan Library

Title: **Unleashing Community Science Power with Notes from Nature and MI-Bug**

Abstract: In this talk, I will discuss the development and implementation of the MI-Bug community science project, a partnership between the University of Michigan Museum of Zoology's Division of Insects collection and the University of Michigan Library's Shapiro Design Lab. As part of the Notes From Nature family of projects on the Zooniverse platform, MI-Bug asked volunteers from around the world to transcribe geographic and temporal data on pinned specimen labels, some of which date back more than a century. In going through the different stages of the project, including the design of project tasks, selecting images, engaging with volunteers on message boards, cleaning and aggregating transcription data, and integrating the data back into the collection repository, my goal is to offer a road map for how insect

collections of varying sizes could utilize the Zooniverse platform to not only increase engagement with their collections, but also make their data more accessible to researchers around the world.

Speaker: **Sherwood, Jade**, University of British Columbia

Co-authors: Michelle Franklin, Tim Haye & Juli Carillo

Title: **Invasive and Inevitable: Parasitoid phenology and host density of *Anthonomus rubi* in their native range**

Abstract: The strawberry blossom weevil (*Anthonomus rubi*), originating from Europe, has recently established in British Columbia. *A. rubi* adults cause damage by ovipositing in developing flower buds of economically important crops in the family Rosaceae (e.g. strawberries and blackberries). Currently, there are limited control options for *A. rubi* in invaded regions of Canada and limited knowledge on associated natural enemies in their invaded and native ranges. To evaluate classical biological control options for Canada and to better understand the biology of *A. rubi* and its associated parasitoids, more than 14,000 infested flower buds were collected over the course of the summer in 2021 in various regions of Switzerland and Germany. Flower buds were collected from 5 different host plant genera (*Fragaria*, *Rosa*, *Rubus*, *Geum* and *Potentilla*) and emerging parasitoids and weevils were counted and identified to further understand the parasitoid species composition and parasitism rates in native host plants in comparison with organic and conventional grown crops. The relationship between the size of host plant buds and emerging weevils and parasitoids is to be further investigated.

Speaker: **Singleton, Kendal**, Simon Fraser University

Co-authors: Regine Gries, Julien Saguez, Emily Lemke, Wim van Herk & Gerhard Gries

Title: **Identification of sex pheromones of two Nearctic *Agriotes* species (Coleoptera: Elateridae)**

Abstract: Click beetles are a diverse family that contains several important agricultural pests, some of which have remerged in high numbers in recent decades. For some species in the Palearctic *Agriotes* pest complex, sex pheromones have been identified but hardly any sex pheromones are known for Neartic species, and sex pheromones of native *Agriotes* species have not yet been studied. The spread of invasive European *Agriotes* species in Canada threatens to displace native *Agriotes* pest species. If pheromone lures were available for both native and invasive *Agriotes* species in Canada, we could study the composition of elaterid pest species in crops, monitor pest spread and species composition over time, and inform mass trapping and pesticide application decisions. Here, we report the identification of sex pheromones of *A. mancus* and *A. ferrugineipennis*. Headspace odorants from female *A. mancus* and *A. ferrugineipennis* were collected on Porapak Q and aliquots of Porapak extract were analyzed by gas chromatographic-electroantennographic detection (GC-EAD) and GC-mass spectrometry. In field experiments (2020 and 2021), Vernon Pitfall Traps baited with synthetic pheromone, captured large numbers of male beetles. Commercial sex pheromone lures may be used in the future to monitor and/or mass trap *A. mancus* and *A. ferrugineipennis* populations.

Speaker: **Sjolie, Dylan**, University of Saskatchewan

Co-authors: Meghan Vankosky & Christian Willenborg

Title: **The effect of early season temperature on adult life history traits of the wheat stem sawfly *Cephus cinctus* (Hymenoptera: Cephidae) and *Bracon cephi* (Hymenoptera: Braconidae)**

Abstract: Wheat stem sawfly, *Cephus cinctus* Norton (Hymenoptera: Cephidae), is a long-standing pest of wheat *Triticum aevstivum* L. (Poaceae) in the northern Great Plains region of North America. Larval feeding damage within the wheat stems causes decreased head kernel weights, reduced photosynthetic capacity, and overall yield losses. Serious *C. cinctus* infestations can cause economic losses exceeding over $400 million annually. Recently, a bioclimatic model for *C. cinctus* was developed for the Canadian Prairie region, but the model lacks forecasting capabilities due to missing knowledge gaps of how early season weather patterns affect *C. cinctus* population dynamics. The purpose of the study was to measure the effects of different post-diapause development conditions on life history traits of adult *C. cinctus* and *Bracon cephi* (Hymenoptera: Braconidae), a native parasitoid of *C. cinctus*. Field-collected individuals were reared under three different temperature regimes to generate three distinct emergence groups for adult longevity, lipid content, and egg volume comparisons. With a better understanding of how early season weather can affect *C. cinctus* population dynamics, a forecasting model for *C. cinctus* can be developed.

Speaker: **Smith, Sand**, University of Toronto

Title: **Biological control of invasive plants in the restoration of forest ecosystems**

Abstract: Japanese knotweed, garlic mustard, dog-strangling vine, and Phragmites are invasive plants currently affecting forest ecosystems in Ontario. Management of these species using conventional methods such as herbicides or cultural control is difficult and costly; biological control using insects provides an additional option in the management toolbox. Specific biological control agents for each weed have recently been approved for release and are currently under study to get them widely established across the Ontario landscape.

Establishing biological control agents and demonstrating broadscale impacts can be a slow process, as biocontrol is often the tactic of last resort, when weed populations have escaped all management. In this presentation, we discuss the unique opportunity that areas such as the Toronto ravines present for future biological control programs. These systems provide accessibility and sheltered locations that makes them ideal nurse sites for newly approved biological control agents, where agent releases could be conducted easily, and their impacts monitored with a frequency and rigour absent from many programs. They also provide an opportunity to bring in greater citizen engagement and knowledge on using biological control agents to manage the growing challenge of invasive plants. Here, we provide an update on the biological control programs for Japanese knotweed, garlic mustard, dog-strangling vine, and Phragmites, and make the case that intensive biological control releases and monitoring in southern Ontario can accelerate the progress of weed biocontrol programs while also contributing to the health and restoration of impacted urban forest ecosystems."

Speaker: **Sola Cassi, Mireia**, Université du Québec à Montréal & Centre de recherche agroalimentaire de Mirabel

Co-authors: Genevieve Labrie, Francois Dumont & Caroline Provost

Title: **Effects of intensive crop management on the diversity and abundance of species in three fruit crop productions of Quebec**

Abstract: The low economic threshold of crop pests and the need for high fruit production has led to intensive crop management by means of landscape diversity simplification and repeated pesticide use. These measures are considered a main cause of insect diversity reduction and difficult the prediction of changing patterns of insect abundances. Overall, complicating the control of crop pests. The objective here was to disentangle the influence of the landscape diversity and pesticide use on the composition and abundance of arthropods as well as yield production in three important fruit crops of Quebec: raspberry, apple orchards and vineyards. For this purpose, 27 fields, 9 of each crop type, classified in three levels of landscape diversification were sampled for arthropods presence twice a week over the 2019 summer season. Arthropod data was analyzed together with pesticides input and yield.

Results show that abundance and diversity of species differs among cultures. For apple orchards and vineyards, a positive correlation with the diversity of landscape and a negative relationship with the use of pesticides was observed. Raspberries presented the opposite tendency. Yield and arthropods abundance was inversely related. Additionally, vineyard held the highest diversity of species while raspberries presented the highest abundance and richness of species.

The sampling of specific pests and rate of predation for each fruit crop and the follow-up of the fields over 3 seasons will provide additional data to determine the impact of landscape diversity and pesticide use on the arthropods diversity and their impact on the fruit productivity.

Speaker: **Solis Sosa**, Rodrigo, eButterfly

Title: **eButterfl-AI: how machine learning improves citizen science data quality**

Abstract: eButterfly, a citizen science program dedicated to recording the presence of butterflies across North America, is turning eight years. It has been a long journey since our beginning, in which we have amassed more than 39,000 checklists, representing 380,000 observations and comprising 707 butterfly species submitted by over 8,200 participants. eButterfly is also an image repository where users can upload pictures of their sightings and have them stored.

By concentrating such a large number of records, eButterfly and its army of citizen scientists are helping researchers to understand the distribution of butterflies at a landscape level and their interactions with their ecosystem. Moreover, by having a checklist system, recording the presence and the absence of a species on a particular location is invaluable for researchers, which can be a powerful tool, particularly in light of climate change.

For the last eight years, eButterfly has focused on gathering information across the US and Canada, and now that we have the expertise, human resources, and trust from our users, we are expanding our reach to all Central and South America. This is an exhilarating moment in which we will start to see records of hundreds of different tropical butterflies.

After a growing period, eButterfly is ready for the next step. We have created an international and transdisciplinary team of experts that have helped us to create an image recognition algorithm (Artificial Intelligence) that will help our users to get the species of each photo they submit. We will discuss the innovative ways we are using this exciting technology to work and how we aim to use this technology to teach our users how to identify butterflies on the field and learn from the way the AI works.

Speaker: **Storozuk, Shayla**, University of Manitoba

Co-author: Alejandro C. Costamagna

Title: **Potential of Carabidae and Lycosidae predators to consume flea beetles and reduce canola damage**

Abstract: The crucifer flea beetle, *Phyllotreta cruciferae* (Goeze) (Coleoptera: Chrysomelidae), and the striped flea beetle, *Phyllotreta striolata* (Fabricius) (Coleoptera: Chrysomelidae), are invasive pests to canola crops, *Brassica napus*, (L.) (Brassicaceae) in North America. Generalist predators may be an important factor in flea beetle mortality, but their impact on flea beetles was seldom studied. Determining potential ground predators that consume flea beetles and decrease their damage is a critical step to further our understanding in natural control methods in canola fields. We tested the effectiveness of multiple species of ground beetles (Coleoptera: Carabidae) and wolf spiders (Araneae: Lycosidae) as predators to flea beetles in a laboratory study using Petri dishes. The proportion of live flea beetles was measured, and the cotyledons were photographed to assess flea beetle damage. We found that three genera of Carabidae and two genera of Lycosidae consume flea beetles and reduced canola damage. We then tested the effectiveness of *Pterostichus melanarius*, *Harpalus amputatus* (Carabidae) and *Pardosa* spp. (Lycosidae) in a more realistic laboratory study using microcosms. Each microcosm contained either three or six canola plants in the cotyledon stage with six flea beetles and one predator. A total of 12 trials took place over 12 weeks that consisted of 150 predators and 40 predator-free controls that were kept at 16 h light at 22℃ and 8 h dark at 18℃ for 48 hours. The proportion of live flea beetles was measured, the cotyledon defoliation was visually assessed, and stem damage was measured to estimate the consumed area. We found that all three predator genera tested consumed flea beetles and the stems and cotyledons in the microcosms with two of the predator genera showed lower damage than controls.

Speaker: **Suresh, Thanusha**, Acadia University

Co-author: Kirk N. Hillier

Title: **Pheromone and host plant odor detection in spruce budworm, *Choristoneura fumiferana***

Abstract: *Choristoneura fumiferana* is an ecologically significant defoliator of spruce and balsam fir in North America, with populations reaching outbreak densities in both Quebec and New Brunswick over the past several years. To better develop strategies for managing this pest, improved understanding of physiological responses to pheromones and other host-related stimuli will be an asset. In view of the limited studies of single sensillum recording of spruce budworm antennal structures, the objective of my study is to examine antennal sensilla for olfactory receptor neuron responses to a range of odorants such as sex pheromones and host plant volatiles in both sexes of budworm using single sensillum extracellular recording (SSR). Previously identified cues, including host compounds and pheromone components will be used to stimulate olfactory receptor neuron responses to compare male and female sensitivity to key odorants. Together, these data will improve our knowledge of mechanisms by which adult budworms respond to pheromone and host plant volatiles and will provide insights that may be complementary to existing IPM strategies based on the chemical ecology of spruce budworm.

Speaker: **Sweeney, Jon**, Canadian Forest Service

Co-authors: N, Kirichenko, R. Johns & M. Stastny

Title: **Feasibility of biological control of the beech leaf-mining weevil, *Orchestes fagi*, in Canada**

Abstract: The beech leaf-mining weevil, *Orchestes fagi*, is a common pest of European beech in Europe that has established in Nova Scotia and become a serious pest of American beech. Little to no evidence to date of mortality from native parasitoids in Nova Scotia suggested we should explore the feasibility of classical biological control. We studied the parasitoid complex of *O. fagi* in Western Europe in 2018 and 2019, focusing mostly on larval/pupal parasitoids attacking *O. fagi* in its mine in spring, and included collections of potential alternate hosts. *Orchestes fagi* was attacked by a rich parasitoid complex comprising many generalist parasitoids of leafminers and fewer potential specialists on *Orchestes* spp. The braconid, *Triaspis pallipes*, and the pteromalid, *Trichomalus inscitus*, were considered the most promising because they have a narrow host range and the potential for high parasitism rates, but they emerge for a second generation and require an alternate host to complete their life cycle. We also found an unidentified mymarid parasitoid attacking *O. fagi* eggs and reared a braconid parasitoid, *Microctonus* sp. from adult beetles. The adult parasitoid might be a suitable biological control agent because it does not need an alternate host to complete its life cycle. Further studies are needed to determine the impact of native parasitoids on the beech leaf-mining weevil in Nova Scotia and the potential of the *Microtonus* sp. as a classical biological control agent.

Speaker: **Terzin, Tomislav**, University of Alberta

Title: **Pachyrhynchini weevils as mimics of Salticidae and Gnaphosidae spiders**

Abstract: This is the first record of a Coleopteran species mimicking identified spider model, and reported are also three probable similar cases without exact model being identified. One *Metapocyrtus* species from Negros Island, the Philippines, mimics the Salticidae spider model. Included in the mimicry are patterns of metallic scales and false spinnerets, a term proposed here, which represents a novel morphological structure positioned on the posterior, dorsal end of the elytra of the beetle. Another, smaller species of *Metapocyrtus*, from the same island, also possesses false spinnerets of slightly different morphology, but most likely represents a more general spider mimic, due to its small size and plane dark coloration. The third Pachyrhynchini species, from the same island, *Eumacrocyrtus canlaonensis* Schultze 1924, is much bigger and has an overall morphology which resembles Gnaphosidae spiders. I propose that this new form of Batesian predator mimicry, in which Coleopterans mimic spiders, be named Schultzean mimicry in honour of the author who first noted such a possibility nearly one hundred years ago.

Speaker: **Thomson, Don**, Pacific Biocontrol

Title: **Codling Moth Mating Disruption: Still Crazy After All These Years**

Abstract: The sex pheromone of codling moth *Cydia pomonella* was identified in 1971. Research by scientists affiliated with public institutions laid the foundation for the commercialization of codling moth mating disruption (CMMD) technologies starting 30 years ago. Initially, adoption was slow with many hurdles to overcome but CMMD is now an integral part of pest management programs for pome fruit worldwide. Dispenser technology has improved in the last 30 years to ensure season long release of pheromone. Despite dispenser improvements, CMMD is still not a stand-alone technology and requires careful monitoring and supplemental controls to ensure that growers get acceptable control. Due to extensive research, we now better understand

the mechanisms of CMMD. The physiological and subsequent behavioural responses to pheromone are different than for other insects such as oriental fruit moth *Grapholita molesta* where mating disruption is a largely stand-alone technology. Pest management systems and technologies have changed dramatically over the last 25 years. High density plantings creating more open and exposed environments are common. Contact insecticides have been replaced by technologies that need to be ingested requiring careful attention to timing and coverage. The success of CMMD requires an understanding of orchard environments and codling moth's physiological and behavioural responses to its pheromone and the strategies needed to best position CMMD in pest management systems.

Speaker: **Thorat, Leena**, York University

Co-authors: Shruti Patel, Sakshi Karwasra & Jean-Paul Paluzzi

Title: **Role of a heterodimeric glycoprotein hormone receptor on *Drosophila* excretory system in response to desiccation stress**

Abstract: Classic heterodimeric glycoprotein hormones in animals consist of a common alpha- (GPA1) and a hormone-specific beta-subunit (GPB1-4). GPA2/GPB5 is a relatively novel glycoprotein hormone that is conserved in bilaterian phyla. In insects, the leucine-rich repeats containing G protein-coupled receptor 1 (LGR1), which is the receptor for GPA2/GPB5, is crucial for insect reproduction and development. However, its involvement in the endocrine regulation and survival under stressful conditions remains untested. In this study, we demonstrate a desiccation stress-responsive role of LGR1 on the excretory system of *Drosophila melanogaster* adults. Using the UAS/Gal4 genetic approach, we achieved targeted knockdown of LGR1 and observed that LGR1 downregulation increased fly vulnerability to desiccation stress. The Malpighian tubules (MTs) and hindgut (HG) in *Drosophila* perform essential roles in excretion and ion-water balance. Ongoing research involves conducting secretion rate and efflux activity assays on MTs as a measure of their performance under physiological water deficits in LGR1-knockdown individuals. Additionally, studies examining the status of excretory and hydromineral homeostasis in the hindgut are underway. Our findings provide the first critical insights into the underexplored role of LGR1 on fly desiccation tolerance, thereby advancing our understanding of the GPA2/GPB5 hormone-receptor signalling system in insect physiology.

Speaker: **Thygesen, Rhonda**, University of British Columbia

Co-author: Leonard Foster

Title: **The Blueberries and the Bees: Assessing Honey Bee Health Stressors Using Proteomics**

Abstract: Honey bee (*Apis mellifera*) pollination is essential for British Columbia’s (B.C.) top fruit export, highbush blueberry (HBB, *Vaccinium* sect. Cyanococcus), to ensure high fruit sets. Recently, B.C. beekeepers have noticed a decrease in health and strength of their colonies after HBB pollination, leading some to avoid contracts and causing financial strain on HBB growers; however, the risk factors affecting honey bee health in HBB pollination are not yet well defined. Pesticides, pathogens, pests and parasites are all possible effectors of decreased bee health in HBB. The proteome is central to health, and its composition is likely to vary with health status. Proteomics allows for the comparative study of an organism’s proteome in healthy versus diseased state so diagnosis and treatment is feasible. Additionally, proteomic research does not require a large sample size from a living hive to obtain quantitative data. This study combines

field and lab work to deduce what the major determinants of bee health in HBB are by observing protein signature change in bees. Two field seasons (2020 and 2021) were used to correlate differences in the proteome of nurse bees before, during, and after HBB pollination, as well as outside of HBB areas as a control. Pesticides and pathogens were also included as variables. Cage trials of individual xenobiotic or pathogen stressors were subsequently performed to validate proteomic changes in order to define the main causes of stress in HBB pollination.

Speaker: **Tousignant, Louka**, University of Moncton

Co-authors: Billie Chiasson & Gaetan Moreau

Title: **Effects of landscape-scale conservation on forest beetle assemblages in late successional stages of a secondary forest.**

Abstract: Forests in the late stages of ecological succession are becoming increasingly rare as a result of intensified forest management. Furthermore, when embedded into a managed landscape, the processes structuring the animal communities of these forests are likely to be threatened, even if at first glance the habitat appears to be healthy. To assess this, we documented late-successional forest beetle metacommunities in managed and conservation landscapes in New Brunswick using flight intercept traps. Results showed that beetle metacommunities changed due to landscape-scale forest management and local deadwood resources. Although species richness was maintained in managed landscapes, beetle abundance was much lower, which may reduce the ecosystem services provided by these insects. This suggests that a significant forest buffer is needed to maintain processes in old forest remnants.

Speaker: **Van Hezewijk, Brian,** Canadian Forest Service

Title: **The role of native generalist predators in controlling populations of forest pests**

Abstract: Generalist predators, with their catholic diets and propensity for prey-switching, have earned a bad reputation when used as classical biocontrol agents, but I will argue that these same qualities allow native predators to play an important role in the suppression of introduced species and the regulation of native pests. Through a series of observational studies and manipulative experiments, we found that native generalist predators significantly reduce populations of both introduced and native forest defoliators. Predation rates can be density-dependent, contributing to the regulation of populations at low densities. We also found important seasonal, landscape, and scaling effects associated with the mortality from a community of predators, and using a combination of sentinel prey and direct observations we identified the key predatory species in the community. By incorporating this information into native pest population models as well as invasion models and risk assessments, we can better manage and conserve these important and beneficial species.

Speaker: **Vankosky, Meghan**, Agriculture and Agri-Food Canada

Co-authors: Jennifer Otani, Ross Weiss, Shelley Barkley, John Gavloski, James Tansey & Carter Peru

Title: **The role of the Prairie Pest Monitoring Network in biovigilance: Annual monitoring and model development for invasive insects**

Abstract: Biovigilance is a pest management framework that is meant to operate on a continuum, that includes awareness, detection, assessment, understanding, mitigation, and appropriateness.

Awareness and detection steps identify threats to plant health. Assessment and understanding contribute to the development of targeted mitigation strategies for pest management. After mitigation strategies are applied, their appropriateness can be evaluated, both in terms of direct effects on the pest, and indirect effects on other organisms in the agroecosystem. Evaluating appropriateness of mitigation contributes to awareness, and thus the continuum persists. The Prairie Pest Monitoring Network has been conducting annual surveys and monitoring for insect pests in prairie field crops for over 20 years and possesses datasets from the early 1900s. Survey data is used to develop distribution and forecast maps and phenology models for insect pests (and their natural enemies). This wealth of data also permits analyses of changing population abundance and distribution trends following the implementation of mitigation strategies and can be used to evaluate the effects of climate change on pests including grasshoppers and the pea leaf weevil. The Prairie Pest Monitoring Network also contributes to awareness of beneficial insects and early detection of invasive insects; members of the Network have contributed to the development of models to predict incursions of invasive species. As such, the activities of the Prairie Pest Monitoring Network contribute to nearly all of the steps in the biovigilance continuum and to plant protection in western Canada.

Speaker: **White, A**ija, University of Northern British Columbia

Co-author: Dezene Huber

Title: **Where's the baseline? Using DNA barcoding to inventory native pollinators in agroecosystems in Central British Columbia, Canada**

Abstract: Maintaining pollinator biodiversity is important to ensuring resilience in pollination services, which are critical for food production. Many agricultural producers rely on native fauna to pollinate crops, but in understudied regions a lack of sufficient information may impede planning and initiatives to better manage pollinator biodiversity. In one such region, the Central Interior of British Columbia, we used vane and pan traps to sample pollinators at 18 agricultural sites. The sites represented a variety of production systems, and were scattered along a ~ 600 km east-west transect. Sampling occurred at three-week intervals between May and August, 2021. Unique morphotypes of all potential pollinators are currently being identified using DNA barcoding (CO1 gene), with the aim of producing a comprehensive taxonomic inventory for the region. The results will allow investigation of community composition and geographical and temporal variation. To our knowledge, this study represents the first substantial and recent inventory of agricultural-associated native pollinator diversity from this region, and will function as a baseline for future monitoring and land management planning in the context of regional industrial and agricultural development and climate change.

Speaker: **Wiens, Daniel**, University of Saskatchewan

Co-authors: Timothy J. Tse & Martin J.T. Reaney

Title: **Using black soldier fly larvae to reclaim and concentrate nutrients from Fusarium head blight infected wheat**

Abstract: Wheat and other grain crops frequently become infected with Fusarium, which can produce a variety of fungal toxins. One of the main toxins produced is deoxynivalenol (DON), also known as vomitoxin. In Canada, strict guidelines are imposed for DON-contaminated wheat intended for consumption by humans (≤ 2 ppm) and livestock (≤ 5 ppm). Above these regulatory

thresholds, wheat is typically buried, burned, or diluted. In this study, we identified a novel method to utilize DON-contaminated wheat (35 ppm) in ethanol production and to convert the toxin loaded co-products into a usable feed using larval *Hermetia illucens*, also known as black soldier fly larvae. Contaminated wheat was initially subjected to alcoholic fermentation using industrial yeast (*Saccharomyces cerevisiae*). The ethanol was then evaporated under vacuum and the subsequent fermented wheat products (whole stillage, thin stillage, and distillers' wet grains) were then fed to larvae over 9 days. After consuming the contaminated feed products, the larvae contained minimal amounts of DON (≤ 0.3 ppm). The remaining feed/frass (i.e. the mixture the larvae were reared in) also had a 40% lower DON concentration compared to the initial feed. These observations suggest that DON-contaminated cereal grains can be reclaimed through bioethanol production and its nutrients concentrated through consumption by insect larvae. These insect larvae contain low concentrations of DON, and can therefore act as a source of high-protein animal feed.

Speaker: **Wijerathna, Asha**, University of Alberta

Co-authors: Maya Evenden & Hector Carcamo

Title: **State-dependent plasticity drives pea leaf weevil (Coleoptera: Curculionidae) host acceptance and feeding preference**

Abstract: Reproductive state can induce phenotypic plasticity in foraging and host-finding behaviour of an organism. This plasticity to host response can influence how well an organism adapts to its habitat. It can increase the fitness of invasive species and increase their probability of establishment in new environments. The pea leaf weevil (PLW), *Sitona lineatus* (Coleoptera: Curculionidae) is an invasive pest of field peas (*Pisum sativum*) and faba bean (*Vicia faba*). Adult weevils feed on foliage and larvae feed on *Rhizobium leguminosarum* bacteria associated with the root nodules. Spring and fall dispersing adults are at two different physiological stages. In spring, adults are reproductively active while, fall dispersing adults are reproductively inactive. We investigated the effects of the PLW reproductive state on host acceptance and feeding preference. We exposed adults to field pea and faba bean seedlings in a series of choice and no-choice tests and we counted the feeding notches on leaves after five days. We repeated the test with a secondary host plant, alfalfa (*Medicago sativa*). Adult weevils exhibit state-dependent plasticity in host preference. Pre-reproductive weevils prefer faba bean over field peas, while reproductively inactive weevils show no preference. This host preference is linked to larval development in which faba bean supports more PLW larvae compared to field peas. The state-dependent plasticity in host preference disappears when weevils are presented with both primary hosts and the secondary host, alfalfa. This study suggests that oligophagous insects may show phenotypic plasticity in host preference to maximize fitness benefits.

Speaker: **Willis Chan, D. Susan**, University of Guelph

Co-authors: Grace McKinney & Peter G. Kevan

Title: **Evaluating dispenser design for delivery of biocontrol agents by honey bees (*Apis mellifera*).**

Abstract: Apivectoring harnesses bees' ability to pick up small particles to deliver biocontrol agents suspended into a powdered diluent precisely to flowering crops. Using a dispenser inserted into the hive entrance, we exposed honey bees to a cornflour diluent which adhered to

their bodies when they exited the hive. We evaluated three dispenser designs for honey bee (*Apis mellifera*) hives based on effect on bee activity, the amount of biocontrol agent delivered, cost, and ease of storage. Thirteen groups of three hives were observed after dispensers were inserted into the hive entrance charged with diluent, with each hive being observed for a day. In one-minute intervals the number of bees entering and exiting the dispenser correctly or incorrectly was counted. Twenty-four hours after charging each dispenser, the amount of diluent delivered by the colony was evaluated. This was repeated until all dispenser types had been tested on each bee hive in a group. Bee activity in and out of the hive and the total diluent delivered by the bees was affected by dispenser design. The superior design was also cheaper to build and easier to use and store. This information supports advances in honey bee apivectoring for flowering field crops.

Speaker: **Wist, Tyler**, Agriculture and Agri-Food Canada

Co-author: John Gavloski

Title: **Field Heroes: the crop protectors standing firm against the invaders**

Abstract: Migratory insects invade the growing regions of Western Canada on a regular basis and they are met by a phalanx of Field Heroes, generalist and specialist insects that we call 'Beneficial Insects' for their beneficial role in protecting crops from invading crop insects. Several Field Heroes of some of the common migratory pests such as cereal and pea aphids, diamondback moth and aster leafhoppers will be highlighted.

Speaker: **Yack, Jayne**, Carleton University

Title: **What does an Insect Hear? Insights from the Non-models**

Abstract: We are all familiar with insect sounds, particularly those that function to attract mates over long distances, such as the chirps of crickets or buzzing of cicadas. Over the past 100 years acoustic communication in insects has been researched extensively, yet most research focuses on airborne sounds of reproductive adults. What many do not realize is that insects of all developmental stages generate and detect an extraordinary diversity of sounds and vibrations that are not detectable by human sensory capabilities. In my laboratory we employ specialized instruments to eavesdrop on these secret acoustic worlds of insects, and have discovered how butterflies listen for predators, how caterpillars perform rap battles, and how bark beetles use passwords to enter trees. This presentation is a shout-out to the intriguing non-model insects, who, through their diversity, provide insights into the function and evolution of insect behaviour. The complex acoustic landscapes of insects remain unchartered territories ripe for further exploration!

Speaker: **You, Taeyoon**, York University

Co-authors: Taeyoon You, Rodney Richardson, Tanushree Tiwari, Alexandra Sebastien, Leonard Foster & Amro Zayed

Title: **The genomics of protein expression in honey bees**

Abstract: The honey bee, *Apis mellifera* is a model organism for the study of social behaviour and sociogenomics. Chemical communication plays many important roles in regulating colony demography and social traits in ants, bees and wasps. Antennae and the proteins their express are

central to the ability of insects to perceive odour cues arising from the social environment. Despite their importance in understanding social behaviour at the molecular level, the genetics underlying sensory perception and chemical communication is not well understood. Here we carried out a novel study to identify the genetics underlying protein expression in the honey bee. Using proteomics, we quantified the expression level of 1890 proteins expressed in the antennae of workers from 420 colonies. These colonies were then subjected to whole-genome sequencing. We then carried out a genome-wide association study to identify expression quantitative trait loci (eQTLs); genetic mutations that are associated with the expression of specific proteins. Our study discovered hundreds of loci that regulate protein expression in bees, include several 'master regulators'.

Speaker: **Zerafa, Anthony**, McGill University

Co-authors: Hans C. E. Larsson & Christopher M. Buddle

Title: **Ecological monitoring of terrestrial arthropods on Umingmat Nunaat/Axel Heiberg Island, in high Arctic Canada**

Abstract: The Arctic is warming at a faster rate than any other place on Earth, yet the effects of this rapid climate warming on Arctic terrestrial ecosystems are not well understood as there is much about the fundamental functioning of these ecosystems that remains to be discovered. Arthropods are the most abundant animal life in the high Arctic, which makes them ideal model organisms for studying high Arctic terrestrial ecosystems. The McGill Arctic Research Station on Umingmat Nunaat/Axel Heiberg Island, high Arctic Canada, is an ideal base of operations for the establishment of a long-term arthropod monitoring project. No ecological study of terrestrial arthropods had ever been conducted on this remote uninhabited landmass, comparable in area to Nova Scotia or Switzerland. In 2018, I therefore sampled 37,958 terrestrial arthropods on Umingmat Nunaat/Axel Heiberg Island and also collected associated environmental data, establishing a baseline for proposed longer term ecological monitoring. In this presentation, I will provide the results of my Master's research on microhabitat affinities of terrestrial arthropods on Umingmat Nunaat/Axel Heiberg Island and also highlight the direction for future ecological monitoring work at the McGill Arctic Research Station. As climate change threatens to cause rapid alterations to high Arctic terrestrial ecosystems, a long-term ecological monitoring program on Umingmat Nunaat/Axel Heiberg Island can help to fill the knowledge gap of how these ecosystems are being impacted.