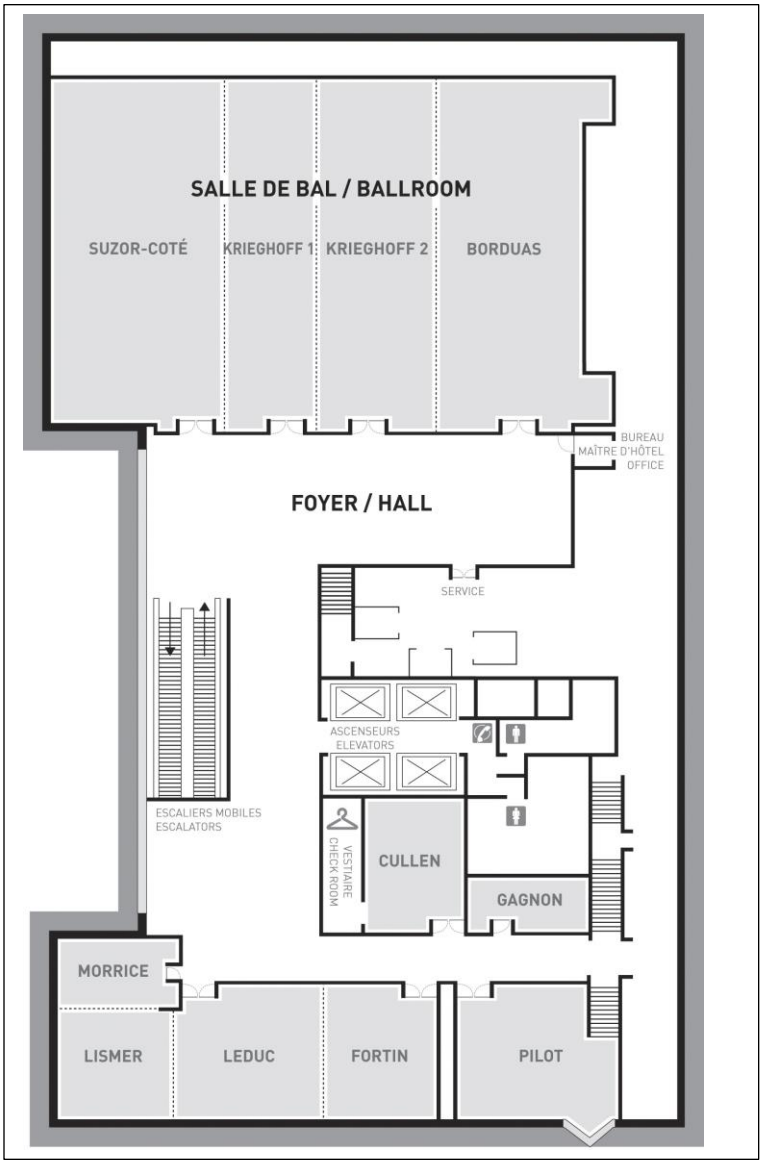
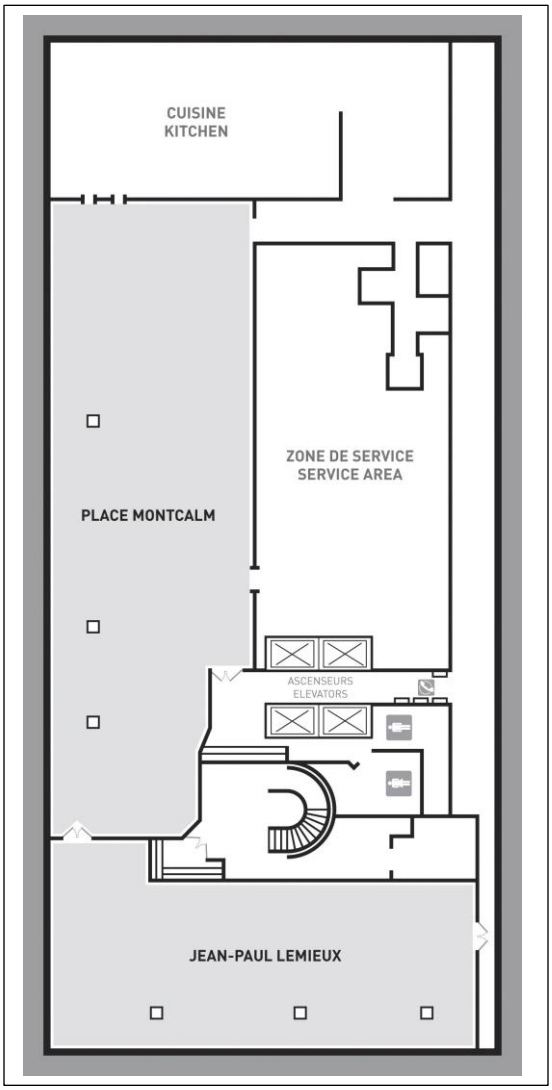
2024 Joint Annual Meeting of the Entomological Societies of Canada and Québec
Sunday, October 20 – Wednesday, October 23, 2024
Le Concorde Hotel, Québec

Réunion annuelle conjointe des Sociétés d'entomologie du Canada et du Québec
Dimanche 20 octobre – mercredi 23 octobre 2024
Hôtel Le Concorde, Québec





Map of the 3rd level of the Concorde Hotel (left); most events in the Scientific Program including poster session, will take place on this level. Room Jean-Paul Lemieux (right) is located in basement.

Plan du 3^{e} étage à l'Hôtel Le Concorde (gauche); la plupart des événements du programme scientifique, incluant la session d'affiches, se tiendront sur cet étage. La salle Jean-Paul Lemieux (droite) est située au sous-sol.

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Natural Resources Canada
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ento system

Institut de recherche en biologie végétale

Ribozome

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President/Président
Colin Favret

First Vice-president/Premier vice-président
Christine Noronha

Second Vice-president/ Deuxième vice-président
Rob Johns

Past president / Président sortant
Chris MacQuarrie

Treasurer/Trésorier
Bryan Brunet

Secretary / Secrétaire
Erin Campbell

Editors-in-Chief/Rédacteurs en chef de, *The Canadian Entomologist*
Dezene Huber, Suzanne Blatt, Amanda Roe

Bulletin* Editor/Rédacteur du *Bulletin
Bernard Roitberg

Assistant *Bulletin* Editor/Rédacteur adjoint du *Bulletin*
Sydney Worthy

Webmaster/Webmestre
Cass Chowdhury

Editor-in-Chief/Rédacteur en chef, *Canadian Journal of Arthropod Identification*
Heather Proctor

Boards of the Entomological Society of Québec - Composition du CA de la SEQ

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Maxime Lefebvre

Past President / Président sortant
Julia Mlynarek

Secretary / Secrétaire
Nicolas Chatel-Launay

General director / Directeur général
Morgan Jackson

Directeur régional (Québec)/ Local director (Québec)
Frédéric McCune

Webmester / Webmestre
Keith Wauthy

Vice-President / Vice-président
Sébastien Boquel

Treasurer / trésorier
Marc Fournier

Registrary / Registraire
Marie D'Ottavio

Student responsable / Représentante étudiante
Amélie Morin

Directeur régional (Centre-du-Québec) / Local director (Centre-du-Québec)
Didier Labarre

Responsable du Fonds-SEQ /SEQ-Found responsable
André-Philippe Drapeau-Picard

2024 ESC-SEQ Joint Annual Meeting Local Organizing Committee - Membres du comité local d'organisation du congrès conjoint SEC-SEQ

Président du comité/General Chairperson
Joseph Moisan-De Serres

Arrangements locaux et gestion des bénévoles/Local Arrangements and Volunteer Coordinator
Valérie Fournier, Frédéric McCune et/and Raymond-Marie Duchesne

Trésorerie/Treasurer
Mario Fréchette

Inscriptions/Registration
Valentine Glaus

Programme scientifique/Scientific Program
Geneviève Labrie, Julien Saguez et/and Sébastien Boquel

Conseiller SEC/ESC advisor
Colin Favret

Financement et recherche de partenaires/Fundraising and Sponsorship
Raymond-Marie Duchesne et/and Sébastien Boquel

Site web/Website
Véronique Martel

Activités étudiantes/Student Activities
Frédéric McCune, Didier Labarre et/and Amélie Morin

Communications et médias sociaux/Communications and Social Media
Étienne Normandin

Préparation du programme/Program preparation
Christine Jean, Sébastien Boquel, Valentine Glaus et/and Julien Saguez

Traduction/Translation
Frédéric McCune et/and Véronique Martel

Welcome from the Entomological Society of Canada - Mot de bienvenue de la Société d'entomologie du Canada

Dear Friends and Colleagues,

With great pride in and on behalf of our Entomological Society of Canada, welcome to the Joint Annual Meeting of the Entomological Societies of Canada and Quebec!
These short days will be JAM-packed with activity: stimulating scientific presentations, fruitful personal interactions, and hopefully a bit of fun thrown in for good measure. Time will fly by, and the JAM will be over soon, so be sure to take advantage of your time here (and get your money's worth!).
Chairman Joseph Moisan-De Serres and the other members of the local organizing committee are all volunteers: unremunerated and, let's be honest, insufficiently recognized. Please express your gratitude when you interact with them or any of the many other volunteers helping to run this remarkable event.
The JAM is frequently cited as one of the most important activities of the ESC. As you enjoy this conference, please take a moment to consider the benefits you gain by participating, which aspects work particularly well, and which may need improvement. Your feedback in an upcoming survey will be critical to how JAMs are organized in the future.
Most of the ESC's Directors are here at the JAM. We act in the interest of the Society, and that Society is you, the members. Please take this opportunity to meet us just as we look forward to getting to know you. We look forward to interacting with you and hearing your thoughts on the past and present, but especially the future of your ESC.
But first and foremost, we hope the JAM will be stimulating, fruitful and fun. Have a great conference!

Colin Favret, President
Entomological Society of Canada

Chers Ami.e.s, chers Collègues,

C'est avec une grande fierté et au nom de la Société d'entomologie du Canada que je vous souhaite la bienvenue à la réunion annuelle conjointe des Sociétés d'entomologie du Canada et du Québec !
Ces quelques jours seront remplis d'activités : des présentations scientifiques stimulantes, des interactions personnelles fructueuses et, nous l'espérons, un peu de plaisir à la mesure de vos souhaits. Le temps passera vite et la réunion sera bientôt terminée, alors assurez-vous de profiter de votre temps ici (et d'en avoir pour votre argent !).
Le président Joseph Moisan-De Serres et les autres membres du comité organisateur sont tous des bénévoles : ils ne sont pas rémunérés et, soyons honnêtes, ils sont insuffisamment reconnus. N'hésitez pas à leur exprimer votre gratitude lorsque vous les rencontrez ou lorsque vous rencontrez l'un des nombreux autres bénévoles qui contribuent à l'organisation de cet événement remarquable.
La réunion conjointe annuelle est souvent citée comme l'une des activités les plus importantes de la SEC. Alors que vous profitez de ce congrès, prenez le temps de réfléchir aux avantages que vous retirez de votre participation, aux aspects qui fonctionnent particulièrement bien et à ceux qui méritent d'être améliorés. Vos commentaires dans le cadre d'une prochaine enquête seront essentiels pour l'organisation des réunions futures.
La plupart des directeurs de la SEC sont présents à cette réunion. Nous agissons dans l'intérêt de la Société, et cette Société c'est vous, les membres. Profitez de cette occasion pour nous rencontrer, tout comme nous sommes impatients de faire votre connaissance. Nous

avons hâte d'interagir avec vous et d'entendre ce que vous pensez du passé, du présent, mais surtout de l'avenir de votre SEC.
Mais avant tout, nous espérons que la réunion vous est stimulante, fructueuse et qu'elle vous donne plaisir. Excellent congrès !

Colin Favret, Président
Société d'entomologie du Canada

Welcome from the Entomological Society of Québec - Mot de bienvenue de la Société d'entomologie du Québec

Dear members and friends,

On behalf of the Board of the Entomological Society of Quebec, it is with great pleasure that I welcome you to this joint annual meeting of the Entomological Societies of Canada and Quebec in 2024. This year, we are fortunate to gather in the beautiful capital of the province of Quebec, under the inspiring theme "The Good, the Bad, and the Ugly – A Matter of Perspective." This theme invites us to explore and reconsider our perceptions, viewpoints, and the ease with which we sometimes make hasty judgments.

I would like to express my sincere gratitude to all the organizers for their dedication and tireless efforts in preparing this event. Their work has been essential in ensuring the success of this meeting.

The involvement of our members is crucial to the vitality of our societies. Indeed, the commitment of our volunteer members is the cornerstone of our activities, making these annual meetings possible. Without them, we would not be able to benefit from these valuable exchanges, multiple meetings—both new and old—nor the fruitful collaborations that drive forward our beloved science, entomology.

I encourage you to take full advantage of the upcoming days and make the most of this collective experience. Together, we have the opportunity to learn, to inspire each other, and to continue advancing in our exploration of this fascinating science.

Welcome to all, and I look forward to meeting you. May this gathering be a source of learning and mutual enrichment for everyone.

Sincerely,
Maxime Lefebvre
Président, Société d'entomologie du Québec

Cher·ère·s membres et ami·e·s entomologistes,

Au nom du conseil d'administration de la Société d'entomologie du Québec, c'est avec un immense plaisir que je vous souhaite la bienvenue à cette rencontre conjointe des Sociétés entomologiques du Canada et du Québec de 2024. Cette année, nous avons la chance de nous retrouver dans la magnifique capitale de la province de Québec, sous la thématique inspirante « Le bon, la brute et le truand – Une question de perspective ». Cette thématique nous permet d'explorer des sujets captivants et à réfléchir à nos perceptions, à nos points de vue, et à la facilité avec laquelle nous portons parfois des jugements trop hâtifs.

Je tiens à exprimer ma sincère gratitude à tous les organisateur·trice·s pour leur dévouement et leurs efforts infatigables dans la préparation de cet événement. Leur travail a été essentiel pour garantir la réussite de cette rencontre.

L'implication des membres est primordiale pour la vitalité de nos sociétés. En effet, l'engagement des membres bénévoles constitue la pierre angulaire de nos activités, permettant à ces rencontres annuelles de se concrétiser. Sans elles, nous ne pourrions bénéficier de ces précieux échanges, de multiples rencontres, tant nouvelles qu'anciennes, ni des collaborations fructueuses qui font progresser notre science bien-aimée, l'entomologie.

Je vous encourage donc à profiter pleinement des journées à venir, à tirer le meilleur parti de cette expérience collective. Ensemble, nous avons l'occasion d'apprendre, de nous inspirer mutuellement, et de continuer l'exploration de cette science fascinante.

Bienvenue à toutes et à tous, au plaisir de vous rencontrer! Que cette rencontre soit pour chacun une source d'apprentissage et d'enrichissement mutuel.

Cordialement,
Maxime Lefebvre
Président, Société d'entomologie du Québec

Welcome from the ESC-SEQ JAM 2024 Organizing Committee - Mot de bienvenue du comité local d'organisation de la réunion annuelle conjointe SEC-SEQ 2024

The Local Organizing Committee of the Joint Annual Meeting of the Entomological Society of Canada and the Société d'entomologie du Québec 2024 extends a warm welcome to the charming city of Québec. We are deeply pleased to welcome you to the cradle of French America, and to a city whose historic portion is a UNESCO World Heritage Site. This year's meeting promises to be a rich learning experience, with 4 plenary presentations, 3 student showcases, 175 oral presentations (67 of which are part of one of the eight symposia) and 60 scientific posters. In addition, the Gold Medal Lecture will be presented by Dr. Terry Galloway and the Heritage Lecture by Dr. Charles Vincent, two renowned colleagues in the entomological world. Our plenary speakers come from a wide range of backgrounds, but they'll all be keen to show you just how much we need to broaden our perspectives on insects, and the technologies we use to study them on a daily basis. It's a busy but exciting program that awaits you, and we hope it will live up to your expectations. We hope you'll take full advantage of this opportunity to meet entomologists from across the country and help entomology flourish.

For the much-anticipated banquet evening, you'll be treated to a colorful performance by the Famille Painchaud, a little Quebec gem. We hope this show will make you appreciate our local folklore!

Joseph Moisan-De Serres
And members of the committee

Le Comité d'organisation local de la réunion annuelle conjointe de la Société d'entomologie du Canada et de la Société d'entomologie du Québec 2024 vous souhaite la plus sincère des bienvenues dans la charmante ville de Québec. Nous sommes profondément heureux de vous recevoir dans le berceau de l'Amérique française et dans une ville dont la portion historique est classée au patrimoine mondial de l'UNESCO. La rencontre de cette année promet d'être riche en apprentissage avec 4 présentations plénières, 3 vitrines étudiantes, 175 présentations orales dont 67 font partie d'un des huit symposiums organisés ainsi que 60 affiches scientifiques. De plus, l'allocution de la Médaille d'Or sera présentée par le Dr Terry Galloway et l'allocution du Patrimoine par le Dr Charles Vincent, deux collègues de renom dans le monde entomologique. Nos présentateurs de plénières proviennent d'horizons bien différents, mais ils sauront tous vous faire voir à quel point les perspectives que nous avons des insectes, ou encore des technologies que nous utilisons pour leur étude au quotidien, doivent être élargies. C'est un programme bien chargé mais palpitant qui vous attends et nous espérons qu'il saura être à la hauteur de vos attentes. Nous vous souhaitons de saisir pleinement ce moment pour rencontrer les entomologistes de partout au pays afin de faire bourgeonner et rayonner l'entomologie.

Pour la très attendue soirée du banquet, vous aurez droit à une prestation haute en couleur qui sera offerte par la Famille Painchaud, un petit bijou québécois. Nous espérons, que ce spectacle vous fera apprécier notre folklore local!

Nous vous laissons sur cet espoir que notre congrès vous permettra de visiter les nombreux

coins et recoins et de la science de l'entomologie ainsi que ceux de notre magnifique ville.

Joseph Moisan-De Serres
Et les membres du comité

2024 ESC-SEQ Joint Annual Meeting Theme and Logo - Thème et logo de la réunion annuelle conjointe ESC-SEQ 2024

The good, the bad and the ugly: a question of perspective. Why did we choose this unusual theme? Many studies focus on insects that attack our agriculture or forests, that are vectors of disease, that pollinate our crops or wild plants, or that are invasive alien species. Many of these "roles" could be judged, from a human perspective, as either good or bad. However, it's important to remember that species that appear harmful to us are almost always also beneficial to other living beings that make up the ecosystems in which we live. Some species of mosquito, for example, can be a nuisance or transmit disease to humans, but they are also vital to the survival of many of the birds and fish we enjoy. Conversely, insects generally seen as beneficial, such as the honey bee (Apis mellifera), can have negative impacts on the native pollinators we are trying to protect. Let's not forget that sometimes it's humans who are the villains. Our new technologies, especially artificial intelligence tools, seem to have almost infinite powers, but they also have the power to cause non-negligible impacts on the nature we all cherish. We used artificial intelligence tools to produce our logo, and their help was much appreciated... but at what cost? The aim of this conference is to highlight the impact of insects on humans, but also the impact of humans on these organisms, which will once again be in the spotlight. As in the well-known Western of the same name, The Good, the Bad and the Ugly, it's all a question of perspective...

Le bon, la brute et le truand : une question de perspective. Pourquoi avons-nous choisi cette thématique un peu hors du commun? Beaucoup d'études portent sur les insectes qui s'attaquent à notre agriculture ou à nos forêts, qui sont vecteurs de maladies, qui pollinisent nos cultures ou nos plantes sauvages ou encore qui sont des espèces exotiques envahissantes. Plusieurs de ces « rôles » pourraient être jugés, du point de vue de l'être humain, comme étant bons ou mauvais. Cependant, il est important de se rappeler que les espèces qui nous apparaissent nuisibles sont presque toujours aussi bénéfiques pour d'autres êtres vivants qui composent les écosystèmes dans lesquels nous vivons. Certaines espèces de moustiques, par exemple, peuvent être dérangeantes ou transmettre des maladies aux humains, mais elles sont aussi d'une importance capitale pour la survie de nombreux oiseaux et poissons que nous apprécions. À l'inverse, des insectes généralement vus comme bénéfiques, comme l'abeille domestique (*Apis mellifera*), peuvent avoir des impacts négatifs sur les pollinisateurs indigènes que nous tentons de protéger. N'oublions pas que c'est parfois l'humain qui est le truand. Nos nouvelles technologies, notamment les outils d'intelligence artificielle, semblent avoir des pouvoirs quasiment infinis, mais ils ont aussi le pouvoir de causer des impacts non-négligeables à la nature que nous chérissons tous et toutes. Ce sont notamment des outils d'intelligence artificielle qui nous ont permis de produire notre logo et leur aide fût très apprécié... mais à quel coût? Ce congrès visera donc à mettre en lumière l'impact des insectes sur les humains, mais aussi l'impact des humains sur ces organismes, qui seront à l'honneur une fois de plus dans cette rencontre. Comme dans le Western bien connu du même nom, le Bon, la Brute et le Truand, tout est une question de perspective…

ENTOMOLOGICAL SOCIETY OF CANADA MEETING CODE OF CONDUCT

[Date code adopted: 21 April 2020]

This Code of Conduct applies to all meetings and events of the Entomological Society of Canada (ESC). By attending any ESC meeting or event you agree to abide by this Code of Conduct. This Code applies to all participants including, but not limited to: attendees, speakers, guests, staff, service providers, vendors and sponsors.

Authorship

All authors listed on a presentation or abstract must agree with all information that is contained in the presentation. Failure to agree will result in the presentation being withdrawn. Submission of a presentation to an ESC Joint Annual Meeting (JAM) indicates the intent of one of the listed authors to attend the meeting. Repeated or consecutive last-minute cancellations may result in the denial of future submissions.

Photography

The ESC requests that there be no photography or videography of presentations or posters without the explicit permission of the presenter.

Expected behaviour

- Treat all other participants with kindness, respect and consideration.
- Communicate openly and with respect for others, and in the language of your choice.
- Personal attacks are not acceptable. Critique ideas, not people.
- Alert the meeting organizers or staff if you notice a dangerous situation or someone in distress.
- Respect the rules and policies of the venue.

Unacceptable behaviour

Violent or discriminatory behaviour or harassment in any form will not be tolerated. Harassment means engaging in a course of vexatious comment or conduct against another person that is known or ought reasonably to be known to be unwelcome. Note that it is possible for a single incident, if sufficiently serious, to constitute harassment.

Harassment includes, but is not limited to: offensive gestures or comments (verbal or written) related to a person's race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, sexual orientation, gender identity, gender expression, age, marital status, family status, or disability; deliberate intimidation; unwanted photography or recording; sustained disruption of presentations and events; or any form of unwelcome attention, including physical contact. Participants asked to stop harassing behaviour are expected to comply immediately.

Other examples of unacceptable behaviour include:

- Physical or verbal abuse of any participant.
- Use of sexual or discriminatory images in public space or in presentations.
- Bullying behaviour,

- Retaliation for reporting of unacceptable behaviour.

Immediate serious threat to personal or public safety
Anyone experiencing or witnessing behaviour that is an immediate threat to personal or public safety should contact local law enforcement (by calling 911) and immediately notify venue security.

Reporting Unacceptable Behaviour
If you are the subject of unacceptable behaviour or have witnessed such behaviour, please immediately notify a Code of Conduct Advocate. Code of Conduct Advocates will be wearing identification so as to assist you in identifying them.

Notification may be done on-site or by emailing your concern to seq.esc2024@gmail.com or phoning 581-980-8154.

Reporting should never be done via social media to protect the confidentiality and fairness of the reporting process, and to ensure that reports are received in a timely manner.

Regardless of whether a notification is made, you are encouraged to document the unacceptable behaviour in writing as soon as possible in the event that further investigation is required.

ESC Investigation and Response to Complaints
Investigations into alleged unacceptable behaviour pursuant to this Code of Conduct shall be the responsibility of a person or committee appointed by the ESC Board of Directors.

The person assigned to conduct the investigation may be internal or external to the organization. The investigator will interview and collect documents from the person who allegedly experienced the violence or harassment, the alleged harasser(s), and any other relevant witnesses.

Information that is provided about an incident or complaint will not be disclosed, except as necessary to investigate the complaint / incident, to take corrective action, or as otherwise required by law. While the investigation is ongoing, the person who has allegedly experienced harassment, the alleged harasser(s), and any witnesses should not discuss the incident or complaint or the investigation with each other or with other ESC members unless necessary to obtain advice about their rights.

Depending on the severity of the alleged incident(s), ESC may impose interim measures to ensure the health and safety of its members, staff and volunteers, including but not limited to suspension from employment with pay or suspension from board/committee duties, pending completion of an investigation.

At the conclusion of the investigation, ESC's Board of Directors will reach a decision as to whether there was violence or harassment and will report its findings, including any corrective action that will be taken, to the person who allegedly experienced the violence or harassment and to the alleged harasser.

In addition to any interim measures taken, violators of this Code of Conduct will receive a written summary of actions taken in response to an investigation or incident report. The ESC Board of Directors shall be responsible for implementing all responses and sanctions that may result from an investigation

of a complaint. ESC shall maintain all records relating to the investigation for at least one year from its conclusion.

Consequences

The ESC reserves the right to remove an individual from any meeting without warning or refund, prohibit attendance at future meetings and suspend or rescind membership in the ESC for failing to abide by this Code of Conduct.

ESC-ESQ JAM 2024 Advocates

Sébastien Boquel
Valentine Glaus
Chris MacQuarrie
Catherine Scott
Meghan Vankosky

GENERAL INFORMATION

Registration Desk
The registration desk will be located in the Hall area on the third floor of the conference hotel, Le Concorde, from 9:30 to 18:00 on Sunday (October 20), and from 7:30 to 18:00 on Monday (October 21), and Tuesday (October 22).

Oral Presentations
Presentations in the Contributed Talks sessions as President's Prize and Melville-DuPorte prize Oral sessions will be limited to 12 minutes plus 3 minutes for questions. Moderators will be asked to strictly adhere to the 15 minute time limit for each speaker as there will be concurrent sessions. Presenters will need to download their presentations (preferred in PPTX format) to a conference laptop in the Cullen Room in advance of their presentation, at least two coffee/lunch breaks before their scheduled presentation time. Ideally, all presenters will upload their presentation when they pick up their registration packages from the Registration Desk. Using a USB stick or other portable device is advised. Please format file names as: "Last Name_First Name_ Presentation Day and Time."

Posters
The maximum poster dimensions should be 116 cm (46") high x 111 cm (44)" wide. Posters can be set up starting at 8:00 AM on Monday, October 21 (until 19:00 Sunday evening) and must be set up by noon on Monday, October 21. Posters are assigned a number (please see the Short Program) and should be set up in the space allocated. Velcros will be provided for set up. Poster presenters should be in attendance for the full duration of the poster session, from 17:00 to 18:30 on Monday, October 21. The posters entered in the President's Prize and Melville-DuPorte competitions will be judged during this time. Posters may be taken down at the presenter's discretion after the poster session is completed, but must be removed before the Banquet on Tuesday, October 22.

Conference Locations
The conferences in the Scientific Program will take place mostly in rooms located on the third floor of the Concorde. However, the Jean-Paul Lemieux room is located in the basement of the hotel. The Pilot room can be used for private meeting (see schedule on the website and near the room door) and for relaxation. Room locations are noted in the Program at a Glance, in the Short Program, and in the Full Program.

Refreshment Breaks and Meals
Coffee breaks are included with meeting registration on Sunday, Monday, Tuesday and Wednesday and will be served in the Hall Area. Gourmet coffee breaks will be served at the start of the day (8:00 a.m.) on Monday, Tuesday and Wednesday to ensure that participants can eat lightly before the presentations begin. Lunches will be provided on Monday and Tuesday. ESC members are encouraged to collect lunch on Monday and then attend the ESC Annual General Meeting in Krieghoff–Suzor-Côté room, starting at 12:15. SEQ members are encouraged to collect lunch on Tuesday and then attend the SEQ Annual General Meeting in Borduas room, starting at 12:15.

Social Functions

- Welcome Reception in the Hall at 19:00 on Sunday, October 20
- Student Mixer, Monday, October 21, 19:00 at INOX pub
- Banquet, Tuesday, October 22, 18:30 in Krieghoff–Suzor-Côté room

Business Meetings

- TCE Editorial Board Meeting in Pilot Room, Tuesday, October 22 at 12:00
- Entomological Society of Canada Annual General Meeting, Monday, October 21 at 12:15 in Krieghoff–Suzor-Côté
- Société d'entomologie du Québec Annual General Meeting, Tuesday, October 23 at 12:15 in Borduas
- Meeting of the New ESC Executive (BOD2), Monday, October 21 at 16:00 in Pilot Room

Silent auctions

The ESC's Student & Early Professional Affairs Committee (SEPAC) and the Fonds de la Société d'entomologie du Québec will be holding silent auctions to raise funds for their respective activities. The organizing committee invites you to visit the tables where auction items will be on display.

INFORMATIONS GÉNÉRALES

Bureau d'inscription
Le bureau d'inscription sera situé dans le Foyer au troisième étage de l'hôtel où se tient le congrès, Hôtel Le Concorde, de 9h30 à 18h00 le dimanche (20 octobre), et de 7h30 à 18h00 le lundi (21 octobre) et le mardi (22 octobre).

Présentations orales
Les présentations orales, incluant les présentations des concours du prix du Président et du prix Melville-DuPorte, sont limitées à 12 minutes plus 3 minutes pour les questions. Les modérateurs devront respecter strictement la limite de 15 minutes pour chaque orateur, puisque plusieurs sessions auront lieu simultanément. Les présentateurs devront télécharger leur présentation (de préférence au format PPTX) sur un ordinateur portable de la conférence dans la salle Cullen avant leur présentation, **au moins deux pauses café/déjeuner avant l'heure prévue de leur présentation**. Idéalement, tous les présentateurs téléchargeront leur présentation au moment de leur enregistrement au bureau des inscriptions. L'utilisation d'une clé USB ou d'un autre dispositif portable est conseillée. Les noms de fichiers doivent être formatés comme suit : « Nom de famille_Prénom_Jour et heure de la présentation ».

Affiches
Les dimensions maximales des affiches doivent être de 116 cm (46") de haut par 111 cm (44") de large. Les affiches peuvent être installées à partir de 13h00 le dimanche 20 octobre et doivent être installées avant midi le lundi 21 octobre. Un numéro est attribué aux affiches (voir le programme abrégé) et celles-ci doivent être installées dans l'espace prévu à cet effet. Des velcros seront fournis pour l'installation. Les présentateurs d'affiches doivent être présents pendant toute la durée de la session de posters, de 17h00 à 18h30 le lundi 21 octobre. Les affiches présentées dans le cadre du concours du prix du Président et du Prix Melville-DuPorte seront jugées pendant cette période. Les affiches peuvent être retirées à la discrétion du présentateur après la séance d'affichage, mais doivent être retirées avant le banquet du mardi 22 octobre.

Emplacement des conférences
Les conférences du programme scientifique se dérouleront principalement dans des salles situées au troisième étage du Concorde. Cependant, la salle Jean-Paul Lemieux se situe au sous-sol de l'établissement. La salle Pilot peut être utilisée pour des réunions privées (voir l'horaire sur le site web et près de la porte de la salle) ou encore pour la détente à l'extérieur des plages horaire prévues pour les rencontres. L'emplacement des salles est indiqué dans le programme court et dans le programme complet.

Pauses et repas
Les pauses café sont incluses dans l'inscription. Ces pauses café seront servies dans le Foyer le dimanche, le lundi, le mardi et le mercredi. Des pauses café gourmandes seront servies en début de journée (8h00) le lundi, le mardi et le mercredi afin d'assurer que les participants puissent manger légèrement avant le début des présentations. Les diners (boîtes à lunch) seront fournis le lundi et le mardi. Les membres de la SEC sont invités à prendre leur diner le lundi et à assister ensuite à l'assemblée générale annuelle de la SEC dans la salle Krieghoff–Suzor-Côté, à partir de 12h15. Les membres de la SEQ sont invités à venir

chercher leur diner le mardi et à assister ensuite à l'assemblée générale annuelle de la SEQ dans la salle Borduas, à partir de 12:15.

Événements sociaux

- Réception de bienvenue dans le Foyer à 19h00 le dimanche 20 octobre
- Soirée étudiante, lundi 21 octobre 19h00, au pub l'INOX
- Banquet, mardi 22 octobre 18h30, dans la salle Krieghoff–Suzor-Côté

Réunions d'affaires

- Réunion du comité de rédaction du *Canadian Entomologist* dans la salle Pilot, mardi 22 octobre à 12h00
- Assemblée générale annuelle de la Société d'entomologie du Canada, lundi 21 octobre à 12h15 dans la salle Krieghoff–Suzor-Côté
- Assemblée générale annuelle de la Société d'entomologie du Québec, mardi 22 octobre à 12h15 dans la salle Borduas
- Réunion du nouvel exécutif de la SEC (BOD2) dans la salle Pilot, lundi 21 octobre à 16h00

Encans silencieux

Le Comité des affaires étudiantes et des jeunes professionnels de la SEC (SEPAC) et le Fonds de la Société d'entomologie du Québec tiendront des encans silencieux afin d'amasser des fonds pour leurs activités respectives. Le comité organisateur vous invite à visiter les tables où seront exposés les articles mis aux enchères.

ESC-SEQ Joint Annual Meeting 2024: Scientific Program at a Glance - Congrès annuel conjoint SEC-SEQ : Aperçu du programme scientifique

Sunday, October 20, 2024 - Dimanche 20 octobre 2024

	Krieghoff – Suzor-Côté
13:30	Opening Ceremony / Cérémonie d'ouverture
14:00	Gold Medal Address / Allocution du médaillé d'or: Dr Terry Don Galloway
15:00	Plenary session 1 / Session plénière 1: Dr Samuel Ramsey
	Graduate Student Showcase / Vitrine aux études supérieures
16 :30	Mahsa Hakimara
17:00	Claire A. Paillard
17:30	Maggie MacDonald
19 :00	Welcome reception and mixer in Hall – Réception de bienvenue dans le hall

Monday, October 21, 2024 - Lundi 21 octobre 2024

	Krieghoff – Suzor-Côté	Lismer-Leduc-Fortin	Jean-Paul Lemieux	Borduas
8:30	Dr Sasha Luccioni			
09:30	**Towards the automation of insect monitoring system**	**Ecology**	**IPM**	**Pollinators**
09:30	Joe Bowden	Nicolas Boucher	Morgane Canovas	Lydia Millette-St-Hilaire
09:45	Maxim Larrivée	Jordanne Jacques	Jason Lemay	Anne-Charlie Robert
10:00	Yuyan Chen	Alannah Penno	Jessica Fraser	
10:15	Mélisande Teng	Gemma Rawson	Malek Kalboussi	Sandra Gillepsie
10:30	**Coffee Break – Pause-café**			
	Towards the automation of insect monitoring system	**Ecology**	**IPM**	**Pollinators**
10:45	Olivier Morin	Marrissa Miller	Jose Correa Ramos	Prabashi Wickramasinghe
11:00	Kishan Sambaraju	Emelie Obi	Jeremy Irvine	Rassol Bahreini
11:15	Matej Stefancic	Eric Fellin	Andrew Colton	Leah Swanson
11:30	Felipe Dargent	Mia Lauzon	Sirine Boubeker	Mackenzie Howse
11:45	Julien Saguez	Emma Despland	Madelaine Empey	Jason Gibbs
12 : 00	**Lunch provided / Diner fourni - Hall**			
12 :15	AGM ESC – AGA SEC			
13 :30	Dr David Rolnick			
14:30	**Citizen science and Artificial Intelligence**	**Ecology**	**IPM**	**Pollinators**
14:30	Shawn Abraham	Ella Dely	Janelle MacKeil	
14:45	Charles-Étienne Ferland	Ilesha Ilperma Arachchi	Didier Labarre	Thilina Hettiarachchi
15:00	Paul Manning	Rebecca Dean	Alissandre Lavoie	Joanna J. Silva
15:15	André-Philippe Drapeau Picard	Iniya Rajan	Annie-Ève Gagnon	Stéphanie Gagnon
15:30	**Coffee Break – Pause-café**			
	Citizen science and Artificial Intelligence	**Ecology**	**IPM**	**Pollinators**
15:45	Amélie Grégoire-Taillefer	Aldo Rios Martinez	Preetpal Singh	Samm Reynolds
16:00	Dominic Ouellet	Sabina Noor	Richard Trudel	Julia Mlynarek
16:15	Ludovic Leclerc	Meganne Harrison	Jeff Gauthier	Samuel Ramsey
16:30	Marshall Ritchie	Noa Davidai	Sara Edwards	
		Simon Coroller	Gwylim Blackburn	
17 :00	**Poster session – Session d'affiches**			
19 :00	**Student Mixer - Soirée étudiante (INOX)**			

Tuesday, October 22, 2024 - Mardi 22 octobre 2024

	Krieghoff – Suzor-Côté	Lismer-Leduc-Fortin	Jean-Paul Lemieux	Borduas
8:30	Dr Alberto Unbanera			
09:30	**Biological control programmes in Canada**	**Diversity, Genomics and Populations**	**Ecology**	**Environment**
09:30	**introduction**	Donovan Bosnich	Olajide Fatukasi	
09:45	Tim Haye	Joshua Molligan	Clarissa Capko	
10:00		Jessica Lario	Carina Lopez	Katelyn Stokes
10:15	Rob Bourchier	Marc-Antoine Poulin	Kanishka Senevirathna	Bennett Grappone
10:30	**Coffee Break – Pause-café**			
	Biological control programmes in Canada	**Diversity, Genomics and Populations**	**Ecology**	**Entotechnology**
10:45	Jennifer Baici	Apolline Maurin	Felix Sperling	Guyllaume Dufresne
11:00	Michelle Franklin	Catherine Hébert	Joel Kitts	Leylia Petryk
11:15	François Dumont	Wei Han Lau	Maxime Lefebvre	Catherine Bolduc
11:30	Chandra Moffat	Savannh Burroughs	Marla Schwarzfeld	Grant Vanderberg
11:45	Chris JK MacQuarrie	Pierre-Marc Brousseau		Florent Pechereau
12 :00	**Lunch provided / Diner fourni - Hall**			
12 :15				AG SEQ
13 :45	**Biological control programmes in Canada**	**Insectes forestiers: de la connaissance à la pratique**	**Ecology**	**Interdisciplinary advances in insect mass rearing in Canada**
13 :45	Ian Jones	Évelyne Barrette	Hadil Elsayed	Jake St. Amour
14 :00	Lucas Roscoe	Nicolas Bédard	Neil Holliday	Omid Joharchi
14 :15	Jocelyn Smith	Christian Hébert	John Soghigian	Marie-Hélène Deschamps
14 :30	Jacques Brodeur	Sandrine Picq	Julio Rivera Castillo	Gabriel Mott
14:45	Michael McTavish	Kathia Bernier	Rylee Isitt	Émile Vadboncoeur
15:00	Frédéric Jean	Audrey Nisole	Christopher Keeling	Jacintha Kong
15:15	**Coffee Break – Pause-café**			
15:30	**Biological control programmes in Canada**	**Insectes forestiers: de la connaissance à la pratique**	**Ecology**	
15:30	Paul Abram	Abdelmadjid Djoumad		
15:45	Rob Johns	Alvaro Fuentealba	Sherry Fownes	
16:00		Richard Berthiaume	Robert Lamb	
16:15		Éric Bauce	Lisa Lumley	
16:30		Véronique Martel		
18 :30	**Banquet**			

Wednesday, October 23, 2024 - Mercredi 23 octobre 2024

	Krieghoff – Suzor-Côté	Lismer-Leduc-Fortin	Jean-Paul Lemieux	Borduas
8:45	**Methods and tools for wild pollinator research**	**New insights from long-term studies of forest insect population dynamics**	**IPM**	**Prairies Predicaments**
8:45	Frédéric McCune	Brian Van Hezewijk	Jean-Philippe Parent	Hector Carcamo
9:00	Kevin Gauthier		Jessee Tinslay	Tyler Wist
9:15	Julia Meyer	Jens Roland	Catherine Pouchet	Meghan Vankosky
9:30	Emily Forrester		Marc Fournier	Sylvia Neumann
9:45	Parker Smale	Barry J. Cooke	Sébastien Boquel	Khaldoun Ali
10:00	Caroline Strang		Aziz Ullah	Boyd Mori
10:15	**Coffee Break – Pause-café**			
10:30	**Methods and tools for wild pollinator research**	**New insights from long-term studies of forest insect population dynamics**	**IPM**	**Prairies Predicaments**
10:30	Amélie Morin	Jacques Régnière	Rachel Rix	Jennifer Retzlaff
10:45			Wim van Herk	Emilio Enrique Tellarini Prieto
11:00	Amanda Liczner	Marc-Antoine Leclerc	Alice de Donder	
11:15			Chris Cutler	
11:30			William Nusillard	
11:45			Syed Usman Mahmood	
12 :00	**Closing ceremony - Cérémonie de clôture**			

Entomological Society of Canada Award Recipients, 2024
Récipiendaires des prix de la Société d'entomologie du Canada 2024

Gold Medal Award / Allocution du médaillé d'or:
The ESC Gold Medal recognizes outstanding achievement in Canadian entomology.
(French to follow for each award)

Dr Terry Don Galloway's outstanding contributions to entomology in Canada have spanned more than 50 years. Always interested in entomology, Dr. Galloway started his professional career as a professor of Veterinary Entomology at the University of Manitoba in 1977. Although retired since 2013, his contributions to entomology continue as an emeritus professor at the university. His research focused on Veterinary Entomology and Ectoparasite Ecology; however, his contributions also included the fields of agricultural entomology, taxonomy, aquatic entomology, biodiversity, to conservation. Evidence of Dr Galloway's recognition as a Canadian authority on lice, fleas and ticks is abundant in the number of refereed publications, book contributions, reports and presentations; he has published 126 refereed publications, 16 contributions to books, 61 scientific reports and over 140 other contributions that include book reviews, extension publications, and presentations.
As a teacher, Dr Galloway taught 13 different courses and contributed in a major way to 12 other courses. He received many awards for teaching excellence. He supervised and co-supervised 22 graduate students and served on graduate advisory and examining committees for 95 MSc, 27 PhD and 12 undergraduate theses.
In addition to research and teaching, Dr Galloway's contributions to public education are well recognized. He prepared written extension literature on pest management for livestock producers and gave presentations and service to the livestock industry, veterinarians, medical practitioners, gardeners, ornithologists, pet owners, and conducted many media interviews. He also provided basic training to the RCMP on handling of insect samples of forensic importance. He contributed his expertise in human and animal health through the Veterinary Medical Board of Manitoba, national and provincial committees concerned with West Nile Virus and the Manitoba Health Lyme Disease Committee and was for many years, a forensic entomology consultant for the RCMP and the Winnipeg Police Department. In 1997, Dr. Galloway was awarded the Dr and Mrs Ralph Campbell Outreach Award, the University of Manitoba's most prestigious award for public engagement.
Dr. Galloway is a long-time member of the Entomological Societies of Canada (53 years) and Manitoba (50 years) and has served on a variety of committees. In addition, he was member of the ESC's Scientific Committee on the Biological Survey of Canada (BSC), and served for seven years on the BSC Board of Directors. He has been a member of the Editorial Board of the Canadian Journal of Arthropod Identification (CJAI) since 2005. He has been a member of Manitoba's provincial committees addressing endangered species, and involved in the Manitoba Region of the Nature Conservancy of Canada, in various roles, for the last 23 years.

Médaille d'or : La médaille d'or de l'ESC récompense les réalisations exceptionnelles dans le domaine de l'entomologie au Canada.

La contribution exceptionnelle du **Dr Terry Don Galloway** à l'entomologie au Canada s'étend sur plus de 50 ans. Toujours intéressé par l'entomologie, le Dr Galloway a commencé sa carrière professionnelle en tant que professeur d'entomologie vétérinaire à l'Université du Manitoba en 1977. Bien qu'il soit à la

retraite depuis 2013, sa contribution à l'entomologie se poursuit en tant que professeur émérite de l'université. Ses recherches se sont concentrées sur l'entomologie vétérinaire et l'écologie des ectoparasites, mais ses contributions ont également porté sur l'entomologie agricole, la taxonomie, l'entomologie aquatique, la biodiversité et la conservation. La reconnaissance du Dr Galloway en tant qu'autorité canadienne en matière de poux, de puces et de tiques est attestée par le nombre de publications avec comité de lecture, de contributions à des ouvrages, de rapports et de présentations ; il a publié 126 publications avec comité de lecture, 16 contributions à des ouvrages, 61 rapports scientifiques et plus de 140 autres contributions, dont des critiques d'ouvrages, des publications de vulgarisation et des présentations.

En tant qu'enseignant, M. Galloway a donné 13 cours différents et a contribué de manière importante à 12 autres cours. Il a reçu de nombreux prix pour l'excellence de son enseignement. Il a supervisé et codirigé 22 étudiants de troisième cycle et a fait partie de comités de conseil et d'examen pour 95 mémoires de maîtrise, 27 thèses de doctorat et 12 thèses de premier cycle.

Outre la recherche et l'enseignement, les contributions du Dr Galloway à l'éducation du public sont bien connues. Il a rédigé des documents de vulgarisation sur la lutte contre les parasites à l'intention des éleveurs de bétail et a donné des présentations et des services à l'industrie de l'élevage, aux vétérinaires, aux médecins, aux jardiniers, aux ornithologues, aux propriétaires d'animaux de compagnie et a accordé de nombreuses entrevues aux médias. Il a également dispensé une formation de base à la GRC sur la manipulation d'échantillons d'insectes d'importance médico-légale. Il a apporté son expertise en matière de santé humaine et animale au sein du Veterinary Medical Board of Manitoba, de comités nationaux et provinciaux concernés par le virus du Nil occidental et du comité de santé du Manitoba sur la maladie de Lyme, et a été pendant de nombreuses années consultant en entomologie médico-légale pour la GRC et le service de police de Winnipeg. En 1997, le Dr Galloway a reçu le Dr and Mrs Ralph Campbell Outreach Award, le prix le plus prestigieux de l'Université du Manitoba pour l'engagement du public.

M. Galloway est membre de longue date de la Société d'entomologie du Canada (53 ans) et de celle du Manitoba (50 ans) et a siégé à divers comités. En outre, il a été membre du comité scientifique de la SEC sur la Commission biologique du Canada (CBC) et a siégé pendant sept ans au conseil d'administration de la CBC. Il est membre du comité de rédaction du Journal canadien d'identification des arthropodes (CJAI) depuis 2005. Il a été membre des comités provinciaux du Manitoba sur les espèces en voie de disparition et s'est impliqué dans la région du Manitoba de la Société canadienne pour la conservation de la nature, à divers titres, au cours des 23 dernières années.

C. Gordon Hewitt Award: The ESC C. Gordon Hewitt Award is given to an individual who received their PhD within the preceding 12 years, and who has made an outstanding contribution to entomology in Canada

Dr. Julia Mlynarek completed her PHD from Carlton University in 2014, after two short periods first as a post doctoral fellow at the University of NB and second as research scientist at Harrow research and development centre AAFC, she moved to her current position in 2020 as entomologist and collections manager at the Insectarium de Montréal, Espace pour la vie, Ville de Montréal (Québec). Julia has produced 37 peer-reviewed publications, 10 non-refereed papers and delivered 43 presentations including 9 to invited symposia. She served as editor for *The Canadian Entomologist* from 2017-2024. She is an active member of the Entomological Society of Canada, serving as bulletin editor, co-chair and member of the Communications, Student Awards and EDI committees. She has also served as president and now as past president for the Société d'entomologie du Quebec, and was Co-organizer and Chair of the Student Affairs Committee for the Entomological Society of America.
In addition to these contributions, Julia has been recognized for her research excellence as a recipient of the NSERC (2016) and FQRNT (2017) Postdoctoral Research Fellowships, the NSERC Doctoral Canada Graduate Scholarship (2010-2013) and the Margaret Duporte Fellowship in Entomology (2007-8). She was also awarded the President`s Prize for both the Entomological Societies of America (2008-9) and Canada (2008).

C. Gordon Hewitt : Le prix ESC C. Gordon Hewitt est décerné à une personne qui a obtenu son doctorat au cours des 12 dernières années et qui a apporté une contribution exceptionnelle à l'entomologie au Canada.

Julia Mlynarek a obtenu son doctorat à l'université Carlton en 2014. Après deux courtes périodes, d'abord comme boursière postdoctorale à l'université du Nouveau-Brunswick et ensuite comme chercheuse au centre de recherche et de développement Harrow d'AAC, elle a accepté son poste actuel en 2020 en tant qu'entomologiste et gestionnaire des collections à l'Insectarium de Montréal, Espace pour la vie, Ville de Montréal (Québec). Julia a produit 37 publications évaluées par des pairs, 10 articles non évalués par des pairs et 43 présentations, dont 9 dans le cadre de symposiums invités. Elle a été rédactrice en chef de The Canadian Entomologist de 2017 à 2024. Elle est un membre actif de la Société entomologique du Canada, où elle a été rédactrice du bulletin, coprésidente et membre des comités des communications, des bourses d'études et de l'EDI. Elle a également été présidente et maintenant présidente sortante de la Société d'Entomologie du Québec, et a été co-organisatrice et présidente du comité des affaires étudiantes de l'Entomological Society of America.
En plus de ces contributions, Julia a été reconnue pour l'excellence de ses recherches en tant que récipiendaire des bourses de recherche postdoctorale du CRSNG (2016) et du FQRNT (2017), de la bourse d'études doctorales du Canada du CRSNG (2010-2013) et de la bourse Margaret Duporte en entomologie (2007-2008). Elle a également reçu le prix du président de l'Entomological Society of America (2008- 2009) et de la Société d'entomologie du Canada (2008).

Fellows of the Entomological Society of Canada: Entomological Society of Canada Fellows recognize members for their major contributions to entomology via research, teaching, application, and/or administration. This year the Society bestows one new fellowship.

Dr Cynthia Scott-Dupree was a professor in the in the School of Environmental Sciences at the University of Guelph for 37 years and retired in 2023. She was the first woman hired on as faculty in the environmental Biology Department in 1986. Her research spanned a wide area including apiculture, pollinator health, toxicology, and integrated pest management which generated over 100 publications. The knowledge gained through her research is being used today by Canadian vegetable and floriculture growers. Her research on the non-target effects of neonicotinoid insecticides contributed to the discussion on the use of these pesticides in Canadian agriculture.

Dr Scott-Dupree's contribution to entomology extends beyond research to teaching several entomology and environmental science courses including an international field entomology course, and mentoring graduate students, she has supervised 60 graduate students. In 2022, she was awarded the G.P. McRostie Faculty Award by the Ontario Agricultural College for her dedication to mentoring. She was a regular contributor to professional development courses for students from School of Environmental Sciences, the Ontario Agricultural College, and the department of Plant Agriculture.

Dr Scott-Dupree has also been highly active in serving the entomological scientific community in Canada. She was the Scientific Advisor for Posh Bee (Pan- European assessment, monitoring and mitigation Of Stressors on the Health of Bees) June 2018- May 2023, funded by the European Union – Horizon 2020 Research Project, 80 scientists in over 20 European countries. She served on the organizing and fundraising committees for the ESC and ESO as well as the first Joint meeting with ESC and ESA in Vancouver.

Dr Scott-Dupree was awarded Fellow of the Entomological Society of Ontario in October 2023 and Honorary Member of the Canadian Association of Professional Apiculturists in February 2024.

Les membres associés de la Société entomologique du Canada : Le titre de membre associé de la Société entomologique du Canada reconnait les membres pour leurs contributions majeures à l'entomologie par le biais de la recherche, de l'enseignement, de l'application et/ou de l'administration. Cette année, la société accueille une nouvelle membre associée.

La **Dr Cynthia Scott-Dupree** a été professeure à l'École des sciences de l'environnement de l'Université de Guelph pendant 37 ans et a pris sa retraite en 2023. Elle a été la première femme à être engagée comme professeur dans le département de biologie environnementale en 1986. Ses recherches ont porté sur un large éventail de domaines, notamment l'apiculture, la santé des pollinisateurs, la toxicologie et la lutte intégrée contre les ravageurs, et ont donné lieu à plus d'une centaine de publications. Les connaissances acquises grâce à ses recherches sont aujourd'hui utilisées par les producteurs canadiens de légumes et de fleurs. Ses recherches sur les effets non ciblés des insecticides néonicotinoïdes ont contribué au débat sur l'utilisation de ces pesticides dans l'agriculture canadienne.

La contribution du Dr Scott-Dupree à l'entomologie va au-delà de la recherche : elle a enseigné plusieurs cours d'entomologie et de sciences de l'environnement, notamment un cours international d'entomologie de terrain, et a encadré des étudiants de troisième cycle (elle a supervisé 60 étudiants de troisième cycle). En 2022, le Collège agricole de l'Ontario lui a décerné le G.P. McRostie Faculty Award pour son dévouement au mentorat. Elle a régulièrement participé à des cours de perfectionnement

professionnel destinés aux étudiants de l'École des sciences de l'environnement, du Collège d'agriculture de l'Ontario et du département d'agriculture végétale.
La Dr Scott-Dupree a également été très active au service de la communauté scientifique entomologique au Canada. Elle a été conseillère scientifique pour Posh Bee (Pan-European assessment, monitoring and mitigation of Stressors on the Health of Bees) de juin 2018 à mai 2023, financé par le projet de recherche Horizon 2020 de l'Union européenne, qui regroupe 80 scientifiques dans plus de 20 pays européens. Elle a fait partie des comités d'organisation et de financement de la SEC et de l'ESO, ainsi que de la première réunion conjointe de la SEC et de l'ESA à Vancouver.
La Dr Scott-Dupree a été nommée membre associée de la Société entomologique de l'Ontario en octobre 2023 et membre honoraire de l'Association canadienne des apiculteurs professionnels en février 2024.

Bert and John Carr Award: The Bert and John Carr Award supports research activities in faunistics, natural history, and/or taxonomy of Canada's insects.

Kiara Calladine grew up a member of Montreal Lake Cree Nation in La Ronge, Saskatchewan. She majored in statistics for her undergraduate degree, but found her passion for entomology when chasing tiger beetles as a field assistant with Troutreach Saskatchewan, a non-profit conservation organization. As a data analyst in the technology field, she considers herself an amateur entomologist, learning about insects while exploring Saskatchewan's natural spaces.
Kiara is requesting support for an entomological expedition to the Athabasca sand dunes in northern Saskatchewan. She and the research team will undertake an entomological expedition to the sand dunes and the associated William River to provide an intensive faunistic and natural history inventory of the arthropods inhabiting this area. The collections will be returned to Saskatoon, Saskatchewan, Canada, where the team will identify and curate the specimens to be submitted to the Royal Saskatchewan Museum, and the data sets to be submitted to the Saskatchewan Conservation Data Centre through the fall of 2024. By December of 2024, the team expects to have developed a natural history inventory of the area which will be written into a manuscript for submission to a peer-reviewed entomological journal."

Prix Bert et John Carr : Le prix Bert et John Carr soutient les activités de recherche sur la faune, l'histoire naturelle et/ou la taxonomie des insectes du Canada.

Kiara Calladine a grandi au sein de la nation Cree de Montreal Lake à La Ronge, en Saskatchewan. Elle s'est spécialisée dans les statistiques pour son diplôme de premier cycle, mais a découvert sa passion pour l'entomologie en chassant les cicindèles en tant qu'assistante de terrain pour Troutreach Saskatchewan, une organisation de conservation à but non lucratif. En tant qu'analyste de données dans le domaine de la technologie, elle se considère comme une entomologiste amateur, qui apprend à connaître les insectes en explorant les espaces naturels de la Saskatchewan.
Kiara demande un soutien pour une expédition entomologique dans les dunes d'Athabasca, dans le nord de la Saskatchewan. Elle et l'équipe de recherche entreprendront une expédition entomologique dans les dunes et la rivière William qui y est associée afin de dresser un inventaire faunistique et d'histoire naturelle des arthropodes qui habitent cette région. Les collections seront ramenées à Saskatoon,

Saskatchewan, Canada, où l'équipe identifiera et conservera les spécimens à soumettre au Royal Saskatchewan Museum, et les ensembles de données à soumettre au Saskatchewan Conservation Data Centre pendant l'automne 2024. D'ici décembre 2024, l'équipe espère avoir élaboré un inventaire de l'histoire naturelle de la région qui sera rédigé dans un manuscrit à soumettre à une revue entomologique évaluée par des pairs.

Norman Criddle Award: The Norman Criddle Award recognizes the contribution of an outstanding non-professional entomologist to the promotion of entomology in Canada.

Robert Vigneault is an amateur entomologist but is quite serious about entomology for the past 30 years. He resides in Oka and has obtained a permit to inventory the insect fauna of the Oka National Park. He collaborates with professional entomologists helping with insect inventories and discoveries of new mentions in the province of Quebec. He has collected over 2200 species of beetles in Quebec. He collaborates often with natural history museums, giving his time and donating specimens. He's an avid coleopterist with a world longhorn beetle collection of at least 5500 species. He has collaborated on a dozen publications including some with new species descriptions.

Prix Norman Criddle : Le prix Norman Criddle récompense la contribution exceptionnelle d'un entomologiste non professionnel à la promotion de l'entomologie au Canada.

Robert Vigneault est un entomologiste amateur, mais il s'intéresse sérieusement à l'entomologie depuis 30 ans. Il réside à Oka et a obtenu un permis pour inventorier la faune d'insectes du parc national d'Oka. Il collabore avec des entomologistes professionnels à l'inventaire des insectes et à la découverte de nouvelles mentions dans la province de Québec. Il a récolté plus de 2200 espèces de coléoptères au Québec. Il collabore souvent avec les musées d'histoire naturelle en donnant de son temps et en faisant don de spécimens. C'est un coléoptériste passionné qui possède une collection mondiale de longicornes d'au moins 5500 espèces. Il a collaboré à une douzaine de publications, dont certaines contiennent des descriptions de nouvelles espèces.

Sunday, October 20, 2023 - Dimanche 20 octobre 2024

All Scientific Program events on Sunday take place in Krieghoff – Suzor-Côté room, 3rd floor

13:30 **Opening Ceremony** - **Cérémonie d'ouverture**

14:00 **Dr Terry Don Gallaway**

Department of Entomology, University of Manitoba

Serendipity, Biodiversity and the Meaning of Lice

As we progress through our lives and careers, there are sometimes moments when a complex series of coincidental events all come together to create a wonderful experience. That moment is totally unanticipated, yet has a favourable outcome. We all experience serendipity, sometimes more than once in our lives. I shall describe a number of serendipitous outcomes, including many influences of important mentors, that I have experienced in my entomological life, specifically en route to a survey of ectoparasitic arthropods of wildlife in Manitoba. This survey began in 1993, and continues today, 31 years later. I shall discuss the nature of the survey, which now includes nearly 13,000 mammals and birds, largely salvaged from wildlife rehabilitation hospitals. The initial objective to explore the biodiversity of parasitic lice has resulted in an increase in the recorded number of species from fewer than 50, to nearly 300. Beyond that, I present three interesting examples of results that include and extend the objectives of a biodiversity study. The discovery of Coloceras tovornikae infesting rock pigeons is a marvelous example of serendipity. I shall describe the plight of Mulcticola macrocephalus, a specific parasite of common nighthawk, an aerial insectivore that has suffered near catastrophic decline. I shall also include a discrete discussion of the sex life of Piagetiella peralis, a louse that lives in the decidedly challenging environment of a pelican's pouch. By the end, I hope you will embrace serendipity, and realize that parasitic lice are neither bad nor ugly, but beautiful.

15:00 **Dr. Samuel Ramsey**

University of Colorado, BioFrontiers Institute

Hive and Prejudice: The Enduring Obstacle to Protecting Pollinators

I assumed that being a bee researcher would be fairly straightforward. Things are killing the bees and we need to counteract them. I always expected that the tough part would be the science, elucidating the "what" and "how" of it. However, along my path to becoming a researcher I've encountered the same obstacles that are slowing our progress in protecting our pollinators. And it turns out it's not so straightforward. Our societal choices from the structuring of our laws to how we disseminate scientific findings have kept our pollinators locked in a problematic trajectory. Thankfully it's never too late to change course.

16:00 Coffee Break (all in Hall) – Pause café dans le Hall

Graduate Student Showcase / Vitrine aux études supérieures

16:30 Masha Hakimara and Emma Despland
Concordia University

Vertical Stratification Effect on Insect Herbivory in a Sugar Maple-Dominated Temperate Forest

We tested the hypothesis that increased light intensity from the understory to the canopy drives differences in leaf physical traits and budburst phenology, affecting herbivore communities and the leaf damage they cause. Conducted at twelve sugar maple (Acer saccharum) sites in southern Quebec from 2020 to 2023, the study observed insect herbivory patterns across understory saplings, shaded canopy, and sun canopy levels, and related them to leaf traits and to predation pressure. Results showed that leaf thickness increased along the vertical gradient, making canopy leaves less palatable to herbivores. Herbivory damage rates consistently decreased from the understory to the sun canopy, driven by leaf cutters, skeletonizers, stipplers, and leaf miners. Insect herbivore abundance aligned with these damage trends. This supports the hypothesis that variations in leaf physical traits contribute to vertical stratification of insect damage. However, lab and understory field bioassays showed that caterpillars both preferred and performed better on sun leaves, suggesting a role for other factors. Predation pressure varied vertically, with more arthropod predation in the understory and more bird and mammal predation in the canopy. Overall, leaves exposed to light were preferred in the lab but suffered less damage in the field, suggesting that the intraspecific vertical gradient in herbivory is influenced not only by light intensity, and that natural enemy stratification could also be involved. Additionally, this study reported an average annual herbivory rate of 9.1%, indicating that background herbivory plays a limited role in the decline of sugar maple forests.

17:00 Claire A. Paillard[1], Lisa M. Poirier[1], Che Elkin[1], Felix A.H. Sperling[2], Dezene P. W. Huber[1]
[1] Faculty of Environment, University of British Columbia, [2] Department of Biological Sciences, University of Alberta

The taxonomic and functional diversity of urban ground arthropods with a special focus on phorids

Urban environments support diverse arthropod communities that play crucial roles in ecosystem services. However, the heterogeneity of cities, with their varied land management practices, can have variable impacts on these arthropods. Given that urban development often involves habitat modifications that can alter or threaten arthropod biodiversity and the services they provide—such as pollination and pest control—it is essential to consider arthropods in urban planning. In my research I examined how different urban land use types influence the taxonomic and functional diversity of ground-dwelling arthropods. I conducted a comparative analysis of arthropod communities across three land use types: industrial, greenbelt, and residential, at twelve sites (four per land use type) in Prince George, a mid-sized city in British Columbia. In further research I focused on Phoridae (Diptera), a particularly diverse and abundant group of insects in urban environments. In the summer of 2022, I sampled phorids from 28 sites, successfully sequencing 590 individuals for the CO1 gene at the Centre for Biodiversity Genomics in Guelph. The findings revealed that while functional and taxonomic diversity of ground arthropods did not significantly differ between land use types, the composition of arthropod communities was distinct. The 2022 DNA barcoding analysis identified 99 potential species (molecular operational taxonomic units) of phorids, with land use type and mean temperature both proving to be significant predictors of abundance. Despite the urban setting,

Prince George supports a species-rich and functionally diverse community of ground arthropods. However, phorids are notably less represented in industrial areas.

17:30 Maggie MacDonald[1], Boyd Mori[1], Maya Evenden[1]
[1]University of Alberta

Towards development of pheromone-based monitoring for the pea leaf weevil L. (Sitona lineatus): Relationship between adult capture in pheromone-baited traps and feeding damage on reproductive host plants in pulse agroecosystems in Alberta

The pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae), is a significant invasive pest of field pea, *Pisum sativum* L. (Fabaceae), and faba bean, *Vicia faba* L. (Fabaceae), that has established on the Canadian Prairie Provinces. Despite various tactics for population management, an effective integrated pest management (IPM) program to manage *S. lineatus* in a sustainable manner remains undeveloped. Semiochemical-baited pitfall traps have been used to monitor local movements and range expansion of *S. lineatus*, while counting leaf notching on host plants has been used to estimate adult populations under the assumption that feeding damage is indicative of population density. Monitoring using feeding damage is conducted in early spring when *S. lineatus* emerges from overwintering sites and disperse to young reproductive hosts, creating characteristic U-shaped notches on foliage. In this study, pheromone-baited pitfall traps were deployed across pulse producing regions in Alberta to attract adult weevils and help delineate range expansion. Leaf notches were counted at the 6th node stage to estimate weevil density and compare with pitfall trap catch. By comparing the number of weevils captured in pitfall traps with the number of notches on host plants, we aim to elucidate the relationship between weevil density and herbivory. Results from this study will contribute to our understanding of herbivore-plant interactions, provide critical insights for *S. lineatus* monitoring, and aid in the development of an IPM program for *S. lineatus* population management in Alberta.

19:00 Welcome Reception / Cérémonie de bienvenue, Hall

Monday, October 21, 2024 - Lundi 21 octobre 2024

Plenary Session 2 / Session plénière 2 **Krieghoff --Suzor-Côté**

8:30 Dr Sasha Lucccioni
Hugging Face

From Hype to Hallucinations: Navigating AI's Past, Present, and (Potential) Future

AI has existed for over 50 years, going from a niche computing technology to the topic of much debate across all levels of society since the advent of ChatGPT in 2022. But there's more to AI than ChatGPT, and even magical LLMs (Large Language Models) aren't perfect - they hallucinate, amplify biases in data, and come with a disproportionate environmental footprint. In my talk, I'll start with a retrospective into AI's history and evolution, and present the different techniques and how they work in practice (and how they fail). I'll also broach the ethical limitations of AI models in terms of bias and representativity, as well as their societal and environmental impacts. I hope to leave you with a better understanding of this sometimes overwhelming technology and to equip you to use it -- or not -- in your research and practice.

 President's Prize (ESC students) / Prix du président (étudiants de la SEC)

 Prix Melville-DuPorte (étudiants de la SEQ)

Ecology / Écologie(1) **Lismer-Leduc-Fortin**

9:30 -10:30
Moderator: John Soghighian

9:30 Nicolas Boucher[1], Timothy Work[1], Christian Hébert[2]
[1]Université du Québec à Montréal, [2]Centre de Foresterie des Laurentides

 **Increased plant diversity does not increase diversity nor abundance of parasitoids of forest defoliatiors**

The "enemies hypothesis" states that increased plant diversity may reduce pest damage by maintaining generalist natural enemies. We tested whether abundance and richness of parasitoid wasps (386 species, 3,797 individuals) increased with tree and understory plant richness or with the abundance and richness of potential hosts (560 moth species, 19,031 individuals) in 16 conifer stands where pest densities were low. Parasitoid and host populations were not correlated. While host richness increased with tree and understory diversity, parasitoids did not. White birch increased the abundance of potential hosts, but reduced parasitoid abundance, demonstrating a strong tree-species identity effects and casting doubt whether the enemies hypothesis justifies increasing plant diversity as a solution to reduce pest damage. We propose tree identity effects related to plant semiochemicals interfere with host detection by parasitoids are at cause and should be integrated in the theories behind forest diversification incentives and considered as important factors in pest control.

9:45 Jordanne Jacques[1], Abraao Almeida Santos[1, 2, 3, 4, 5], Anne-Sophie Brochu[1, 2, 3, 4, 5], Nicolas Plante[1, 2, 3, 4, 5], Joshua Molligan[1, 2, 3, 4, 5], Frédéric McCune[1, 2, 4, 5], Valérie Fournier[1, 2, 4, 5], Edel Pérez-Lopez[1, 2, 3, 4, 5]

Département de phytologie, Faculté des sciences de l'agriculture et de l'alimentation, Université Laval, Quebec City, Canada, [2]Centre de recherche et d'innovation sur les végétaux (CRIV), Université Laval, Quebec City, Canada, [3]Institut de Biologie Intégrative et des Systèmes (IBIS), Université Laval, Quebec City, Canada, [4]Réseau québécois de recherche en agriculture durable, Quebec City, Canada, [5]Centre Sève, Université de Sherbrooke, Sherbrooke, Canada

Ecological interactions of leafhoppers and their parasitoids in Quebec's strawberry fields in the face of climate change

Climate change has a significant impact on agriculture and pest insects. Higher temperatures alter the distribution ranges of insects, promote their winter survival, and accelerate their development. In Quebec, an increase in leafhoppers in strawberry fields has led to greater pesticide use, raising concerns for both the environment and the strawberry industry, given its economic importance for the province. This project aims to study the abundance and diversity of leafhoppers and their Dryinidae parasitoids in Quebec's strawberry fields. The effects of landscape composition and climate on these parameters have also been examined. To achieve this, yellow sticky traps were installed in 19 and 16 strawberry fields in 2023 and 2024, respectively, across five regions of Quebec. Leafhoppers were then classified by genus, and those carrying parasitoid or with signs of larvae hatching were recorded and used for the identification of the parasitoid through metagenomics. In 2023, over 30,000 leafhoppers from 57 different genera were identified, with the genera *Macrosteles* spp. and *Empoasca* spp. being the most dominant. In some fields, nearly 8% of natural parasitism was observed, likely caused by parasitoids from the genus *Gonatopus* spp. Here, we will further discuss the factors that may be influencing parasitoid colonization of leafhoppers in Eastern Canada. The results of this project provide a representative overview of leafhoppers and their parasitoids in Quebec's strawberry fields and offer perspectives for more sustainable pest population management in the context of climate change.

10:00 Alannah Z. Penno[1], Tyler D. Nelson[2], Chandra E. Moffat[2], Dezene P.W. Huber[1], Michelle T. Franklin[2]

[1]University of Northern British Columbia, [2]Agriculture and Agri-Food Canada

Assessing the potential spread of insect pests of wild and cultivated *Vaccinium* species in British Columbia using digitized occurrence records

Plant species within the genus *Vaccinium* - including blueberries and their relatives - grow both naturally and as cultivated crops in British Columbia. *Vaccinium* cultivation is primarily undertaken in the southern areas of British Columbia, but there is growing interest in cultivating *Vaccinium* further north, particularly as climate change alters northern agricultural conditions. *Vaccinium* species are a popular food source for humans and many other species, including insects, and much remains unclear about which insect species may pose a threat to these plants at northern latitudes, both presently and in the future. We identified *Vaccinium* insect pest species through a literature review, and used this list of species to inform the collection of digitized occurrence records. The degree of risk each species poses to *Vaccinium* cultivation was assessed, and *Rhopobota naevana*, the blackheaded fireworm, was identified as a *Vaccinium* insect pest of significant concern in British Columbia, where it is a major pest of cranberry. We used species distribution modeling software (MaxEnt) to assess the distribution of *R. naevana* under both current and future climate change scenarios in British Columbia. Improving our understanding of insect pest distributions and how they

may change in response to climate change is important for informing future pest risks for northern *Vaccinium* cultivation in British Columbia.

10:15 Gemma Rawson[1], Nolan Boyd[1], Daniel Peach[2], Laura Ferguson[1]
Acadia University, [2]University of Georgia

Virus surveillance and species distribution modelling of vector mosquitoes in the Maritime provinces

Mosquito-borne arboviruses are a major concern worldwide. In Canada, arboviruses such as West Nile virus (WNV), eastern equine encephalitis virus (EEEV) and the California serogroup viruses (CSVs) are endemic and a threat to humans, domestic animals and wildlife. In the Maritimes, arbovirus risk has been historically low; however, climate change will affect both mosquito populations and the viruses they vector, with potential for increasing disease risks. To address these future risks, we first conducted mosquito and virus surveillance to provide a baseline of current arbovirus prevalence. In 2023 and 2024, we collected adult and larval mosquitoes from 262 locations across New Brunswick, P.E.I. and Nova Scotia. We preserved all captured adults and sent them to the New Brunswick Provincial Veterinary Laboratory for RT-PCR testing for WNV, EEEV and CSVs. Thus far, WNV and EEEV have been absent from our samples; however, we detected a prevalence of 15 positive CSV pools, largely within our most abundant mosquito, *Coquilletidia perturbans*. To track the future of WNV and EEEV, we also created species distribution maps for the primary amplification vectors for WNV and EEEV, *Culex pipiens* and *Culiseta melanura,* in the Maritimes. Using Maxent, we combined our species presence locations, 19 bioclimatic variables and habitat/land use variables to determine the areas of high habitat suitability for each of our species of interest. The combination of updated virus prevalence and species distribution maps provide tools for the future of monitoring and preventing mosquito-borne disease in the Maritime provinces of Canada.

IPM / Lutte intégrée (1) **Jean-Paul Lemieux**

9:30-10:30

Moderator: Claudine Desroches

9:30 Morgane Canovas[1], Paul K. Abram[2], Jean-François Cormier[3], Tigran Galstian[4], Martine Dorais[1]

[1]Plant Research and Innovation Center, [2]Agriculture and Agri-Food Canada, [3]National Optics Institute, [4]Physics dept, Université Laval

Mood lighting: spectral effects on mating and developmental parameters of the predatory bug *Orius insidiosus* (Say)

Artificial lighting (AL) is a powerful tool to promote crop growth while disrupting pest activity in protected environments (e.g., greenhouses, tunnels, plant factories). However, the optimization of AL for beneficial insect behaviors remains largely unexplored. After assessing various light spectra for the predation efficiency of the generalist beneficial *Orius insidiosus* against pest thrips, we hypothesized that extending daylength with optimal AL spectra could enhance predator reproduction.

Using tunable LEDs, predators were exposed to daily light sequences consisting of a 12-hour artificial sunlight phase, followed by 8 hours exposure to one of the tested blue, blue-red, or blue-green-red light spectra (except for a control group without photoperiod extension). Mating behaviors of *O. insidiosus* pairs were recorded and analyzed from video footage while exposed to one of the tested spectra. Afterward, the pairs

were exposed to the tested daily light sequences to assess development-related parameters (fecundity, fertility, development duration, adult survival, and sex ratio). Surprisingly, the blue-red spectra that increased the most mating events did not lead to higher offspring numbers. However, extending the photoperiod with blue light almost doubled the number of adults emerging in the second generation compared to no photoperiod extension, suggesting that AL could support predator establishment in commercial crops. Furthermore, adding supplementary lighting after 12 hours of simulated sunlight significantly improved developmental parameters. We identified a blue-red light ratio that enhances both *O. insidiosus* predation and developmental performance, paving the way for AL-mediated biocontrol optimization in protected environments.

9:45 Jason Lemay[1], Cynthia Scott-Dupree[1]
[1] School of Environmental Sciences, University of Guelph

Temperature, Cultivar, and Biological Control Interactions in the Management of Cannabis Aphid in Cannabis Cultivated in Controlled Environments

Cannabis aphid (*Phorodon cannabis*) (CA) is a major pest of cannabis (*Cannabis sativa*), particularly when cultivated in controlled environments. The economic damage caused by CA is predominantly through the contamination of harvestable inflorescences. The novelty of cannabis as a legal crop has resulted in a paucity of information on CA biology. Due to a lack of effective insecticides, growers rely primarily on biological control to manage insect pests in cannabis. To address knowledge gaps in CA biology, we used leaf disks and rooted cuttings to assess the development and fecundity of CA at temperatures from 20-28 °C and on four different cultivars. The time to reproductive maturity was shortest at 24 °C (7.7 days) and increased by 36.4% at 28°C (10.5 days). Time to reproductive maturity and fecundity also differed between cultivars. When reared on leaf disks, CA produced significantly more offspring on *cv*. Unicorn Poop. Yet, on rooted cuttings, fecundity was greatest on *cv*. Crown Royal. We photographed different plant tissues from the four cannabis cultivars and quantified the area covered by trichomes, which varied by tissue type and cultivar. In fecundity assay using rooted cuttings, the cultivar with the greatest trichome coverage on its leaves had the fewest CA nymphs. Finally, as parasitoids are a common biological control agent used to manage aphids, we evaluated five different parasitoid species to identify the most effective management option alongside the effect of cultivar on parasitoid performance. This will provide growers with strong recommendations for biological control strategies to manage CA.

10:00 Jessica Fraser[1, 2], Jacques Brodeur[1], Annie-Ève Gagnon[2]
[1]Université de Montréal, [2]Agriculture and Agri-Food Canada

Getting to the heart of the matter: How does lettuce plant architecture affect aphid predator foraging behaviour?

Cannabis aphid (*Phorodon cannabis*) (CA) is a major pest of cannabis (*Cannabis sativa*), particularly when cultivated in controlled environments. The economic damage caused by CA is predominantly through the contamination of harvestable inflorescences. The novelty of cannabis as a legal crop has resulted in a paucity of information on CA biology. Due to a lack of effective insecticides, growers rely primarily on biological control to manage insect pests in cannabis. To address knowledge gaps in CA biology, we used leaf disks and rooted cuttings to assess the development and fecundity of CA at temperatures from 20-28 °C and on four different cultivars. The time to reproductive maturity was shortest at 24 °C (7.7 days) and increased by 36.4% at 28°C (10.5 days). Time to reproductive maturity and fecundity

also differed between cultivars. When reared on leaf disks, CA produced significantly more offspring on *cv*. Unicorn Poop. Yet, on rooted cuttings, fecundity was greatest on *cv*. Crown Royal. We photographed different plant tissues from the four cannabis cultivars and quantified the area covered by trichomes, which varied by tissue type and cultivar. In fecundity assay using rooted cuttings, the cultivar with the greatest trichome coverage on its leaves had the fewest CA nymphs. Finally, as parasitoids are a common biological control agent used to manage aphids, we evaluated five different parasitoid species to identify the most effective management option alongside the effect of cultivar on parasitoid performance. This will provide growers with strong recommendations for biological control strategies to manage CA.

10:15 Malek Kalboussi[1], Annie-Ève Gagnon[2], Colin Favret[1]

[1]Université de Montréal, [2]Agriculture et Agroalimentaire Canada

Enhancing natural enemies with flower strips in Quebec's Lettuce Fields

Given the harmful effects of insecticides on both the environment and human health, developing sustainable pest control alternatives is crucial. Conservation biological control includes practices such as integrating flower strips around crops to support natural enemies, which can disperse into adjacent fields to naturally control pest populations. However, research on the effectiveness of this approach in Canada remains limited. In our study, we evaluated the impact of different flower compositions on the attraction of natural enemies in Québec lettuce crops. We tested sweet alyssum, buckwheat, and various mixtures of annual and perennial flowers. The results showed a significant increase in both the diversity and abundance of predators and parasitoid wasps in flower strip plots compared to control plots. Buckwheat and tailored annual flower strips attracted more lady beetles, representing 45% and 33% of the total collected samples, respectively. Sweet alyssum was particularly effective in attracting parasitoid wasps Hymenoptera and syrphid flies. A total of 1,934 syrphid specimens were collected, representing 14 species, with 12 known as aphid predators during their larval stage. The most common species, *Toxomerus marginatus*, accounted for 70% of the total syrphid captures. These preliminary results suggest that diverse flower strips can significantly enhance the presence of beneficial insects, with different groups responding to specific plants. Future research will focus on developing a precise and rapid method for molecular identification and quantification of natural enemies and herbivores to deepen our understanding of the trophic networks associated with the use of flower strips.

Pollinators / Pollinisateurs (1) **Borduas**

9:30-10:30

Moderator: Sandra Gillespie

9:30 Lydia Millette-St-Hilaire[1], Amélie Gervais[1], Frédéric McCune[1], Valérie Fournier[1]

[1]Université Laval

Analyse de la nidification des bourdons dans des nichoirs artificiels sur des fermes fruitières du Québec

L'établissement des colonies de bourdons est une période critique durant laquelle les reines sont particulièrement vulnérables. Afin d'assurer leur pérennité, il est essentiel de mieux comprendre l'habitat et les ressources artificielles utilisés à ces deux moments de l'année. Dans cette étude, nous avons installé quatre types de nichoirs artificiels (en bois sous terre, en bois hors sol, sous une plaque de béton ou dans un

pot en terre cuite) sur des fermes de pommes, de bleuets en corymbe et de canneberges. Le taux d'occupation des nichoirs, les espèces de bourdons les occupants, la force des colonies et la présence de prédateurs ont été déterminés. Les résultats préliminaires indiquent que le nichoir en bois au-dessus du sol a un taux d'occupation plus élevé que les autres types. De plus, les vergers affichent le plus haut taux d'occupation, suivis par les bleuetières et les cannebergières. *Bombus bimaculatus, Bombus impatiens, Bombus borealis*, *Bombus ternarius* et le groupe *Bombus vagans* ont établi des colonies dans les nichoirs. Les résultats du projet contribueront à l'augmentation du nombre de sites de nidification adéquats pour les bourdons, participant à leur conservation et augmentant leur abondance sur les fermes fruitières.

9 :45 Valérie Fournier[1], Anne-Charlie Robert[1], Pierre Giovenazzo[1]
[1]Université Laval

Management methods to optimize commercial bumble bee (*Bombus impatiens*) colonies' performance during the lowbush blueberry (*Vaccinium angustifolium*) pollination.

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

10:15 Sandra Gillespie[1]
[1]University of the Fraser Valley

Long-term patterns in pathogen prevalence and Bombus impatiens spread in the Fraser Valley, British Columbia.

In the past decade, North America has seen range contractions and declines of many previously common bumblebee species. Our understanding of the mechanisms behind declines has been hampered by a lack of monitoring data. Within the Fraser Valley bumblebees face multiple potential threats including land use change, pathogens, along with the naturalization and spread of the eastern bumblebee *Bombus impatiens*. To address this, we monitored bumblebee populations across seven locations for seven years, documenting community composition and prevalence of the two most common bumblebee pathogens: the microsporidian *Nosema* (or *Varimorpha*) *bombi* and the trypanosome *Crithidia bombi.* We find that (1) *Bombus impatiens* prevalence and abundance has increased over time; (2) prevalence of both the pathogen *N. bombi* and *C. bombi* were high and (3) infection rates varied significantly across species, time and locations, with *Bombus impatiens* showing significantly higher infection of *C. bombi*. These patterns have implications

for the potential future impacts of *Bombus impatiens* on native bumblebees and raise questions about the health and stability of native bumblebee populations in our region.

9:30-10:30 **Symposium: Towards the automation of insect monitoring system (1/2)**
Organized by Joe Bowden
Krieghoff – Suzor-Côté
Moderator: Joe Bowden

9:30 Joe Bowden[1]
[1] Natural Resources Canada, Canadian Forest Service

Towards the automation of insect monitoring system

Deep learning and computer vision represents a disruptive technology: one that will substantially alter the way in which we detect, measure and identify insects for monitoring purposes. These rapidly advancing technologies, machine learning and camera systems (along with audio, and molecular tools like meta-barcoding), will greatly contribute to (but is not limited to) the detection of alien invasive species, irruptive pest insects, new species, and biodiversity -which is declining rapidly. This symposium aims to highlight projects underway that seek to advance our ability to measure this critically important and diverse group of animals and stimulate discussions on where we are, and where we need to go to in this field of 'automated entomology'.

9:45 Maxim Larrivée[1], Joe Bowden[2], Kent Macfarland[3], Michael Bunsen[4]
[1]Insectarium, [2] NRCAN , [3] Vermont Center for Ecostudies, [4] Insectarium/MILA

What about the species with no data? Machine learning for rare and undescribed insects

Insect diversity and abundance are threatened around the world, with some species declining rapidly. Large-scale, long-term monitoring of insect populations is essential to understand population changes and inform responses accordingly. Machine learning algorithms are increasingly used to help scale up data collection on insect populations by automating the identification of species from images. However, such algorithms normally require extensive data to be “trained” on, and in entomology applications, data for many species is limited or nonexistent. The ability to detect such species is nonetheless crucial as they can be especially rare or even undescribed. In this talk, we introduce algorithms for species identification that can recognize when an image represents a species outside of the training data, a problem known as “open set recognition” in machine learning. Specifically, we show how tools from contrastive learning can be applied to pinpoint previously unobserved species, using a case study of data from a global network of moth camera traps.

10:00 Yuyan Chen[1,2], David Rolnick[1,2]
[1]McGill University, [2] Mila - Quebec AI Institute

Predicting butterfly and bird species occurrence patterns from partial observations

Biodiversity is declining at a rapid rate and understanding the current state of biodiversity is crucial to guide conservation policies. However, there remain large knowledge gaps in the distribution of species as observational data on most species remains very limited, and the amount of data available varies

greatly between taxonomic groups. Recent works have demonstrated the potential of machine learning and citizen science data in the form of presence-absence observation reports for bird species distribution modelling. However, birds represent an atypical case with relatively large amounts of data and such methods might not be suited to model butterflies. But birds and butterflies interact, and knowing the distribution of bird species can help predict the distribution of butterflies and vice versa.
In this work, we consider the problem of predicting species occurrence patterns given (a) satellite imagery and/or environmental data and (b) known information on the occurrence of other species.
In order to tackle this challenge, we built SatButterfly, a dataset of satellite images, environmental data and observational data modelled after the SatBird dataset, using data from eButterfly.
We propose a method for predicting species occurrence patterns that enables the use of partial observational data wherever found, and find that our method outperforms other methods in predicting species encounter rates with partial information across taxa (birds and butterflies).
Our approach opens new perspectives to leveraging insights from species with abundant data to other species with scarce data, and could be extended to predicting butterflies distribution from plants data for example.

10:15 Hager Radi Abdelwahed[1], Mélisande Teng[2,1], Hugo Larochelle[3], David Rolnick[1,4]
[1] Mila, [2] Université de Montréal, [3] Google Deepmind, [4] McGill University

Monitoring insect diversity at scale using automated sensors assisted by AI in North-Eastern North America

Insects are declining at an alarming rate across the globe. While the rate of decline is more pronounced in the tropics, important insect biodiversity declines have been documented in temperate regions, mainly in Europe. Standardized monitoring of insect biodiversity at scale is a daunting task and seldom achieved because of their hyper diversity and abundance and the paucity of expert taxonomists to identify them. In recent years, automated sensors for non-lethal standardized monitoring of insects assisted by artificial intelligence have been developed and show significant potential to address the shortcomings and challenges of traditional insect monitoring and detection techniques to monitor insect biodiversity at scale and rapidly with limited expert knowledge required. Using moth monitoring data from 6 automated sensors deployed in North-Eastern North America we showcase the potential for this emerging technology coupled with a pipeline of AI algorithms for detecting, segmenting, tracking and classifying insects to measure biodiversity trends at scale, provide early detection for insect pest, invasive species, novel species discovery and range expansions.

10:30-10:45 Coffee Break / Pause café

Ecology / Écologie (2) Lismer Leduc Fortin

10:45-12:00
Moderator: John Soghighian

10:45 Marrissa Miller[1, 2], Clement Bataille[1], Tom Sherratt[2], Gerard Talavera[3], MJ McAllister[2]
[1]University of Ottawa, Earth Sciences Department, [2]Carleton University, Biology Department, [3]Institut Botànic de Barcelona

Using Hydrogen Isotopes to Verify the Migration of Odonates

Understanding and tracking insect migration presents unique challenges not present in vertebrates. For example, many insects are too small to use radio telemetry, have movement too poorly understood for mark-recapture, and do not move in large enough groups to be tracked by radar, among other challenges. My work uses stable isotope analysis as a tool to overcome these challenges. Using isotopic analysis we can verify latitudinal migration and determine the natal origins of a dragonfly. My model organism, the Red Veined Darter (*Sympetrum fonscolombii),* is suspected of seasonal latitudinal migrations but this had yet to be confirmed in Europe. To address this, we created an odonate calibrated hydrogen isotopic prediction model (isoscape) of Afro-Eurasia then applied this isoscape to *S. fonscolombii* isotopic data. This method confirmed the seasonal latitudinal migration of *S. fonscolombii* and suggested migration from northern Europe in the fall and southern Europe in the spring in the European *S. fonscolombii* population. We believe this odonate calibrated isoscape has the potential to be applied to other migratory or dispersing odonates like the Common Green Darner (*Anax junius*) and the Globe Skimmer (*Pantala flavescens*).

11:00 Emelie Obi[1], Zoë Lindo[1]
[1]University of Western Ontario

Experimental climate warming in boreal peatlands alters below-ground communities through peat drying

The ability of boreal peatlands to sequester large amounts of carbon is threatened under climate change, due to changes in both abiotic conditions and biological communities. Specifically, boreal peatlands are predicted to experience a temperature increase of ~8°C, with a concomitant reduction in moisture levels, both of which are expected to directly affect below-ground communities such as microarthropods. Oribatid mites are one of the most dominant microarthropod communities in boreal peatlands; they contribute to carbon flux by feeding on decomposing organic matter and regulating microbial communities. Using ambient and experimentally warmed plots established for 7 years which led to warming-induced soil drying, I examined the response of oribatid mites to warming at two boreal peatlands that differ in vegetation and water table (moisture). I hypothesised that the warming-induced drying effect will decrease richness, diversity, and composition. I also hypothesised that warming would increase the abundance of the small-sized (asexual) oribatid mite species leading to reduction in average community body size. At the drier *Sphagnum*-dominated fen, warming-induced drying reduced diversity, evenness, and altered composition. There was also increased abundance of some small sized species with concurrent reduction in average community body size. At the wetter *Carex*-dominated fen, warming-induced drying was weaker, leading to no clear trends on richness and diversity. Nonetheless, warming altered community composition, implying that higher moisture levels may buffer the effects of warming to some extent.

11:15 Erica Fellin[1], Mathieu Varin[2], Virginie Millien[1], Roberto Quezada Garcia[2]
[1]McGill Univeristy, [2]Centre d'enseignement et de recherche en foresterie

Spatio-temporal distribution patterns of blacklegged ticks under extreme climate conditions

As the climate warms, the geographic distribution of blacklegged ticks (*Ixodes scapularis*) advances northward. Since these ticks can transmit the causal agent of Lyme disease (*B. burgdorferi*) to various hosts, including humans, monitoring their distribution and density is important. Several drivers can influence tick distribution including climatic factors. While climate change may improve tick fitness by shortening life cycles and lengthening tick seasonal activity, extreme weather events such as extensive flooding or droughts may

reduce tick survival. Data previously collected by the Millien lab from 2011-2014 was used to predict the 2024 distribution of blacklegged ticks under various climate scenarios to determine how current distributions have been affected by climate change. Ecological niche models were performed using 2011-2014 tick data to predict the tick density and distribution for: 1) 2024 under random (stochastic) climate conditions, 2) 2024 under climate warming conditions that improve tick survival (longer, warmer seasons), and 3) 2024 under climate warming and extreme climate conditions that reduce tick survival (severely high temperatures or precipitation). Various land cover types (agriculture, anthropogenic, forest, forest edge) at predicted present and absent sites were surveyed to validate which model most accurately depicted the current distribution. By predicting when these changes occur or how variable these changes can be, we can improve how we interpret trends in tick activity, and, by extension, the pathogenic transmission of *B. burgdorferi*.

11:30 Mia Lauzon[1], Maranda van Oirschot[2], Amber Gough[2], Jantina Toxopeus[2], Laura Ferguson[1]
[1]Acadia University, [2]St. Francis Xavier University

Does the bacterium causing Lyme Disease, Borrelia burgdorferi, enhance the cold tolerance of black-legged ticks?

The ability for the invasive black-legged tick, *Ixodes scapularis*, to survive the winter in Canada determines, in part, their range and abundance, and tick-borne disease prevalence. Thus, characterizing the cold tolerance of these ticks is critical for predicting the future of tick-borne diseases. Additionally, winter survival of black-legged ticks may be modified by the presence of pathogens such as the bacterium that causes Lyme disease, *Borrelia burgdorferi*, which correlates with improved overwintering survival in adult female *I. scapularis*. We do not yet know the mechanism underlying this improved survival; however, the presence of *B. burgdorferi* could increase the ability to tolerate or recover from exposure to low temperatures. To determine if infected ticks are more cold-tolerant than uninfected ticks, we measured the supercooling point and median lethal temperature (LT_{50}) and determined the cold tolerance strategy both before and after overwintering, in adult, field-collected ticks. We then preserved ticks for DNA extractions and nested PCR to test for infection with *B. burgdorferi*. We will assess whether infection with *B. burgdorferi* correlates with changes in the cold tolerance of *I. scapularis*, and whether cold tolerance varies between seasons. Overall, this research will help to determine why *B. burgdorferi* may enhance overwintering survival, improving our ability to predict the abundance and infection risk associated with black-legged ticks in Canada.

11:45 Emma Despland[1]
[1]Concordia University

Does smoke exposure disrupt insect development?

The catastrophic fires of 2023 prevented our planned field work on forest insect pests in northwestern Québec and impelled us to instead test effects of smoke exposure during larval development. Spruce budworm (*Choristoneura fumiferana)* individuals collected as pupae in the field after the peak in air contamination showed higher rates of wing deformities than individuals collected prior to fires. Forest tent caterpillar (*Malacosoma disstria*) pupae collected after smoke exposure also showed increased levels of wing deformities. Male forest tent caterpillar moths collected in pheromone traps showed no wing deformities, suggesting that deformed-wing moths cannot fly to these traps. Intriguingly, for both species, moths with deformed wings were slightly heavier than those with normal wings.

Further lab work artificially exposing spruce budworm to smoke at the 4th, 6th instar or pupal stage showed no effects on mortality but increases in wing deformities relative to controls. Individuals with deformed

wings performed poorly in flight tests. Gravimetric analysis confirmed increased pupal mass in females with deformed wings, and indicated that it occurred via an increase in growth rate but no change in food consumption rate.
There is no indication of the 2023 fires having slowed outbreaks of these two pests, but our findings suggest that smoke effects on insect development warrants further investigation as climate disruption intensifies fire regimes. Previous research in Southeast Asia has shown increases in wing deformities in two Nymphalid butterflies following smoke exposure from large-scale forest fires, but does not point clearly to a mechanism.

IPM / Lutte intégrée (2) Jean-Paul Lemieux

10:45-12:00
Moderator : Claudine Desroches

10:45 Jose Correa Ramos[1], Maya Evenden[1]
[1]University of Alberta

The effect of canola and field pea intercrops on diamondback moth (Plutella xylostella) development and herbivory

The diamondback moth (*Plutella xylostella*) is a worldwide insect pest of brassica crops, including canola. Current *P. xylostella* management practices primarily rely on the impact of natural enemies and insecticidal control. Growing insecticide resistance in some populations and ineffective biological control during outbreaks are challenges to effective and sustainable pest management. Intercropping is the agricultural practice of growing two or more crops in a field and provides producers with agronomic and pest management benefits. This research explores the effect of intercropping field pea (*Pisum sativum*) and canola (*Brassica napus*) on *P. xylostella* feeding performance and development in laboratory experiments. *Plutella xylostella* development time from 1st instar to adult eclosion was not impacted by canola and field pea intercrops when compared to canola alone. Fertilizer regime also did not affect *P. xylostella* development time under laboratory conditions. Analysis of the effect of crop assemblage and fertilizer regime on feeding performance is ongoing. Determining the impact of canola and field pea intercrops on *P. xylostella* behaviour and development is important in evaluating the efficacy of intercropping as a sustainable management strategy for *P. xylostella.*

11:00 Jeremy Irvine[1], Sean Prager[1]
[1]University of Saskatchewan

Economic Injury Levels and Economic Thresholds for the Lesser Clover Leaf Weevil (Coleoptera: Curculionidae) in Red Clover Seed Production

Red Clover (*Trifolium pratense*) is a perennial legume grown for seed production in Saskatchewan and is a vital commodity in the Canadian Prairies. However, red clover seed production can be significantly decreased by up to 50% by the lesser clover leaf weevil (LCLW; *Hypera nigrirostris* Fab.) (Coleoptera: Curculionidae). Primary damage occurs when LCLW larvae feed on the developing shoots, flower heads, and seeds of red clover plants. Further, secondary damage occurs by the feeding of adult LCLW. The pest is traditionally controlled using insecticides, damaging to non-target insect species, notably bees, which are essential pollinators for red clover. Further, there are no established economic thresholds for control of LCLW in red clover, leading to redundant insecticide applications, which create a multi-faceted problem. Principally, the producer will have a reduced income due to additional costs associated with applying an insecticide.

Additionally, pollinator populations present during insecticide applications will be significantly decreased. Lastly, there is a substantial risk of developing insecticide resistance as only one registered insecticide material exists. This study aims to generate economic thresholds and sequential sampling plans through on-farm plot trials designed to identify the yield reduction from different LCLW densities, giving producers access to LCLW management tools that will reduce input costs and environmental harm.

11:15 Andrew Colton[1], Angela Gradish[1], Graham Ansell[1], Rebecca Hallett[1]
[1]University of Guelph, School of Environmental Sciences

Laboratory and field assessment of Colorado Potato Beetle (*Leptinotarsa decemlineata*) attraction to aggregation pheromone and kairomone combinations

The purpose of this study was to conduct laboratory and field bioassays to evaluate adult Colorado Potato Beetle (CPB), *Leptinotarsa decemlineata*, attraction to synthetic, male-produced aggregation pheromone, (*S*)-CPB I, and several host plant kairomone combinations. CPB responses to the pheromone and kairomones (linalool, methyl salicylate, (*Z*)-3-hexenyl acetate, nonanal and 2-phenylethanol) were evaluated in a series of bioassays using a four-arm olfactometer in the lab. Although results were not statistically significant, several kairomone blends were identified with attractive potential. The objectives of 2024 field experiments were to identify an optimal pheromone release rate by comparing five different rates and to assess adult CPB attraction to lab-identified kairomone blends with and without the pheromone. Lures containing pheromone and/or kairomones were placed in pitfall traps in potato fields. CPB were collected from traps and counted twice per week and lure blend efficacy was assessed. Responses to different stimuli will be reported. To the best of our knowledge, this study represents the first field evaluation of CPB response to combined pheromone and kairomone treatments. Determination of the optimal pheromone and kairomone combinations for CPB is important for the development of non-insecticidal management strategies for this pest.

11:30 Sirine Boubeker[1], Éric Bauce[2], Lionel Ripoll[1], Catherine Girard[1], Annie Deslauriers[1]
[1]UQAC, [2]Université Laval

Exploration du potentiel insecticide de l'ADN conspécifique : défis et perspectives

Les épidémies de tordeuse des bourgeons de l'épinette (TBE) provoquent des niveaux élevés de défoliation dans les peuplements de conifères, entraînant une réduction de la croissance, de la productivité, voire la mortalité des arbres. Bien que le Btk soit utilisé et efficace pour réduire les impacts de la TBE sur les pertes ligneuses, son impact potentiel sur des espèces non-ciblées et l'absence d'option insecticide alternative appellent à explorer d'autres outils de lutte directe. En 2015, la découverte des effets inhibiteurs de l'ADN conspécifique (ADN de la même espèce) chez les plantes et les insectes a ouvert une voie prometteuse pour la lutte biologique. Cette perspective mérite d'être approfondie pour définir des seuils optimaux de doses létales en vue du développement de produits alternatifs qui pourraient être utilisés dans la lutte contre les insectes, dont la TBE.

L'objectif de cette étude est d'explorer les conditions conduisant à la toxicité de l'ADN fragmenté (ADNfr) de la TBE afin d'explorer le potentiel insecticide de l'ADNfr encapsulée.

Des tests ont été réalisés pour déterminer les doses létales d'ADNfr sur les larves de TBE et des cellules, dont certaines proviennent d'autres organismes. Cependant, les résultats n'ont pas tous été concluants, soulignant la complexité de ce mécanisme. Parallèlement, un processus d'encapsulation à l'aide de polymères biodégradables a été initié, et des capsules fluorescentes ont été produites et testées sur des TBE

montrant une ingestion efficace sans signe de répulsion, ouvrant la voie à des approches innovantes pour le développement de nouvelles formulations pour les pesticides biologiques.

11 :45 Madelaine Empey[1], Monica Reyes[1], Vance Trudeau[1]
[1]University of Ottawa

Invertebrate and vertebrate species sensitivity distribution for *Bacillus thuringiensis israelensis* and deltamethrin insecticide products

Few studies have investigated the susceptibility of non-target invertebrates, fish, amphibians, and mammals to *Bacillus thuringiensis israelensis* and deltamethin insecticides. There are especially controversial results regarding how Bti affects amphibians, and few studies have been conducted on North American species. The medial lethal concentration (LC_{50}) of the Bti insecticide VectoBac® 200G (potency of 200 international toxic units per litre (ITU/L)) and deltamethrin (95% active ingredient) on chorus, leopard, and wood frog tadpoles were therefore conducted. The LC_{50} values for VectoBac® 200G were estimated to be 513 000 ± 1.15, 78 860 ± 1.10, and 525 363.4 ± 1.13 ITU/L, and LC_{50} values for deltamethrin were estimated to be 2.66 ± 1.06, 7.22 ± 1.05, and 1.14 ± 1.06 µg a.i./L, respectively, for chorus, leopard, and wood frog tadpoles. These values and the LC_{50} values of other organisms exposed to Bti and deltamethrin insecticides from published literature were used to construct species sensitivity distribution (SSD) curves. The SSD curves indicated that increased concentrations of Bti insecticides can affect non-target invertebrates, such as chironomids. High concentrations of Bti may also affect vertebrates such as fish and amphibians. In contrast, low concentrations of deltamethrin are lethal to various non-target invertebrates and hazardous to amphibians and fish, especially larvae. Using SSD curves is an advantageous tool to assess which organisms are at risk and how to mitigate possible ecological effects in habitats where these agents are applied.

Pollinators / Pollinisateurs (2) **Borduas**

10:45-12:00
Moderator: Sandra Gillespie

10:45 Prabashi Wickramasinghe[1], Olav Rueppell[1], Esmaeil Amiri[2], Bin Han[3]
[1]University of Alberta, [2]Delta Research and Extension Center, Mississippi State University, [3]Chinese Academy of Agricultural Sciences

Virus infection dynamics and immune response in honey bee queens

The honey bee queen is the central hub of the colony, yet a plethora of viruses compromise her health and reproductive vigor. Since our understanding of viral pathogenicity in queens remains limited, we studied the effect of IAPV infection on the transcriptome and the proteome of queen pupae, 2-day-old virgin, and 2-week-old queens. RT-qPCR, transcriptomic, and proteomic analysis between IAPV-inoculated and sham-treated queens within each stage revealed a combination of adaptive host responses to combat the virus and viral strategies to manipulate the host. Directional overlap analysis across queen stages uncovered a constitutive response against IAPV and modeling the interaction between queen maturation and viral treatment highlighted stage-specific responses. Pupae were the most virus-susceptible, with the highest effect on the transcriptome and the proteome, primarily activating stress-responsive pathways while adult stages showed stronger activation of immune pathways including Toll and RNAi. Young adults mounted a stronger immune response suggesting a higher virus susceptibility than older queens. The reduced effect on the transcriptome and proteome of the older queens implies a potential viral strategy to minimize harm to

the queen, facilitating transgenerational viral transmission. We investigated whether the queen could counteract this putative viral strategy via transgenerational immune priming conferring protection to offspring against viruses. Despite a classic maternal vaccination approach with heat-inactivated IAPV, offspring showed no significant increase in survival after acute IAPV infection. The study highlights the intricate nature of honey bee queen antiviral immunity and emphasizes the need for further exploration to develop effective strategies against viral threats.

11:00 Rassol Bahreini[1], Joel González-Cabrera[2], C. Sara Hernández-Rodríguez[2], Sara Moreno-Martí[2], Samantha Muirhead[3], Renata Labuschagne[4], Olav Rueppell[1]
[1]University of Alberta, [2]Universitat de València, [3]Alberta Agriculture and Irrigation, [4]Alberta Beekeepers Commission

The persistence of acaricides resistance in *Varroa destructor* population in Canada

The beekeeping industry has been threatened by the ectoparasitic mite *Varroa destructor* for decades, contributing to excessive winter colony loss in Canada. *Varroa* mite control has relied on a limited number of approved synthetic varroacides from the formamidine and pyrethroid families despite the risk of resistance evolution and associated decline in control efficacy. In this study, we evaluated the resistance to amitraz, the most commonly used varroacide, in *V. destructor* in Alberta. Using the Apiarium bioassay technique, we have revealed that 86% of samples collected in Alberta show a certain level of phenotypic amitraz-resistance. We also surveyed the populations for the presence and incidence of mutations previously associated with varroacide resistance. The mutation Y215H in the octopamine receptor gene $Oct\beta_2R$ responsible for amitraz resistance was found in 90% of tested apiaries. Pyrethroids resistance was also widespread across Alberta, where the L925I and L925M mutations in the voltage-gated sodium channel were identified in 100% of tested apiaries. These results support the notion that the practice of relying on a single treatment for a prolonged period contributes to increased rates of resistance evolution to synthetic varroacides. Our findings suggest that a widespread monitoring program across the country would benefit a *Varroa* management plan and also reinforce the urgent need to further develop new *Varroa* control options.

11:15 Leah Swanson[1], Andony Melathopoulos[2], Matthew Bucy[3]
[1]University of Northern British Columbia, [2]Oregon State University, [3]Oregon Department of Agriculture

Systematic review of residual toxicity studies of pesticides to bees and veracity of guidance on pesticide labels

Pesticide residues on crops can be fatal to foraging bees if the bees encounter the residues while the pesticide is still toxic. Therefore, pesticide applicators in the U.S. encounter a statement on pesticide labels, which coarsely indicate which products dissipate over the course of an evening. However, these labels might not always reflect actual residual toxicity data. Without comprehensive residual toxicity data, it is not possible to determine if label statements diverge from data presented in published studies. We compiled 50 studies on residual toxicity trials with formulated pesticides and calculated the residual time to 25% mortality (RT_{25}) of each assay for three bee species (*Apis mellifera*, *Nomia melanderi*, and *Megachile rotundata*). We compared these findings with a U.S. Environmental Protection Agency (EPA) published database of RT_{25} values. Of the comparable RT_{25} values, over 90% were in agreement with the EPA's conclusions. We then compared these values to statements on 155 EPA-registered pesticide product labels. Almost one-third of these pesticide product labels presented residual toxicity information inconsistent with their calculated RT_{25}

values and current EPA labelling guidelines. Unfortunately, over a third of the labels contained active ingredients neither listed in the EPA's RT_{25} database nor had a published study for RT_{25} value estimation thus making RT_{25} comparison impossible. We provide the first evidence that many pesticide labels may inaccurately convey residual toxicity information to applicators, potentially exposing bees to harmful residues.

11:30 Mackenzie Howse[1], Dezene Huber[1]
[1]University of Northern British Columbia

Post-wildfire sampling of remote regions suggests broad range expansions for some British Columbia bee species

Outside of major population centres, much of Canada's biodiversity is under-surveyed. With wildfires and climate change drastically altering North American landscapes and pollinator numbers declining on a global scale, understanding trends in remote insect populations is essential to a more complete understanding of ecosystem function. Much of the work on British Columbia's pollinator communities has taken place in the southern third of the province. We surveyed the less-characterized dry interior plateau using ultraviolet reflective pan traps deployed in previously burned areas (1-90 years post-fire). Specimens were captured during 32000 trap hours and identified to the lowest taxonomic level by morphological analyses and DNA barcoding. This resulted in 932 individual bees representing 81 species. The assemblage was assessed in relation to time since fire, position relative to fire edge, trap colour, and environmental factors such as vegetation, coarse woody debris, and crown closure. Species accumulation curves indicated that local bee diversity was not yet fully characterized; however, our collections suggested many range expansions and at least two new species records for Canada, one of which was collected 1000 km north of its currently known range. Recent post-burn interior and edge trap locations exhibited greater species richness than recovered forests, but rare species drove trends in diversity as only a small fraction of species were caught repeatedly. Our sampling reveals substantial species diversity in a previously under-sampled region and provides insight for future pollinator conservation efforts following wildfire.

11:45 Jason Gibbs[1], Steve Robinson[1, 2]
[1]University of Manitoba, [2]University of Winnipeg

A fistful of pollens; systematics of the specialist bees, *Protandrena* (*Pterosarus*)

Bees in the subgenus *Protandrena* (*Pterosarus*) (Hymenoptera: Andrenidae) are host plant specialists of composite flowers. They are widespread in North America. Although they can be locally abundant, many species are uncommonly collected. The first taxonomic revision of the group has been done, which describes sixteen new species. The validity of the subgenus is established for the first time using a phylogenomic analysis.

Symposium: Towards the automation of insect monitoring systems (2) Krieghoff – Suzor-Côté

10:45-12:00

Organized by Joe Bowden

Moderator: Joe Bowden

10:45 Olivier Morin[1]

[1]CFIA

Traps, apps, and dying plants. How early detection of new exotic insects can safeguard our forests and our crops

Invasive alien species pose major global threats to ecosystems, economies, food security and human health. The number of new pest records is rising throughout the world, with no signs of saturation. Most exotic insects have been introduced in recent decades through international trade and transport of goods and people. Climate change is opening the doors for insects to colonize new environments. Not all exotic insects will become invasive, but some will have negative impacts on the biodiversity, the economy, and plant health.

The Canadian Food Inspection Agency (CFIA) is Canada's representative under the International Plant Protection Convention (IPPC) and administers the Plant Protection Act. The act and the IPPC treaty establish a common approach to prevent the introduction and spread of plant pests and promotes appropriate measures for their control. Early detection and rapid response are shown to be effective at reducing rates of alien species establishment. The sooner we can detect exotic insects in the environment, better are our chances to eradicate or control them efficiently.

This talk with present the exotic insect monitoring program of the CFIA, the different methodologies employed for early detection, and how automation of insect monitoring can be used in a regulatory context.

11:00 Kishan Sambaraju[1], Marwa Nouira[1], Salomon Massoda Tonye[1], Françoise Pelletier[1], Maurice Lebon[1]

[1] Natural Resources Canada

Image-based insect detection and identification using deep learning models

Insect monitoring often involves the collection of targeted insects via traps that are brought to the lab for manual identification and counting. However, this approach can become laborious when a large number of trap collections needs to be processed and the numbers and diversity of insect species caught in the traps are high. Novel approaches, such as artificial intelligence (AI) algorithms, which can automate the detection and identification of insects, are needed to overcome challenges associated with manual identifications. Deep learning models are powerful object detection algorithms for identifying objects in photos, videos, and in real-time situations. In this study, we assessed the performances of two deep learning models, You Only Look Once (YOLOv9) and RT-DETR (Real-Time DEtection TRansformer) in detecting and identifying sap beetles (Coleoptera: Nitidulidae) in images. Certain sap beetle species are vectors of the oak wilt disease caused by a fungal pathogen, *Bretziella fagacearum*. The disease was first discovered in Canada in Niagara Falls, ON, in 2023, and impacts oaks (*Quercus* spp.), especially red oaks (*Q. rubra*). We took more than 3000 images of sap beetles that varied in species composition, insect counts, and background noise. We were interested in identifying two key vectors of oak wilt, *Caplothorax sayi* and *Colopterus truncatus*, in these images. Model performance metrics showed that both algorithms performed well (>90% precision) in

detecting and identifying *Ca. sayi* and *Co. truncatus*. We discuss practical applications of this detection approach and future steps to be undertaken to expand our work to other insect species.

11:15 Matej Stefancic[1]
[1]Trapview

Data quality challenge in IPM

With the pest resistance challenge traditional chemistry and genetically modified seeds are facing, new Integrated Pest Management (IPM) approaches that include various biological crop protection solutions are emerging. However, such solutions are far less effective if not used at optimal time - that creates a significant problem which was neglectable in the past. Therefore, a vastly improved understanding of pest insect populations in certain area is needed in order to utilize new IPM effectively.
In the presentation we will analyze the importance of real-time pest insect data for understanding pest insect population and what kind of data accuracy levels are needed to be able to use such data in modelling of future development of the population. We will also present how machine learning can be used on such data to accurately predict timing and intensity of different development stages of the insect for the next 7-10 days. Other data enhancements like improved temperature predictions and impact of data from other traps in the grid will be discussed as well.
Finally, we will present some of the most useful use cases of applying such data in day-day crop consultancy as well as for research and strategic planning.

11:30 Jean-Noël Candau[1], Felipe Dargent[1]
[1]Canadian Forest Service

New tools for monitoring the dispersal and population dynamics of forest insects

Forest insect outbreaks remain a major challenge to predict and manage. One crucial driver of outbreaks is long-distance dispersal as it often acts as the mode of propagation of the epidemic state. Yet, long-distance dispersal is challenging to study because it is often the result of unpredictable, singular events that occur for a few hours and a few times during the flight season. We will present recent development of new tools to monitor the dispersal and population dynamics of insects with an emphasis on forest pests. These new tools include automated pheromone traps, dispersal modelling and stable isotopes analysis. We will describe how these tools can be used in a coordinated fashion to better monitor and characterize spruce budworm moth dispersal and ecology across Eastern Canada.

11:45 Julien Saguez[1]
[1]CEROM – Centre de recherche sur les grains

Monitoring insect pests in field crops with automatic traps

Insect pest monitoring is typically performed in agriculture to determine the pest status in given locations. Data are collected to evaluate the pest occurrence and abundance, in order to inform producers if control methods should be used to manage the pest. In many cases, insect pest monitoring is typically performed using traps. Agronomists, technicians or students need to frequently visit sites to remove and count the number of catches in traps. These operations are expensive, time-consuming and have limited spatial and temporal resolution.

The emergence and improvement of new technologies (e.g. new sensors, miniaturization of electronics, development of artificial intelligence and software to automatically recognize objects) open new opportunities such as the development of automatic traps to monitor pests at a distant location.
The use of automatic traps equipped with sensors or cameras allows optimization of monitoring, with limited human support. Once traps are installed in the fields, data are collected automatically, on a daily basis (or more). Then, they are analyzed by algorithms, to provide automatic counting of insect pest caughts in traps. Automatic traps are practical decision-making tools to improve the surveillance and the management of agricultural insect pests. Results obtained with different pests during the recent years will be presented.

12:00 Lunch provided in Hall
12:15 ESC Annual General Meeting, Krieghoff – Suzor-Côté
Assemblée générale de la SEC

13:30 Plenary Session 3 - Session plénière 3

Dr David Rolnick
McGill University

AI for biodiversity and entomology

Artificial intelligence (AI) is increasingly a buzzword across society, but is it actually useful? In this talk, we will explore how AI is being applied impactfully in the study of biodiversity, and in particular in entomology, from camera traps to species distribution models. We'll look at both what is possible right now, as well as capabilities that may exist in the near future. Finally, we'll discuss how entomologists can learn about and apply AI tools when the need arises.

Citizen Science and Artificial Intelligence - Science citoyenne et intelligence artificielle (1/2) Krieghoff – Suzor-Côté

14:30-15:30
Moderator: Paul Manning

14:30 Shawn Abraham[1], Felix Sperling[1]
[1]University of Alberta

Morphometric analysis of semiaquatic fly microtrichia using SEM and a novel application of an AI image classification program

Morphometric analyses typically quantify differences between related species and can help frame evolutionary hypotheses. However, in practice they are often limited to characters visible with standard light microscopy, which could prevent analysis of relevant characteristics not visible at those magnifications. In Ephydridae, the shore flies, certain taxa are known to dive underwater as adults and maintain a surface attached bubble, even in hot springs or hypersaline lakes. We took scanning electron micrographs of *Paracoenia turbida*, an extremophilic fly collected from Yellowstone National Park's hot spring systems, and *P. bisetosa*, a closely related environmental generalist species, to visualize and allow quantification of microtrichia. Traditional measurements of microtrichial length and density were taken, and the AI-based image classification program Ilastik was novelly applied to measure density as well, showing consistent

agreement. *Paracoenia turbida* showed higher overall microtrichial density, a weak signal for longer microtrichia after accounting for body size, and a less variable length distribution in key body areas that are potentially involved in preventing wetting when submerged. These results suggest ecological relevance of microtrichial characters, highlighting the possibility of undetected evolutionary signal in other taxa. Additionally, the accuracy and precision of Ilastik shows potential for further use in counting microscopic surface features of arthropods.

14:45 Charles-Étienne Ferland[1, 2], Julia Meyer[1, 2], André-Philippe Drapeau Picard[1], Sonya Charest[1], Michel Saint-Germain[1], Maxim Larrivée[1]
[1]Insectarium de Montréal | Espace pour la vie, [2]Institut de recherche en biologie végétale

Mission Monarch: 8 Years of Participatory Science

Launched in 2016, Mission Monarch is a participatory science program led by the Insectarium de Montréal (Space for Life) which seeks to document the breeding habitats of the monarch butterfly Danaus plexippus (L.) across Canada. The data collected by the public can be used by scientists to better protect this emblematic species considered endangered in its summer breeding area.
Everyone can participate in carrying out monarch and milkweed inventories with Mission Monarque and we encourage parks, museums, municipalities, foundations and NPOs, as well as government organizations to use our platform and our open-access database in their conservation activities.
In this presentation, we present the state of the Mission Monarch program in 2024 and take a look at participation statistics with data from the 8th edition of the International Monarch Monitoring Blitz.
https://www.mission-monarch.org/fr

15:00 Paul Manning[1], Matthew McSweeney[2]
[1]Dalhousie University, [2]Acadia University

Knowledge of an insect pest negatively affects sensory perception and emotional response to blueberries

Managing insect pests is a major challenge for sustainable food production. Beyond the impacts of insects in reducing food quality and quantity, insects often elicit negative emotions in humans including disgust and fear. Negative emotional responses might lead to impaired enjoyment of food when insects are encountered alongside food. Using a sensory trial, we asked how providing information about an insect pest (Blueberry maggot, *Rhagoletis mendax* (Diptera: Tephritidae)) affects the sensory perception and emotional response to blueberries (the fruits it infests). Participants in the sensory trial consumed and evaluated an initial sample of blueberries. Participants were then randomly assigned to receive information about the blueberry maggot (Maggot-Informed) or a bumblebee (Bumblebee-Informed) that functioned as a control, before they evaluated a second blueberry sample of identical origin. Maggot-informed participants rated blueberries lower with respect to flavour, texture, and overall liking compared to Bumblebee-Informed participants. Maggot-Informed participants were less likely to describe blueberries as “sweet”, “juicy”, “fruity” and purple compared to initial samples. Maggot-Informed participants reported lower frequencies of “happy”, “joyful”, “pleasant”, and “satisfied” emotions but more frequently reported disgust compared to the initial sample. Bumblebee-Informed participants did not perceive any differences beyond a reduction in the frequency of reporting the emotion “happy” compared to the initial sample. Our results demonstrate that knowledge of an insect pest can negatively impact the sensory evaluation and emotional response to

food. This study reaffirms the low tolerance of consumers towards insects in fresh fruit and demonstrates the importance of effective pest control.

15:15 André-Philippe Drapeau Picard[1]
[1]Insectarium de Montréal

Web of sensation: Exploring the link between spider representation in online news stories and attitude towards spiders

Likely rooted in evolutionary history, fear of spiders might also have a cultural component. Recent studies have shown that a significant fraction of spider-related media reports is misleading and sensationalistic. Such a framing could contribute to fear, yet the link between spider-related news stories and such behaviors remains unexplored.
Using a public database providing a content-analysis of spider-related online media reports, we first examined whether the volume of spider-related queries in Google Trends, Wikipedia, and iNaturalist increased in the week following the publication of news stories. Then, we used sentiment analysis to assess the tone used within the news stories. For each story, we extracted a score representing the percentage of negative, neutral and positive sentences. We then used those scores as response variables and explored their associations with news-level variables.
Our results suggest that traditional media have a detectable impact on the behavior of the public towards spiders, supporting the hypothesis that the fear of spiders is perpetuated by culture. By recognizing the role of media in shaping attitudes towards spiders and acknowledging the benefits of accurate representation, we can lay the foundation for a more informed and harmonious relationship between humans and spiders.

Ecology - Écologie (3) Lismer-Leduc-Fortin

14:30-15:30
Moderator: Marc Bélisle

14:30 Ella Daly[1], David Renault[1]
[1]University of Rennes

Using morphometric functional trait metrics measurements to understand terrestrial invasion filters in the sub-Antarctic

Antarctic environments are thought to be predominantly abiotically-driven ecosystems where biotic interactions are less important for species persistence than less extreme regions. These environmental conditions likely shaped the evolution of native species and act as a strong filter for introduced species. They may therefore select for species with similar functional traits or specializations, facilitating the invasion of non-native species similar to native ones. However, in the sub-Antarctic, many of these environmental filters may be more relaxed due to milder environmental conditions, which could instead promote invaders with very different traits to native species so as to limit similarity and therefore competition. To better understand the invasibility of sub-Antarctic terrestrial ecosystems, we measured functional morphometric traits from eight communities across two sub-Antarctic archipelagos, Crozet and Kerguelen. We hypothesized that ecological filters are more important than environmental filters in sub-Antarctic arthropod communities and tested whether (1) sub-Antarctic arthropod communities have low functional redundancy and (2) that established invaders are functionally unique, rather than similarly specialized to native species. We found mixed support for our hypothesis and alternative hypothesis, that environmental filtering is currently more

important in this region and acts to select similarly specialized species. These results have implications for the changing invasibility of this region as environmental filters weaken due to warming temperatures.

14:45 Ilesha Ileperuma Arachchi[1], Stephen Heard[1], Christopher Ranger[2], Jenny Barnett[2], Deepa Pureswaran[3]

[1]University of New Brunswick, [2]USDA-Agricultural Research Service,OH,USA, [3]Canadian Forest Service, Fredericton, New Brunswick

Effect of temperature on brood production and fungal symbiont growth of the invasive ambrosia beetle *Xylosandrus crassiusculus*

Xylosandrus crassiusculus, a newly recorded invasive species in Southern Ontario, Canada, is expanding its range northward in North America. This pest, of Southeast Asian origin is established and spreading in the USA and many European countries. We examined how temperature influences the brood production of this invasive beetle and the growth of its fungal symbiont, *Ambrosiella roeperi*. We tested both beetle and fungal growth at six temperatures (16°C, 19°C, 22°C, 25°C, 28°C, and 31°C) using young Norway maple (*Acer platanoides*) stems (for beetles) and a sawdust-based medium (for the symbiont). After 40 days of incubation, we found that temperature significantly affected brood production. The highest average progeny occurred at 22°C (n=19), while the lowest was at 25°C (n=23), with the former being six times the mean brood produced at 25°C. We observed mature females only at 25°C, 28°C, and 31°C, with the highest mean at 28°C. Fungal growth varied significantly with temperature, with the highest mean diameters at 22°C and 25°C. Our findings suggest that *X. crassiusculus* can produce brood across this temperature range, but developmental rates may vary, particularly at lower temperatures. Additionally, it shows a potential impact of symbiont growth on brood development.

15:00 Rebecca Dean[1], Ella De Nicola[1], Heath MacMillan[1]

[1]Carleton University

Renal transcriptional plasticity during cold acclimation allows *Drosophila melanogaster* to prevent chill injury

Most insects, including *Drosophila melanogaster,* suffer from chilling injury in the cold, in part because of a progressive loss of ion and water balance that causes cell, and ultimately organismal, death. This ionoregulatory collapse has been linked to temperature-induced reductions in membrane-bound transporter activity (e.g. Na^+/K^+ ATPase, H^+-ATPase) in the renal system. Cold acclimation can improve low temperature tolerance and is associated with an increase in water and ion transport rates in the Malpighian tubules (equivalent to human kidneys) of cold acclimated flies, but a paradoxical reduction in the activity of ATPases in the same tissues. These findings raise questions about whether the current models of ion transport apply to cold-acclimated insects, or if modulation by other mechanisms, such as membrane structural reorganization allow for improved renal function in the cold. Here, we report the results of transcriptomic sequencing of the anterior Malpighian tubules of warm and cold-acclimated flies before, during, and after a cold stress. These results illustrate firstly that physiological state before a cold stress is more important to insect capacity to tolerate chill coma, and secondly that cold acclimation elicits a repair response during recovery, as opposed to an immune response. Together, these findings generate new hypotheses on how cold acclimation shifts injury thresholds and hint at novel renal mechanisms that serve to mitigate chilling injury.

15:15 Iniya Rajan[1], G. Christopher Cutler[1]
[1]Dalhousie University, Faculty of Agriculture, Truro, NS

Does exposure to mild heat and nutritional stress stimulate survival and reproduction in aphids?

Hormesis is a biphasic stress response characterized by high-dose inhibition and low-dose stimulation of biological responses. The phenomenon has been widely documented in insects, with implications for pest management. We examined whether exposure to mild heat shock and nutritional stress hormetically affects the reproduction and survival of green peach aphid, *Myzus persicae*. Adult aphids were exposed to 25 (control), 30, 34, and 38 ^{0}C for 2, 4, and 6 h. No significant ($P > 0.05$) stimulation of reproduction and survival were observed with any treatment, and both of these biological measures were inhibited at 38 ^{0}C. In nutritional stress experiments, adult aphids were deprived of food for 0, 24, 48, or 72 h, and nymph production and adult survival were recorded for 8 days. There was a significant treatment-day interaction ($P<0.0001$); nymph production exceeded control levels for both the 24 h and 48 h food deprivation treatments, but this occurred on different days, corresponding to the day after the food was reintroduced. Mean adult survival at the end of the experiment was greatest for the 24 h food deprivation treatment (67%), followed by the control (0 h, 46%), the 48 h food deprivation treatment (28%), and the 72 h food deprivation treatment (2%) ($P = 0.009$). Ongoing experiments will measure the effects on aphids of concurrent mild heat stress and nutritional stress, including RNA-seq transcriptome analysis, to identify differentially expressed genes and pathways associated with these responses.

IPM - Lutte intégrée (3)

Jean-Paul Lemieux

14:30-15-30

Moderator : Annie-Ève Gagnon

14:30 Janelle MacKeil[1], Dr. G. Christopher Cutler[1]
[1]Dalhousie University

Blueberry fruit fly management: degree-day, chemical, and biological solutions

Blueberry fruit fly *(Rhagoletis mendax)* is a major pest of lowbush blueberry in north-eastern North America. Integrated pest management (IPM) strategies for this insect are underdeveloped, and several key insecticides are under threat of deregistration or are subject to highly restrictive international pesticide residue limits, largely handcuffing growers who are required to maintain *R. mendax* maggot contamination levels below export limits. We are therefore undertaking a multi-pronged project incorporating phenological models with biological control and novel insecticides to equip growers with new tools for managing blueberry fruit fly populations. A degree-day (DD) model being developed for this insect, based on data from 12 weather stations in Nova Scotia, indicates fly emergence begins at 520 DD, peaks at 780 DD, and declines after 850 DD. Field trials confirmed blueberry fruit fly susceptibility to acetamiprid, novaluron + acetamiprid, cyazypyr, and flupyradifurone. Other products including chlorantraniliprole, *cyclaniliprole, spirotetramat, and bioinsecticide Beauvaria bassiana were less efficacious but may also be viable options for R. mendax control*. Because the field cricket *Gryllus pennsylvanicus* is a prominent omnivore in lowbush blueberry fields, we are also conducting predation and pesticide susceptibility and experiments with this insect. In predation experiments, crickets readily consumed blueberry fruit fly larvae and pupae on the soil surface but did not exhume or consume buried pupae. Preliminary results using the same insecticides listed above show crickets

are susceptible to acetamiprid, novaluron + acetamiprid, and cyclaniliprole, but are less so to chlorantraniliprole, cyantraniliprole, flupyradifurone, *spirotetramat, and B. bassiana*.

14:45 Didier Labarre[1, 2], Alice De Donder[1], Gabriel Ayotte-Breton[1], Daniel Cormier[3], Eric Lucas[2]
[1]Centre de recherche et d'innovation sur la canneberge, [2]Laboratoire de lutte biologique, Université du Québec à Montréal, [3]Institut de recherche et développement en agroenvironnement

Comparaison de méthodes de lâchers mécanisés de trichogrammes

La méthode de lâcher d'agents de lutte biologique la plus répandue demeure à ce jour les lâchers manuels. Or, dans le contexte de développement d'un programme de lutte biologique inondative à grande échelle, il devient impératif de mécaniser l'opération. Dans ce projet, cinq systèmes d'application mécanisés en vrac ont été comparés dans le cadre de lâchers inondatifs de trichogrammes (Hymenoptera: Trichogrammatidae). Les cinq systèmes étaient : 1) pulvérisation en solution aqueuse avec un système à injection directe, 2) pulvérisation en solution aqueuse avec un système à air comprimé, 3) épandage solide dans une matrice de perlite humidifiée au moyen d'un système de soufflerie, 4) épandage solide par drone dans une matrice de sable et 5) épandage par drone sans matrice. Les différentes méthodes ont été comparées sur la base de leur homogénéité d'application, le taux d'émergence des trichogrammes relâchés, le coût des systèmes et des matrices utilisées, le temps d'application ainsi que la main-d'œuvre nécessaire pour l'opération. Nos résultats suggèrent que les appareils d'application terrestres offrent la plus grande homogénéité au niveau de l'application par rapport aux drones. Cependant, l'épandage solide occasionne une plus grande diminution de l'émergence de trichogrammes, faisant de la pulvérisation en solution aqueuse, peu importe le type de système, la plus prometteuse quant à l'efficacité. D'un point de vue économique, le coût de ces systèmes est relativement compétitif et ils ne nécessitent qu'un seul opérateur. Ces résultats seront discutés dans un contexte d'applicabilité au sein de différents systèmes agricoles et forestiers.

15 :00 Alissandre Lavoie[1], Jacques Brodeur[1], Annie-Ève Gagnon[2]
[1]Université de Montréal, [2]Agriculture et Agroalimentaire Canada

Parasitic castration in the context of biological control for managing carrot weevil population

The carrot weevil (*Listronotus oregonensis*) is an increasing threat to Apiaceae crops in North America, particularly affecting carrot, parsley, and celery. Given the limitations of chemical control, it is crucial to explore alternatives such as biological control. The castrating nematode, *Bradynema listronoti*, has been identified as a promising biological control agent, as it sterilizes female weevil hosts. The main goal of this project is to better understand the interaction between *B. listronoti* and *L. oregonensis* to optimize biological control. We studied the impact of infection on various aspects of weevil biology: development time, size, dispersal capacity, overwintering survival, and cold tolerance. Our results show that parasitized larvae exhibit a longer development time to reach the adult stage (+2 days) and are slightly smaller (-7%) than healthy adult weevils. The walking capacity of parasitized adult weevils is comparable to that of healthy individuals, with an average distance of 3 meters per hour. The supercooling point is similar between infection treatments and sexes, with a mean temperature of -15°C. However, overwintering survival of parasitized males is significantly reduced, with only 21% of parasitized males surviving compared to 55% of healthy males. No such difference is observed for females, with a survival rate of about 60%. These findings demonstrate that *B. listronoti* affects the size, development time and, for male only, overwintering survival.

This suggests that females may persist in the fields and contribute to nematodes dispersion. In addition, nematodes decrease male overwintering survival, thereby lowering the reproductive potential of the pest population.

15:15 Annie-Ève Gagnon[1], Alissandre Lavoie[1], Liwen Han[2], Pierre Dutilleul[2]
[1]Agriculture and Agri-Food Canada, [2]McGill University

Advancing Detection and Understanding of Nematode Parasitism in Carrot Weevils Using Micro-CT Scanning

Parasitic relationships hold significant potential for developing biological control methods in order to manage pest populations. Recently, a parasitic nematode, *Bradynema listronoti*, was identified in adult carrot weevils (*Listronotus oregonensis*), a major pest of Apiaceae crops such as carrot, celery, and parsley. Unlike typical entomopathogenic nematodes, this species does not kill its host; instead, it sterilizes the weevils. Detecting the nematode within the weevil is challenging, as it requires destructive dissection or waiting for juvenile nematodes to emerge from the host more than four weeks after the adult weevil itself emerges. To enhance detection capabilities and elucidate the anatomical positioning of the nematode within the weevil, we applied micro-computed tomography (micro-CT) scanning technology. We scanned both infected and uninfected adult male and female weevils to visualize the infection and compare internal structures. The micro-CT images duly processed clearly revealed the presence of adult-stage female nematodes within the abdomen of adult weevils. Infected weevils showed evidence of internal organs being displaced, likely due to the release of the juveniles in the hemolymph. These results represent a significant first step towards the application of the technique to other developmental stages. This will allow us to better understand potential entry points for the nematodes and their movement within organs across developmental stages. These findings improve our ability to detect this nematode and provide deeper insights into the parasitic interactions within the system, thereby advancing our understanding and preparing for the future management of this agricultural pest.

Pollinators - Pollinisateurs (3) **Borduas**

14:45-15:30

Moderator: Geneviève Labrie

14:45 Thilina Hettiarachchi[1], Jason Gibbs[1]
[1]Department of Entomology, University of Manitoba

Review of the bee subgenus *Lasioglossum* (*Hemihalictus*) in western North America (Hymenoptera: Halictidae)

Sweat bees in the cosmopolitan genus *Lasioglossum* are some of the most diverse and commonly collected bees in terrestrial ecosystems. The subgenus *Lasioglossum* (*Hemihalictus*) has never been reviewed in western North America. A taxonomic study was conducted to assess the status and validity of species in this region. Twenty-five species of *L.* (*Hemihalictus*) were treated, five of which are described as new. Linear discriminant analysis and partitioning around medioids were used to test species limits in the *L. arizonense* species complex. Two Palaearctic species are documented in North America: *L. villosulum* (Kirby) and *L. buccale* (Pérez). The male of *L. subobscurum* (Cockerell) is described for the first time. *Lasioglossum vanduzeei* (Sandhouse & Cockerell) is resurrected from synonymy with *L. arizonense. Lasioglossum aspilurum*

(Cockerell) is considered a senior subjective synonym of *Halictus humboldtensis* Michener. Western Nearctic species in the *L. nitidiusculum* species-group are included in two species complexes: *L. ruficorne* (including *L. ruficorne, L. vaporellum*, and *L. pulveris*) and *L. diatretum* (including *L. diatretum, L. synthyridis*, and *L. supranitens*) species complexes, which likely include unverified synonymies.

15:00 Joanna Silva[1], Taehoon Kim[2], Jessica Griesheimer[3], Kevin Begcy[2], Sandra Wilson[2], Xavier Martini[3], Rachel Mallinger[3]

[1]Ph.D. Candidate at University of Florida, [2]Environmental Horticulture Department, University of Florida, [3]Entomology and Nematology Department, University of Florida

Effects of plant origin and water irrigations on floral resource value for pollinators

Pollinator gardening has gained momentum in recent years with increased consumer interest in selecting native over non-native plant species to reduce water dependence and maximize biodiversity value in both public greenspaces and domestic gardens. Native plant species can enhance biological control and benefit ecosystems and wildlife. They are also often better adapted to local environmental conditions, including temperature and rainfall, which increases their survival and reduces associated maintenance costs. Commercially available pollinator-friendly plant mixes often include both native and non-native species. A two-year study was conducted to determine the main effects of plant origin (native or non-native) and water irrigation (full or partial irrigation) on vegetative traits (plant size, flowering), floral resources (nectar volume, pollen protein, and pollen quantity), and pollinator recruitment to twenty plant species including 10 congeneric pairs of native and non-native species that were planted in two locations in Florida, USA. The results revealed that native plants outperformed non-native plants, exhibiting more growth and greater floral abundance regardless of the irrigation treatment. While there was no overall effect of irrigation on plant size or flower abundance, floral rewards responded differently. Nectar, floral display, and pollen quantity were affected by the origin of plants, whereas pollen protein responded to irrigation. Pollinators visited more native plants under full irrigation, but the preferences changed through groups. Generalist bees showed no difference, while wild native bees preferred native species well irrigated. Thus, in general, the effects of plant origin were stronger and more consistent across years than irrigation.

15:15 Stéphanie Gagnon[1], Jessica Gillung[1]

[1]McGill University

Insects and cranberries: Understanding floral resources for wild pollinators around cranberry farms

As a consequence of anthropogenic disturbance, we are now witnessing the Earth's sixth massive extinction, leading to the demise of the most abundant and biologically significant group of animals, insects. Modern agriculture is a fundamental pillar of our society. Nonetheless, it is arguably the most polluting industry on the planet, acting as the primary catalyst for deforestation and habitat degradation. Thankfully, it is becoming increasingly popular to incorporate sustainable management practices to promote habitat heterogeneity and ecosystem stability. In Quebec, given the significant drive to make the cranberry farming industry as sustainable as possible, edges of farms are often left untouched to promote local biodiversity and pollinators find refuge and resources in these areas. Floral strips represent a widespread strategy implemented globally in urban spaces to enhance green areas. However, current knowledge about the specific pollinators present and the roles they play within these systems remains incomplete. Therefore, we analyzed plant-insect networks around organic and conventional cranberry bogs to gain deeper insights into

ecosystem functioning across varied farm management practices. We collected samples in the summer of 2023 and 2024 in the *Centre-du-Québec* region from June to July along four transects in cranberry beds. Preliminary results reveal a higher abundance of insects in organic farms, primarily belonging to Hymenoptera and Diptera, with Asteraceae identified as the most abundant flower family these insect groups interact with. Surprisingly, we did not observe a correlation between flower abundance and farm management, indicating that floral diversity does not necessarily decrease around conventional farms.

15:30 Break - Pause

Citizen science and artificial Intelligence - Science citoyenne et intelligence artificielle (2) Krieghoff – Suzor-Côté

15:45-16:45

Moderator : Paul Manning

15:45 Amélie Grégoire-Taillefer[1], Maxim Larrivée[1], Julia Mlynarek[1], Jean-François Gélinas[1]
[1]Insectarium de Montréal - Espace pour la vie

Nunavik Sentinels: documenting northern pollinator biodiversity and supporting Indigenous youth leadership through participatory research and education

There is compelling evidence that a biodiversity crisis is underway, driven by pollution, climate change, overexploitation, and invasive species. These pressures are reshaping ecosystems and the connections between species, prompting urgent efforts to document various species. The effects are particularly pronounced in Canada's northern regions, where monitoring of insects and other arthropods is critically needed to protect these fragile environments. Pollinators play a crucial role in the production of culturally significant berries, which are vital for Indigenous communities as sources of food and medicine. Monitoring the diversity of these insects is essential for understanding their habits, distribution, and how best to protect them.

Nunavik Sentinels, a community-based participatory research program, seeks to address these monitoring gaps by fostering collaboration among northern organizations, community members, and scientists. This innovative insect monitoring initiative, led by the Montreal Insectarium - Espace pour la vie, makes entomology accessible to young Indigenous participants by equipping them to lead expeditions into unexplored habitats and engage in data collection. The program is structured around four key pillars: training land camps, summer employment opportunities, educational kits, and research activities. Since 2015, monitoring has been conducted using simple, cost-effective methods tailored to the northern environment, following a standardized protocol over eight weeks each summer in participating communities. The addition of light interception traps and autonomous machines to the traditional net and pan traps ensures effective and standardized biodiversity monitoring. The collected data is made accessible through the SIKU platform and communicated back to the communities, promoting transparency and ongoing collaboration.

16:00 Dominic Ouellette[1], Maxim Larrivée[1], Michel Saint-Germain[1], Julia Mlynarek[1], Andre-Philippe Drapeau Picard[1], Amélie Grégoire Taillefer[1], Thierry Boislard[1], Thomas Théry[1], Mario Bonneau[1], Nicolas Haket[1], Bruno Demers Moreau[1], Audrey Mallet[1], Jérémie Pelletier[1], Marjolaine Giroux[1], Jennifer De Almeida[1]
[1]Insectarium de Montréal

Ecosystèmes exceptionnels : une nouvelle initiative de l'Insectarium de Montréal

La dégradation rapide des écosystèmes par l'activité humaine est l'une des causes principales de l'effondrement de la biodiversité. Heureusement, les réserves écologiques et autres zones de conservation qui parsèment le territoire québécois agissent comme des remparts à cette crise écologique. Ces écosystèmes exceptionnels présentent des caractéristiques écologiques distinctes et abritent une diversité d'espèces fauniques ou floristiques, dont certaines rares ou menacées. Divers projets d'inventaires et de recherches ont permis de documenter la biodiversité unique de ces écosystèmes, mais les études sur l'entomofaune restent sous-représentées et rares. En 2021, l'Insectarium de Montréal a mis sur pied un projet visant à documenter la biodiversité d'habitats divers de façon standardisée selon l'expertise des employés de l'Insectarium et de collaborateurs. Les inventaires ciblent principalement des groupes comme les coléoptères, fourmis, araignées et lépidoptères. Dans un but de suivi à long terme de la biodiversité, ces zones seront inventoriées tous les cinq ans à l'aide de méthodes d'échantillonnage passif et actif. Je présente les réserves visitées depuis 2021, la méthodologie de collecte et le traitement des échantillons. Finalement, quelques résultats surprenants des réserves écologiques du Boisé-des-Muir et du Pin-rigide. Parmi les résultats préliminaires, des nouvelles mentions, des espèces rarement collectées ou pouvant bénéficier d'un statut de conservation. À long terme, ce projet fournira beaucoup de données sur l'histoire naturelle de ces espèces et de leurs habitats.

16:15 Ludovic Leclerc[1, 2], Christian Hébert[2], Mathieu Bouchard[1]
[1]Université Laval, [2]Ressources naturelles Canada

Tracking Biodiversity with Beetles: A 20-year Case Study within a Mature Temperate Forest of Quebec

The temperate forests of eastern North America are among the most ecologically diverse ecosystems, yet they have experienced significant fragmentation since European settlement. This fragmentation, driven by both anthropogenic and natural disturbances, has profoundly reshaped the forest mosaic. In Quebec, research on the impact of these disturbances on insect diversity has largely focused on the boreal forest, providing limited insights on the biodiversity of undisturbed and mature forests, where insect populations are presumed to remain stable over time. To address this knowledge gap, we studied beetle communities in La Mauricie National Park to assess whether these communities remain stable over a 20-year period as mature forest stands age. Data were collected in 2003 and 2023 from three forest types: yellow birch stands, sugar maple stands, and red spruce stands. Ground-dwelling beetles were collected using pit-light traps, while flight-interception traps targeted flying beetles, resulting in the collection of 16,534 specimens and 398 species. Environmental data on habitat structure and climate were also recorded. While no significant changes in the basal area of dominant tree species were observed after two decades, flying beetle abundance and diversity increased significantly in 2023. Both ground-dwelling and flying beetle assemblages exhibited significant taxonomic and functional shifts after 20 years. These results highlight subtle changes in beetle communities as forests age, underscoring the need for a long-term biodiversity monitoring network in Quebec's protected areas.

16:30 Marshall Ritchie[1], Emily McColville[1], Jennie Mills[1], Jennifer Provencher[2], Sue Bertram[1], Heath MacMillan[1]
[1]Carleton University, [2]Environment Canada

The disadvantage of having a big mouth: the relationship between insect body size and microplastic ingestion

Microplastics (MPs; plastics <5 mm in size) have been silently accumulating worldwide over the last century, and the environmental consequences of this pollution remain largely unknown. The potential interactions among terrestrial organisms, such as insects, with microplastics (MPs) have been particularly understudied. This is concerning given that an estimated 6800 megatons of plastics have been directed to terrestrial systems. We conducted a study using a generalist insect, a cricket (*Gryllodes sigillatus*), to investigate how behaviour and growth enable the ingestion of microplastics (MPs) of varying sizes. We measured changes in growth during development and studied the extent to which MPs are broken down and deposited back into the environment. We fed crickets fluorescent MPs (28-500 µm; 1% w/w) mixed into a standard diet and tracked changes in cricket morphology throughout development while examining the frass for MPs. By comparing ingested plastic size to body size, we sought to identify at what point in growth and development insects could likely ingest MPs of different sizes. We also investigated whether differently sized plastics affected survival and growth and how the mouthparts of generalist insects allowed for ingesting MPs of varying sizes. We found crickets did not ingest large beads early in development, and the size of the labium (lower lip) of the cricket could be used to predict the ingestion of MPs. These findings reveal how insects are likely contributing to increasing and decreasing the size of present MPs and can help inform policy regulation surrounding MP production and disposal.

Ecology - Écologie (4) Lismer-Leduc-Fortin

15:45-17:00
Moderator: Marc Belisle

15:45 Aldo F. Ríos Martínez[1], Boyd A. Mori[1]
[1]Department of Agricultural, Food and Nutritional Science, University of Alberta

Exploring edge effects and dominance by *Pterostichus melanarius* (Coleoptera: Carabidae) in ground beetle communities in central Alberta canola

Ground beetles (Carabidae) are among the most abundant generalist predators in agricultural fields in North America contributing to pest suppression. The establishment and maintenance of grassy field edges can enhance ground beetle communities through the provision of overwintering sites, microhabitat diversification, and refuge from field management-related disturbances. Understanding the spatio-temporal patterns of ground beetle communities in agricultural fields in relation to grassy field edges can benefit conservation biological control efforts. A ground beetle survey was conducted in ten canola fields in central Alberta over two years. Fields were sampled three times per growing season along field edges adjacent to grassy habitat and field interiors (100 m from the edge). Collected ground beetles were identified to species and functional traits were obtained from the literature. We compared taxonomic and functional diversity of ground beetles between field edge and interior throughout the growing season. We also examined spatio-temporal changes in ground beetle community composition, activity density, and species dominance. Finally, we used indicator species analysis to explore associations of species to either habitat. We found that ground beetle assemblages were heavily dominated by *Pterostichus melanarius*, which seemed to dampen ecological

responses of ground beetle communities to grassy edges. The ecological implications of *P. melanarius* dominance will be discussed under a biological control framework.

16:00 Sabina Noor[1], Emma Despland[1]
[1]Concordia University Montreal

Echoes of the Wild: Do Mixed-Species Plantations Maintain Arthropod Diversity Like Natural Forests?

Arthropods are integral to the resilience of forest ecosystems and engage in essential trophic interactions such as herbivory, predation, and decomposition—that sustain ecosystem stability. This diversity, reinforced by variations in tree species, canopy openness, and microhabitat structures, is vital for the overall health of forest communities.

Our study aimed to detect if mixed-species plantations could mimic the arboreal herbivorous arthropod community diversity fundamental in that of natural forests. Focusing on young white spruce (*Picea glauca*) trees within the Eastern boreal forest of Canada (Quebec), we selected ten sites in open-grown plantations and naturally regenerated under-canopy forest stands, examining ten trees per site. Sampling methods, such as beat sheeting and timed surveys, were carried out in the early and late summers of 2021 and 2022, with the 2023 efforts limited to early summer only due to forest fires. Comparison of functional groups included herbivores, predators, parasitoids, and decomposers. Our analysis encompassed beta diversity and functional diversity via community-weighted Weighted Mean (CWM), revealing forest habitats rich in herbivores, featuring their crucial ecological roles in such habitats. In total, the research captured 10,872 arthropods, comprising 61 distinct species. Interestingly, mixed-species plantations demonstrated high species abundance and reflected the complex functional diversity typically found in natural under-canopy environments of white spruce. However, these patterns exhibited seasonal and annual variation. These findings suggest that while mixed-species plantations can approximate natural forest dynamics regarding tree-associated arthropod diversity, the full ecological ramifications of these management practices on boreal forest health and integrity remain inadequately understood.

16:15 Meganne Harrison[1], Jasmine Janes[1], Dezene Huber[1]
[1]University of Northern British Columbia

Forage pests in agroecosystems of British Columbia's central interior and their relationships with the landscape

Monitoring and identifying insect and spider communities within forage crop fields and adjacent areas is increasingly important as climate change and changing weather patterns have altered the usual geographic ranges of pest species and the timing of insect activity and plant emergence. Producers and pest managers often do not know which pests are in their fields and pest damage can affect yields, particularly in years with poor growing seasons. To address this, we monitored insect communities during the 2022 and 2023 growing seasons using sweep net collections at 15 sites along a ~600km corridor in the central interior of BC. Grasshopper populations were low in 2022 but much higher in 2023. We also sampled other pests in both years, including prominently the aster leafhopper, *Macrosteles quadrilineatus* (Hemiptera: Cicadellidae); the pea aphid, *Acyrthosiphon pisum* (Hemiptera: Aphididae; and *Lygus* species (Hemiptera: Miridae). We are identifying and sorting our samples using a combination of morphological keys and DNA barcoding and are analyzing crop pest assemblages in relation to surrounding land use and management - particularly whether the forested edges surrounding the fields are influencing pest communities in the fields.

16:30 Noa Davidai[1], Samuel Evan Gonzalez-Fleurant[1], Emma Despland[1], Carly Ziter[1]
[1]Concordia University

Predicting spongy moth reservoir locations, between outbreaks based on forest-composition

The invasive spongy moth (*Lymantria dispar dispar)* is a periodic outbreaker responsible for severe defoliation of hardwood and softwood trees in North America. Understanding aspects of biotic and abiotic factors impacting the survival and population density of *Ldd*, across a geospatial gradient can provide insight into these outbreaks in its non-native habitat. Between periods of outbreak, *Ldd* moths maintain lower-density reservoir populations that do not cause as much notable damage to forests. These populations provide a source for future outbreaks but are discreet and challenging to identify. As part of my doctoral work, I explore factors, such as forest composition and historical *Ldd* densities, that may help predict the locations of low-density populations, in-between outbreaks. I surveyed sites across Quebec during the breeding and flying seasons of 2023-24 and hypothesize that there will be: a higher density of *Ldd* in forest stands consisting of both oak and pine compared to stands composed of either one without the other; and a lower density of *Ldd* in historically severe outbreak locations. The ability to identify these variables could facilitate forest management and control practices that may head off an oncoming outbreak.

16:45 Simon Coroller[1]
[1]Université de Sherbrooke

Bons, brutes et truands ; oisillons, asticots et guêpes : Comment les contextes agroenvironnementaux influencent leurs dynamiques tri-trophiques à l'intérieur d'un nid?

L'intensification agricole, caractérisée par l'homogénéisation des paysages, l'utilisation massive de pesticides et des pratiques de fauchage fréquentes, perturbe profondément les communautés d'oiseaux, d'insectes et les dynamiques trophiques des réseaux dont ils font partie. Pourtant, rares sont les études longitudinales explorant les effets de ces contextes agroenvironnementaux sur plusieurs niveaux trophiques déconnectés de la production agricole.

En analysant 2673 nids d'Hirondelles bicolores répartis entre l'Estrie et la Montérégie de 2004 à 2019, j'ai étudié les interactions entre hôtes, parasites et hyperparasites, en fonction de divers contextes agro-paysagers, météorologiques et phénologiques, ainsi que des mécanismes de densité-dépendance. Les oisillons sont hôtes d'asticots ectoparasites *Protocalliphora* (Diptera), dont l'abondance est mesurée via les puparium trouvés dans le nid après leur métamorphose. Une analyse minutieuse m'a permis d'identifier ces ectoparasites, de mesurer leur taille, et de déterminer leur succès d'émergence. Les échecs d'émergence sont attribués aux guêpes parasitoïdes *Nasonia*, lorsqu'il y a des signes d'hyperparasitisme sur les puparium. Mes modèles statistiques montrent une baisse significative de la charge en *Protocalliphora* dans les habitats agro-intensifs (monocultures de maïs ou de soya avec usage intensif de pesticides), ainsi qu'une diminution de l'hyperparasitisme par *Nasonia*. Les nids contenant davantage d'oisillons et des séjours prolongés dans le nid avaient des charges parasitaires plus élevées, augmentant le risque d'hyperparasitisme. En plus de réduire la densité aviaire, l'agriculture intensive semble affecter les densités en ectoparasites et hyperparasites, par des effets directs et des cascades trophiques complexes, illustrant l'impact de ces pratiques sur des réseaux trophiques non liés à la production agricole.

IPM - Lutte intégrée (4)

Jean-Paul Lemieux

15:45-17:00

Moderator : Annie-Ève Gagnon

15:45 Preetpal Singh[1], Chris MacQuarrie[2], Sandy Smith[1]

[1]University of Toronto, [2]Natural Resources Canada-Canadian Forest Service

Does insecticide exposure undermine the fitness of an introduced biocontrol agent for integrated emerald ash borer management?

Integrated pest management (IPM) strategies for invasive species such as the emerald ash borer (EAB) need to combine chemical control with biocontrol agents to protect ash trees. Systemic insecticides are widely used for EAB management in urban areas, while classical biocontrol with introduced natural enemies is a key strategy for managing EAB populations in natural forests. When used in tandem with biocontrol, systemic insecticides may have negative effects on biocontrol agents. To evaluate the impact of systemic insecticides on the fitness of EAB biocontrol agents, we assessed the non-target effects of azadirachtin, a widely used systemic insecticide, on *Tetrastichus planipennisi*, an introduced larval parasitoid of EAB. We developed a novel bioassay protocol where EAB larvae reared on green ash sticks were briefly fed an artificial diet containing azadirachtin at concentrations known to cause 30% and 50% mortality in EAB larvae. After azadirachtin exposure, EAB larvae were returned to ash sticks and exposed to parasitism by *T. planipennisi*. Insecticide exposure reduced parasitism of EAB by *T. planipennisi* and affected the fitness of *T. planipennisi* by altering parasitoid sex ratio and decreasing adult emergence, female body size, potential fecundity, and adult longevity. Our study establishes a methodological framework to test non-target effects of insecticide exposure on larval parasitoids for woodboring insect pests. Findings suggest there are negative interactions between systemic insecticides and EAB biocontrol agents that may impact the success and sustainability of IPM strategies for EAB in urban landscapes.

16:00 Richard Trudel[1]

[1]GDG Environnement

Le FraxiProtec, outil de lutte biologique pour le contrôle des populations d'agrile du frêne

L'agrile du frêne, *Agrilus planipennis* Fairmaire (Coléoptères : Buprestidae), est un coléoptère originaire d'Asie et qui s'attaque aux frênes sains (*Fraxinus* Linnaeus; Oleaceae), en se nourrissant de phloème. Il a été détecté en 2001 à Détroit, au Michigan et l'année suivante à Windsor en Ontario, où l'agrile du frêne a poursuivi ses ravages. Au Québec, il a été observé pour la première fois en 2008, à Carignan et depuis, il a agrandi son aire de distribution à plusieurs régions du Québec, dont au Bas Saint-Laurent ainsi qu'au Saguenay.

Malheureusement, les tactiques pour gérer l'agrile du frêne sont limités et difficiles à évaluer, principalement en raison de la difficulté de détecter de nouvelles infestations. Cependant, plusieurs stratégies de gestion contre l'agrile du frêne ont été déployés en Amérique du Nord, qui se concentrent principalement sur la lutte biologique classique et la protection systémique des arbres de grande valeur.

Le FraxiProtec, un dispositif d'autodissémination utilisant l'isolat de champignon *Beauveria bassiana* CFL-A, a été développé pour infecter les adultes de l'agrile du frêne et ainsi réduire leurs populations. Au cours de plusieurs années d'études de terrain, il a été possible d'observer la capacité de dissémination de l'agent pathogène au-delà des zones traitées ainsi qu'une diminution significative de la croissance moyenne des populations de ce ravageur. Suivant ces études, des analyses exploratoires ont été réalisées sur des

paramètres tels que la superficie à traiter, le frêne densité et densité FraxiProtec pour documenter les relations potentielles, qui pourraient être utilisées dans la détermination d'une prescription.

16 :15 Jeff Gauthier[1], Karin Van der Burg[2], Katie Marshall[3], Brian Boyle[1], Michel Cusson[4], Amanda Roe[5], Roger C. Levesque[1]

[1]Institute for Integrative and Systems Biology, Université Laval, Quebec, QC, Canada, [2]Department of Biological Sciences, Clemson University, Clemson, SC, USA, [3]Department of Zoology, University of British Columbia, Vancouver, BC, Canada, [4]Laurentian Forestry Center, Natural Resources Canada, Quebec, QC, Canada, [5]Great Lakes Forestry Center, Natural Resources Canada, Sault-Ste-Marie, ON, Canada

Genomic basis for the non-diapause phenotype of eastern spruce budworm (*Choristoneura fumiferana*)

Background: The Eastern spruce budworm (*Choristoneura fumiferana*) causes massive defoliation in Canadian forests, leading to millions of hectares lost over several years. There is an urgent need for population control strategies. Interestingly, laboratory-grown spruce budworm colonies can be made to inheritably skip diapause (i.e. a dormant state essential to winter survival). Therefore, introducing non-diapause (ND) budworm in wild-type populations could help limit outbreaks by decreasing their overwintering fitness.

Methods: The genome of a ND budworm larva (6th instar, male) was sequenced with both Oxford Nanopore MinION dynamic reads and Illumina MiSeq 2 x 300 bp short reads. Dovetail Omni-C was used to further scaffold the draft assembly. For gene annotation and gene expression analysis, we used comparative RNAseq across early life stages (i.e. eggs, 1st, and 2nd instar larvae) from wild-type (WT) and ND *C. fumiferana*.

Results: The resulting non-diapause spruce budworm assembly had a total size of 572 Mbp, about 50 Mb short of the WT assembly produced by Cusson *et al.* (2022). About 90% of all bases were contained within the largest 30 contigs. No major genome rearrangements were found between both WT and ND genomes, however, major changes in gene expression associated with glycolysis and environmental signal processing happened as early as halfway through first instar.

Conclusion: The non-diapause phenotype appears underlain by early developmental gene expression shifts, but no major changes in genomic structure, indicating a possible involvement of small genetic variations or epigenetic regulation, hence the heritability of the ND trait.

16:30 Sara Edwards[1], Emily Owens[1], Rob Johns[1]

[1]National Natural Resources Canada, Canadian Forest Service - Atlantic Forestry Centre, Fredericton, New Brunswick

Efficacy of the Early Intervention Strategy for suppressing spruce budworm outbreaks

Spruce budworm (*Choristoneura fumiferana*) is a major defoliating pest of spruce and fir in northeastern North America. Early Intervention Strategy (EIS) is an area-wide management program aimed at containing the spread of spruce budworm in Atlantic Canada. In brief, intensive regional monitoring is used to help identify emerging 'hotspots' along the leading edge of outbreak, which are then treated with relatively narrow-spectrum insecticides (i.e., Btk or tebufenozide) to slow or prevent further population expansion. After 9 years of monitoring, we are now able to evaluate the efficacy of EIS in its ability to suppress hotspots within treatment areas and if hotspot suppression conferred area-wide outbreak suppression in

northern New Brunswick. Results suggest that under the right conditions the EIS has strong potential for containing budworm outbreaks with minimal impacts on non-target species.

16:45 Gwylim Blackburn[1]
[1]Canadian Forest Service

Profiling invasive traits via genomics: a case study in spongy moth female flight capability

Traits that strongly shape invasion risk ("invasive traits") offer powerful targets for profiling and managing invasive populations. In this presentation I review types of invasive traits and consider conditions in which they can best advance invasive species management. I then illustrate these concepts using the spongy moth, for which our group is developing a genomic assay to profile female flight capability—a key trait mediating spongy moth population establishment and spread.

Pollinators - Pollinisateurs (4) **Borduas**

15:45-16:45
Moderator: Geneviève Labrie

15:45 Samm Reynolds[1], Emily Forrester[1], Carolyn Callaghan[2], Lauren Des Marteaux[3], Jeff Skevington[3], Andrew Young[1], Nigel Raine[1]
[1]University of Guelph, [2]Canadian Wildlife Federation, [3]Agriculture and Agri-Food Canada

Syrph-ing habitats: the impact of seminatural habitats in agricultural landscapes on native flower fly populations in southern Ontario, Canada

Pollinator activity is critical for economically sustainable yields of 75% of global food crops, valued at $577 billion USD annually. Increased native pollinator diversity improves pollination success, increases seed set and yields in many agroecosystems. Although critical to understanding the abundance and diversity patterns of insects, pollinator habitat studies at a species-specific level are lacking in Canada. As such, there is a dire need for more research investigating these niches (including the nesting and foraging requirements) of native pollinators associated with various landscape compositions. Our objectives were to understand how pollinator biodiversity is affected by habitat type and landscape features. To do this, we assessed differences in pollinator richness (wild bees and flower flies (Syrphidae)) and abundance among three habitat types (forest, field margin and grassy margins) on agricultural fields in two counties with different landscape features. We deployed 60 Malaise traps (20 in each habitat of interest) in 2021 and samples were collected every three days for eight weeks. Our research provides novel data on species-level identification of flower flies inhabiting different habitat types within agroecosystems in southern Ontario. Preliminary syrphid results show that habitat is significant in the model for abundance, with field margin having the highest abundance overall and that habitat is not significant in the species richness model. Results also show that there are significant differences between the two counties of interest. Our results will be discussed in detail and will be used to inform policy on agricultural landscape design to improve pollinator abundance.

16:00 Julia Mlynarek[1], Olivier Slupik[2], Frédéric McCune[2], Valérie Fournier[2]
[1]Insectarium de Montréal, [2]Université Laval

The forgotten: making the case to include Stratiomyidae (Diptera) in pollination studies

Most pollination studies focus on bees, hoverflies and sometimes butterflies. But there are many other groups of insects that also have potential as pollinators, including beetles and many other families of flies. We make the case that Stratiomyidae (soldier flies) should be included in pollination studies. We used specimens collected during a 2019-2020 study looking to compare bees and hoverflies diversity along an agricultural intensification land-use gradient. We identified the soldier flies collected during that study to compare abundances and diversity to those of flower flies and bees. We also measured hair density, a morphological defining factor, and contrasted them between the different groups to present where soldier flies fall within the continuum of pollinator potential. Even though we focus on one additional family, we hope to encourage everyone doing pollination ecology research to include not so obvious families to have a better understanding of what is happening in the landscape.

16:15 Samuel Ramsey[1]
[1]University of Colorado, BioFrontiers Institute

Evaluation of efficacy of formic acid and thermal remediation for management of honey bee parasites *Tropilaelaps* and *Varroa* mites in central Thailand

The western honey bee, *Apis mellifera*, faces a new threat from the spread of parasitic *Tropilaelaps* (Tropi) mites, specifically *T. mercedesae*, which adds additional complexity to an apicultural landscape heavily impacted by Varroa destructor and its associated virus complex. In this study conducted in central Thailand, we investigated the efficacy of two methods of applying formic acid and a thermal remediation technique in controlling Tropi mites and *Varroa*. We focused our attention on the reproductive stage of the mites which is restricted to capped brood cells. Results revealed that both formic acid treatments we tested (Formic Pro and liquid formic acid) demonstrated an immediate and substantial reduction in live Tropi and Varroa populations, maintaining near-zero levels for the 3- week duration of the study. In contrast, thermal remediation, employing heating pads, exhibited a more gradual decline, achieving an 85.42% reduction in Tropi mites and a 92.33% reduction in Varroa mites by week three. Both applications of formic acid maintained residual efficacy continuing to result in dead mites being found in cells 14 days post exposure to the chemical. No dead mites were found inside of cells after the first week of the study in the thermal remediation treatment. Notably, heat-treated colonies experienced an unexpected resurgence in mite populations during week two. The findings contribute valuable insights into potential strategies for mitigating the threat of Tropi mites (via chemical and nonchemical treatment measures) and highlight the urgency of further research to safeguard global honey bee populations.

16:00 ESC Incoming Board of Directors Meeting Pilot room
Réunion du nouveau conseil d'administration de la SEC
Invited guests only - Personnes invitées seulement

POSTER SESSION Hall

17:00-18:30

President's Prize (ESC students) - Prix du président (étudiants de la SEC)

Prix Melville-DuPorte (étudiants de la SEQ)

01 Laura Lapierre[1], Arthur Thompson de la Chenelière[1], Martha Paola Rivera Rodriguez[1], Vincent Banville[2], Martin Lapierre[3], Grant W. Vandenberg[1], Marie-Hélène Deschamps[1]

[1] Université Laval, [2] Centre de Développement Bioalimentaire du Québec, [3] La Crevette du Nord Atlantique Inc.

Effects of Shrimp Powder as a Finisher-Feed Supplement on the Reproductive Success of the Black Soldier Fly (*Hermetia illucens*)

As food security issues increase from the global population growth in the current climate crisis, the upcycling of organic waste management by black soldier fly larvae (BSFL) into animal feed and fertilizer could contribute to new circular economy models in agriculture. In the North Atlantic fisheries industry, shrimp shells and heads are transformed into a safe and edible powder with high contents in PUFAs and chitin. It was hypothesized that an increase of PUFAs in the diet could improve the quality of the larval fatty acid composition and thus modify pupation rate and enhance reproductive success (clutch number, egg mass, emergence, sex ratio, fecundity). Furthermore, hydrolysis of chitin complexes may also increase the protein digestibility. This preliminary project involved nutritional trials (n = 3/diet; n = 600 larvae/tank; 30 mg/ind./d) with (10% inclusion, dry basis) or without (Gainesville diet, 70% HR) crude or hydrolyzed shrimp powders as a finisher-feed supplement for the prepupal stage (day 10 to 17 post-hatching). No significant difference in growth performance or bioconversion was observed. However, the imago's rate of emergence in rearing cages (28 ± 14 vs. 18 ± 8 Vs 18 ± 5 flies/d) decreased while the hatching of neonates remained stable in average. These preliminary results will provide a better understanding of the advantages and limitations of including shrimp co-product substrate in BSF production as well as the technical and economic feasibility to offer new local markets for shrimp processors.

02 Sophie Kasdorf[1], Susan Bertram[1], Heath MacMillan[1]

[1] Carleton University

Microalgae-based Diets Lead to Growing Pains for an Edible Cricket Species

Edible insects are an attractive source of sustainable protein to feed the growing global population. However, the unsustainability of traditional feed ingredients used for commercial insect farming like fishmeal and soy has led to interest in environmentally-friendly alternatives. Microalgae are rich in protein and other nutrients, and can be cultivated using limited resources, potentially with waste products (like insect frass) as a source of organic carbon. Therefore, they are a promising feedstock for insects that may fit within the framework of a circular bioeconomy. However, there is limited knowledge on how insects perform on diets containing microalgae. We investigated the use of a microalgae species (*Euglena gracilis*) as feed for crickets (*Gryllodes sigillatus*). Unfortunately, in an isolated rearing environment, crickets fed a 100% microalgae diet experienced minimal growth and a 0% survival rate. Intriguingly, growth and survival of crickets fed a 2:3 microalgae:farm feed diet matched crickets fed the control diet, and had a significantly higher growth rate

than crickets fed a 2:3 cellulose (filler):farm feed diet. Therefore, crickets are capable of extracting some, but not all, of the nutrients from microalgae necessary to thrive. Future research will explore potential supplementation of microalgae-based diets to improve cricket performance and inform development of renewable food systems involving insects and microalgae.

03 Arthur Thompson de la Chenelière[1], Martha Paola Rivera Rodriguez[1], Laura Lapierre[1], Vincent Banville[2], Martin Lapierre[3], Grant Vandenberg[1], Marie-Hélène Deschamps[1]
Université Laval, [2] Centre de développement bioalimentaire du Québec, [3] La crevette du Nord Atlantique Inc.

Impact of dietary calcium on growth and bioconversion performances of Black soldier fly larvae (*Hermetia illucens*, Linnaeus, 1758)

Global population growth exacerbates food security issues. Black soldier fly larvae (BSFL) can contribute to sustainable agricultural systems in upcycling organic residues into ecofriendly animal feed and fertilizers. Shrimp fisheries produce large volumes of processing residues with needs to be valorized. However, preliminary findings suggest that high calcium content inhibits BSFL growth and bioconversion. This project thus aimed to quantify the effect of increasing levels of CaCO3 through nutritional trials (n = 3/diet) using BSFL neonates (0 to 5 days post-hatching; n = 200 larvae/tank; 30 mg/ind/d) and BSFL (days 5 to 10 post-hatching; n = 400 larvae/tank; 30 mg/ind/d). A reference diet (Gainesville, 70% RH) supplemented with or without crude or hydrolyzed shrimp powder (10 and 20%, dry basis) or with increasing levels of CaCO3 (0.75, 1.5, 3 and 6% of Ca^{2+}, dry basis) was tested. In neonates, 1.5% of Ca^{2+} decreased length from 11.2 ± 0,4 to 10.6 ± 0.7 mm, while 10% shrimp powder (1.5% Ca^{2+}) decreased it from 11.2 ± 0,4 to 9.53 ± 0,2 mm. In BSFL, 3% of CaCO3 decreased bioconversion (from 11.3 ± 0.1 to 10.5 ± 0.5 %) and length (from 16,7 ± 0,3 to 15,7 ± 2,4 mm) while 10% shrimp powder increased bioconversion (from 11.3 ± 0.1 to 12.4 ± 0.3 %) and length (from 16.7 ± 0.3 to 17.2 ± 0.9 mm). These results provide a better understanding of the effects of high-calcium substrates on different stages of development in BSFL, which must be investigated to optimise insect production.

04 Carly Demers[1], Sherah VanLaerhoven[1], Roselyne M. Labbé[2]
[1]Department of Integrative Biology, University of Windsor, [2]Agriculture and Agri-Food Canada

Examining two *Dicyphus* species (Hemiptera: Miridae) for their potential use as biological control agents on greenhouse crops

The production of tomato crops in greenhouses represents a large component of Canada's agricultural output, valued at $666M in 2020. In these environments, pests represent a threat to crop production. However chemical control agents are not always viable options for mitigating pest pressure due to either insecticide resistance or the frequent application of beneficial arthropods - such as bumblebees for pollination. Therefore, expanding the diversity of alternative pest control tools is essential. *Dicyphus hesperus* (Hemiptera: Miridae) is an effective native biological control agent (BCA) commercially applied in Canadian greenhouses. Recently, two previously unassessed species - *Dicyphus discrepans* and *Dicyphus famelicus* - were locally collected and colonies established at Agriculture and Agri-Food Canada's Harrow Research and Development Centre. Here, I present the results of a laboratory study intended to describe the potential of these two predator species to consume and control pests of greenhouse tomato including greenhouse whitefly, green peach aphids and two-spotted spider mites. The effect of supplemental plant and insect prey on predator longevity and fecundity was also examined. Together, this research, along with ongoing, large

scale greenhouse trials, will serve to determine how well these predators establish, persist and control pests on tomato and strawberry crops. In addition, this study will begin to clarify the degree of zoophytophagy and plant damage potential exhibited by these BCAs in a greenhouse system. Determining how to utilize these *Dicyphus* species as new BCAs will increase the number of available natural enemies for controlling current and future pests of economic significance.

05 Abbe Pawluk[1], Robert Laird[1], Jenny McCune[1], Valentina Ibarra Galvis[2], Brendan Roy[2], Hector Carcamo[2]
[1]University of Lethbridge, [2]Agriculture and Agri-Food Canada

Edge-effects on parasitoid Hymenopteran biodiversity and a survey of subclade Parasitoida in canola fields

Parasitoid Hymenopterans (subclade Parasitoida) can provide effective pest control ecosystem services. These beneficial insects target insecticide-resistant pests, provide host-specific suppression, and secondary pollination. Non-crop habitats adjacent to arable land provide critical ecological services for these insects by functioning as corridors from uncultivated land to farmland; this interaction is a form of edge effect. This study was conducted to evaluate how three types of non-crop edges (road verges, tree shelters, and coulees) affected the diversity and richness of parasitoid Hymenopterans in canola fields, as well as how this diversity varied from distance from the edge. Sampled genera were compiled into a survey of Parasitoida to better understand the composition of parasitoid Hymenopterans found in southern Alberta fields. The study concludes that edge-type and distance from the edge have little influence on the diversity of parasitoid Hymenopterans at the level of genera; instead, individual farms have greater influence on parasitoid biodiversity, implying farm management is a strong driver. We also report Diolcogaster spp. (Ichneumonoidea: Braconidae: Microgastrinae)—likely Diolcogaster claritibia Papp, first reported in Canada in 2014—to be the dominant group of parasitoids in southern Alberta canola fields, consisting of >70% of collected specimens. This research aims to increase our understanding of integrated pest management, and provides one of the few contemporary surveys of Parasitoida in southern Alberta.

06 Geneviève Labrie[1], Hector Carcamo[2], Steve Lamothe[3], Caroline Provost[3]
[1]UQAM, [2]AAFC, [3]CRAM

Tarnished plant bug, *Lygus lineolaris*, parasitism in Quebec agroecosystems

Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), attacks more than 300 different plants and is a major pest in 130 crops of economic importance in fields and greenhouses. Biological control of TPB has been considered as potential alternative to insecticides in North America, and the European braconid *Peristenus digoneutis* was introduced in alfalfa in the 1980's in Northeast USA. This parasitoid has been observed in alfalfa in Ontario and Quebec at the beginning of 2000. The long-term objective of this project is to relocate and establish this exotic parasitoid wasp from Quebec to the Canadian Prairies. This study determined the efficacy of parasitism on TPB in different crops in Quebec and identified the parasitoid species. In 2023, collection of TPB nymphs have been done in 25 fields (20 alfalfa and forage, 5 canola crops) and in 25 fields in 2024 (9 canola, 6 alfalfa and forage, 2 grapevine, 5 apple orchards and 3 vegetables fields and greenhouses crops). In 2023, dissections of 449 TPB demonstrated a global parasitism rate of 18% in alfalfa/forage crops while it was 6,5% in canola fields. In 2024, dissection of more than 400 nymphs or Lygus demonstrated parasitism rate between 5 and 66%. Molecular identification of parasitoid will help to identify the parasitoid species composition of TPB in different crops.

07 Caitlin Watt[1], Adele Beaudoin[2], Jennifer Retzlaff[3], Hector A. Carcamo[1], Boyd A. Mori[2]
Agriculture and Agri-Food Canada, [2] University of Alberta, [3] Alfalfa Seed Commission of Alberta

Beneficial Insects in Alfalfa Seed Fields of Southern Alberta

Alfalfa weevils and lygus bugs present a major threat to the production of alfalfa seed in Alberta, yet we know relatively little about the natural enemies of these pests, particularly parasitoid wasps. Many beneficial insects, such as lady bird beetles, lacewings, ground beetles, pirate bugs, damsel bugs, big-eyed bugs, and parasitoid wasps, prey on damaging insects. However, research on beneficial insects in alfalfa seed production is limited. Understanding these beneficial insects could guide decisions on insecticide spray applications, helping to preserve these beneficial communities and boost production. In particular, knowledge on parasitoid wasps, such as *Bathyplectes, Oomyzus,* and *Peristensus* species, could enhance their control of alfalfa weevils and lygus bugs. As part of a larger study developing thresholds for alfalfa weevil and lygus bugs, we examined beneficials in insecticide treated and untreated areas of ten fields in southern Alberta in 2023 and 2024. Sweep samples were collected from four areas in each field, where each area had two strips (300ft x 100ft) with or without insecticide applications. Beneficial species varied across southern Alberta, likely influenced by differences in environmental conditions, such as surrounding crops, temperatures, plant densities, and pest pressures. The most commonly observed parasitoid wasps were *Bathyplectes* species, which were most abundant in fields with the highest alfalfa weevil pressure. Beneficial insects were impacted by insecticide applications, with notable reductions observed in damsel bugs and lacewings. This work continues to explore beneficial insects and environmental factors that may influence them.

08 Nicolas Plante[1], Abraao Almeida Santos[1], Edel Perez-Lopez[1]
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Établissement d'une colonie de la cicadelle de la pomme de terre (*Empoasca fabae*) en serre et les futures expériences

La cicadelle de la pomme de terre (*Empoasca fabae* Harris) est un hémiptère de la famille des Cicadellidae. C'est un insecte polyphage qui peut causer des dommages sévères appelés brûlure de la cicadelle lorsqu'elle se nourrit sur le feuillage des plantes et elle est aussi soupçonnée d'être un insecte vecteur de phytopathogènes. Selon nos études effectuées de 2021 à 2024, cette cicadelle est la principale espèce présente dans les fraisières du Québec et elle est aussi celle qui pose le plus de problèmes aux producteurs québécois. Dans l'objectif de mieux contrôler le ravageur et de diminuer les applications répétitives d'insecticides, une colonie de cicadelles de la pomme de terre a été établie en serre. Pour s'y faire, des cicadelles ont été capturées sur le terrain, puis incubées dans des cages sur des plants de luzernes pour la poursuite du cycle de vie. Des générations en continu ont été générées en faisant le transfert et l'entretien des cages chaque semaine. Sous les volets 1 et 2 de la subvention LeafHope et de ses nouveaux projets de recherche, de futurs essais seront réalisés lors des quatre prochaines années. Dans cette affiche, nous présenterons le travail que nous avons effectué pour maintenir la colonie d'*Empoasca fabae* ainsi que les prochaines étapes pour son utilisation.

09 Dan Johnson[1], Jason Cheng[1], Hector Carcamo[2]
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A multi-region multi-year study of diversity, biogeography, and sampling methods of Orthoptera of Peace and Athabasca regions of northern Alberta

The diversity and biogeography of Orthoptera of northern grassland regions in Canada is not well known. In collaboration with the Association of Alberta Agriculture Fieldmen, and Alberta Agriculture and Irrigation (Shelley Barkley, Scott Meers), we held workshops on sampling and identification. Surveyors from 31 northern counties and districts used sweepnets for standard collections (typically 25 sweeps each) along field margins and vegetated roadsides. They submitted 688 sample bags during 2014-2019. The bags of collected Orthoptera were frozen and sent to the University of Lethbridge for cleaning, sorting, and taxonomic identifications. A total of 12,686 Orthoptera were identified (DLJ), none not identified, yielding a database of species, age class, location, region, vegetation type, and year. The list was augmented by field trips to the northern regions by DLJ during 2017-2023. Overall results of the submitted specimens: of the 27 species, Melanoplus bruneri (Bruner's Spur-throat Grasshopper), 61%, *Pseudochorthippus curtipennis* (Marsh Meadow Grasshopper), 22%, *Melanoplus borealis* (Northern Spur-throat Grasshopper) and *Melanoplus bivittatus* (Two-striped Grasshopper) at 5-6% each, and *Camnula pellucida* (Clear-winged Grasshopper), 2%. We compared sampling methods, methods of GIS modelling, trends over years, diversity, and spatial point analysis. We geo-located samples and compared to standard survey results, assessed parasitism of the dominant species, and compared species composition to environmental variables.

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Modulation de la résistance au cyantraniliprole et au thiaméthoxame chez Leptinotarsa decemlineata par ARNi

La culture de la pomme de terre, l'un des aliments les plus consommés au monde, est menacée par le doryphore de la pomme de terre, *Leptinotarsa decemlineata*. Ce ravageur a développé une résistance à plusieurs insecticides disponibles pour en faire la lutte, dont le cyantraniliprole et le thiaméthoxame. Cette résistance passe par la surexpression de divers gènes incluant ceux associés aux cytochromes P450 et aux glutathion S-transférases. L'exploration d'approches ciblées contre ces derniers, comme celles basées sur l'ARN interférence (ARNi), est donc d'intérêt dans le contrôle de cette résistance. La mesure de différents transcrits codant pour les cytochromes P450 a donc été effectuée et a notamment révélé la surexpression de *CYP6a23* et *CYP6d4* chez des populations adultes de *L. decemlineata* traitées aux composés d'intérêt. L'injection d'ARN double brin (ARNdb) a conduit à une réduction significative de ces transcrits, validé par qRT-PCR, confirmant l'efficacité de l'ARNi. L'impact de cette réduction d'expression a été mesurée sur la survie des insectes pendant 30 jours via une analyse Kaplan-Meier. Les résultats ont montré une augmentation significative de la mortalité chez les insectes injectés avec l'ARNi ciblant *CYP6a23*lorsqu'exposés au thiaméthoxame, de même que chez ceux exposés au cyantraniliprole et dont le *CYP6d4*avait été ciblé. Ces résultats supportent l'ARNi comme une approche prometteuse pour modifier la réponse aux insecticides chez *L. decemlineata*. En conclusion, la modulation de cytochromes P450 spécifiques via ARNi représente une voie d'intérêt pour améliorer l'efficacité des insecticides et gérer les populations résistantes de cet insecte ravageur.

11 Caroline Provost[1], Manon Laroche[1], Claudine Desroches[1]
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Lutte aux acariens phytophages en vignoble biologique : est-ce que l'introduction de prédateurs est efficace?

La viticulture est en croissance depuis une vingtaine d'années au Québec et avec l'augmentation des superficies de vigne, les problématiques en lien avec les ravageurs sont de plus en plus importantes. Les acariens phytophages sont de plus en plus observés en vignoble, soit les acariens causant l'érinose, *Colemerus vitis* (Pagenstecher), et l'acariose, *Calepitrimerus vitis* (Nalepa). Quelques informations concernant ces ravageurs sont disponibles pour les vignobles européens et dans les vignobles du Nouveau Monde, mais peu est connu de la biologie et de l'épidémiologie au Québec. Le projet proposé concerne donc l'acquisition de connaissance sur la biologie de ces ravageurs au Québec et l'objectif final est d'établir une stratégie de lutte contre les acariens dans les vignobles en régie biologique par l'introduction d'acariens prédateurs. Lors de la première année du projet, un suivi des populations d'acariens phytophages en vignoble biologique a été effectué afin de suivre leur cycle et pour identifier les prédateurs potentiels. Des essais avec l'introduction d'acariens prédateurs ont été effectués en 2023 et 2024. Les résultats préliminaires ont démontré que les acariens prédateurs sont présents et se dispersent au sein du vignoble lorsqu'on les introduit. Avec une meilleure connaissance des cycles des acariens en vignoble, les traitements phytosanitaires seront mieux justifiés et planifiés si nécessaire. Ce projet amènera aussi à mieux gérer les interventions phytosanitaires en vignoble biologique tout en réduisant les impacts négatifs sur les ennemis naturels présents et qui permettent de contrôler ces ravageurs.

12 Elisabeth Ménard[1], Clarisse Bannery[1], Alexander Faigan[1], Kim Ostiguy[1], Mick Wu[1], Célia Bordier[1]
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Pesticide resistance: the need for bioassays!

Pesticide resistance becoming a major worry in agriculture sector, many studies tried to find and standardize methodologies to monitor resistance insects' appearance. Molecular and chemical analyses are more common due to rapidity, repeatability and lower sample size needs. However, bioassays based on comparison of susceptibility between a sensible strain and wild populations by exposing insect to a predetermined lethal or discriminating dose, can allow an effective diagnosis of resistance. Insecticide resistance was evaluated on mortality percentage of two species: *i)* Colorado potato beetle (*Leptinotarsa decemlineata*) by pesticide ingestion of contaminated leaf on second instar larvae and *ii)* Carrot weevil (*Listronotus oregonensis*) by pesticide deposit on adult elytra. For Colorado potato beetle, 11 wild populations including three organic farms were exposed to 9 active ingredients. At least one resistance was demonstrated for each population tested, up to 6 active ingredients across the four tested chemical groups. For Carrot weevil, 3 wild populations were exposed to 2 active ingredients from two chemical groups. Only one resistance was detected for one chemical group. Those results allowed the discovery and confirmation of resistance in Québec populations of each pest. Without a doubt, properly designed bioassays are essential and can be done at the beginning of a resistance suspicion. Bioassays can be combined with a molecular biology approach to be even more accurate. Other possible explanations of resistance appearance were analyzing such as the farms' crop management and the avoidance behaviour. An Agrholistique*TM* approach is needed to understand resistance mechanism.

13 Enock Omakele[1], Fatoumata Bintou Diagne[2], Kim Ostiguy[1], Élisabeth Ménard[1], Pier Jr Morin[2], Célia Bordier[1]
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Molecular characterization of Colorado potato beetle insecticide resistance and target validation using RNA interference

The Colorado potato beetle (*Leptinotarsa decemlineata*) is a major potato pest, with a demonstrated resistance to 56 active ingredients, resulting in a challenge to control field populations and damages. This resistance stems from the overexpression of detoxification genes, in particular cytochromes P450 (CYP450) and glutathione S-transferases (GST). This project aims to assess molecular changes in 7 CYP450 and 3 GST in response to 9 insecticides from 4 chemical groups. After larvae exposition from 11 populations (conventional and organic management), the most resistant and the most sensitive population were compared for each pesticide. The overexpression of different targets was identified using RT-qPCR method. All tested targets were overexpressed after the exposure to pyrethroids. The exposure to neonicotinoids and diamides induced the overexpression of CYP6a23 and CYP6d4, respectively. In Spinosyn group, a difference was observed between conventional and organic insecticides, with the overexpression of CYP4g15 and CYP9e2, respectively. These results led to molecular bioassays based on RNA interference (RNAi) directed against the overexpressed genes, to validate its function in the resistance mechanism. Initial tests showed that RNAi approaches can knock-down the expression of target genes such as CYP6a23 and CYP6d4, 24 hours after ingestion of a 1 µg dose in larvae (L1). Following this step, the same dose was used to expose resistant larvae and knock-down the targeted gene within 3 different populations for 5 insecticides. These promising results will allow the development of possible resistance detection tools in field populations, a useful service for growers in Québec.

14 François Dumont[1], Caroline Provost[1]
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Nysius niger en framboisières et fraisières : biologie, écologie, dommages et stratégie de gestion

L'incidence de *Nysius niger* serait en augmentation au Québec dans les framboisières et les fraisières, ce qui inquiète les producteurs. L'impact économique de cette punaise est mal connu. La biologie et l'écologie de l'espèce sont aussi des aspects sur lesquels nous disposons de peu d'informations. Il est donc difficile d'établir une stratégie de lutte ciblée sur ce ravageur émergeant ou périodique. Toutefois, cette punaise polyphage partage de nombreux hôtes avec la punaise terne, un ravageur principal beaucoup mieux connu. Les plantes pièges utilisent dans la gestion des punaises ternes pourraient aussi s'avérer efficace contre *N. niger*. De plus, les prédateurs généralistes qui consomment la punaise terne s'attaquent probablement à *N. niger*. Ainsi, les stratégies de lutte mises en place pour réguler les populations de punaises ternes pourraient s'avérer aussi efficaces pour lutter contre les punaises *N. niger*. La stratégie de lutte biologique contre *N. niger* sera donc inspirée des projets de recherche en cours sur la punaise terne. Les objectifs de ce projet sont de : 1) documenter la biologie et l'écologie des *N.* niger (cycle de vie, hôtes exploités, prédateurs potentiels et effet du paysage); 2) décrire et dénombrer les dommages en fonction des stades de *N. niger*; et 3) évaluer une stratégie de gestion des *N. niger* basée sur l'utilisation de bandes pièges et sur la lutte biologique par conservation (aménager un environnement favorable au maintien des prédateurs naturels). Les résultats préliminaires de 2022 et 2023 seront présentés.

15 Fazia Berkani[1], Marc Fournier[1], Livain Breau[1], Éric Lucas[1]
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Nouveaux attractifs contre la chrysomèle rayée du concombre en production biologique

Abstract Title: New attractants against striped cucumber beetle in organic production. Cucurbit production is an important crop in Quebec with a cultivated area of 2554 hectares, for a value of more than $39.1 million. The striped cucumber beetle (SCB) *Acalymma vittatum* (F.) (Coleoptera: Chrysomelidae) is the main pest of cucurbits in North America. It can transmit bacterial wilt, a disease that can cause plant death early in the season. Commercial attractants against SCB exist but are ineffective in maintaining CRC populations below the economic threshold (Tinslay et al. 2024). The general objective of this project is to develop a new attractant against SCB. We evaluated the attractive potential of new molecules in order to increase the capture of hibernating adult pests before squash planting and during field colonization or with summer adults (new adults) at the end of July. In the field, we trapped SBC during 3 periods, i.e. before cultivation, after planting and after the emergence of the new adult generation. We tested 5 to 9 new molecules depending on the period. The attractants were placed in 4-liter yellow traps containing an attractant. We tested the attractants on 3 farms and replicated twice by farm. We counted the number of SBC/trap weekly. Results will be presented during the poster session.

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A royal stop: monarch roosting during their fall migration

The monarch butterfly is renowned for its long-distance migration between Canada and Mexico, yet little research has been conducted in Canada to understand its fall roosting behavior during their southward migration. In the fall 2019, we observed a large gathering of monarchs (over 10,000 individuals) at the Agriculture and Agri-Food Canada experimental farm in southern Quebec. Its coniferous windbreak and flowering crops created an ideal environment for the butterflies to rest and feed. Actions were taken to enhance the biodiversity by optimizing floral resources (buckwheat, clover, flower strips) to attract monarchs, while a long-term monitoring protocol was implemented to track population dynamics over time. From 2022 to 2024, observations documented the timing of monarch clustering behavior in relation with weather conditions. Butterflies were counted at sunset each day between mid-August and mid-September along a 1.4 km section of the windbreak. Monarch populations were lower than during the first roosting observation in 2019, with peak counts of 54, 150, and 33 butterflies, in 2022, 2023 and 2024, respectively. The peak observation period occurred between late August and early September, with monarchs clustering primarily on white spruce trees and feeding on buckwheat and red clover. Higher monarch counts were associated with southern winds, likely forcing them to remain in their roosting sites longer while waiting for favorable conditions. The next steps will focus on continuing data collection over time and identifying which floral species are most beneficial to monarchs during their fall roosting behavior to further support their migration.

17 Fausto Henrique Vieira Araujo[1], [2], George Corrêa Amaro[3], Abraão Almeida Santos[4], Ricardo Siqueira da Silva[2], Edel Pérez-López[4]
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Climate Modeling of the Potential Distribution of *Macrosteles quadrilineatus* (Hemiptera: Cicadellidae)

Macrosteles quadrilineatus (Hemiptera: Cicadellidae) is a herbivorous insect of significant economic importance in Canada, as it serves as a vector for the Aster Yellows phytoplasma (AYp) in crops such as canola. This polyphagous insect requires specific climatic conditions for its presence, and thus, its spatial distribution is influenced by the availability of food and thermal thresholds. Climate plays a crucial role in shaping the distribution of *M. quadrilineatus*. In this context, the objective of this study was to develop models predicting potential areas for the occurrence of *M. quadrilineatus* using the ecological modeling software MaxEnt. To achieve this, we gathered occurrence records from the Global Biodiversity Information Facility and iNaturalist databases, covering the years 1970-2024, yielding a total of 294 records of *M. quadrilineatus* worldwide. Additionally, 19 bioclimatic variables, derived from monthly temperature and precipitation data, were used in the model. The model was calibrated using the distribution of *M. quadrilineatus* in North America, which also served as the validation region. The three most influential bioclimatic variables identified were: BIO10 (Average Temperature of the Warmest Quarter) at 26.09%, BIO7 (Annual Temperature Range) at 26.02%, and BIO2 (Mean Diurnal Range - the average monthly difference between maximum and minimum temperatures) at 21.73%. The results indicate that suitable climatic conditions for *M. quadrilineatus* exist on all five continents, with countries such as the United States, Canada, Argentina, Turkey, France, Italy, Russia, and China identified as regions with potentially suitable areas for the species.

18 Samantha Bennett[1], Paul Manning[1], David Burton[1]
[1]Dalhousie University

Downstream Effects of Supplementing Beef Cattle Diet with Seaweed on Dung Beetles: Resource Selection and Reproductive Success

Supplementing beef cattle diet with seaweed has been recognized as a promising strategy to reduce enteric methane production; however, the broader ecological effects of these additives remain poorly understood. This project explores how North Atlantic Organic Seaweed Meal, a brown seaweed (*Laminaria* spp.) -based feed additive, influences dung beetle (Coleoptera: Scarabaeoidea) resource selection and reproductive success. Cattle were assigned to four treatment groups based on the percentage of seaweed included in their diet: control (0% DMI), low (0.5% DMI), medium (1% DMI), and high (2% DMI). Dung beetle resource selection and reproductive success were assessed using both laboratory and field-based experiments. Laboratory experiments were utilized to evaluate how the brown seaweed supplement influenced resource selection and reproductive success of the dung beetle species *Onthophagus nuchicornis*. A field study was performed to acquire a broader perspective of the effects of this feed additive on coprophagic insect communities, through the comparison of species abundance and richness across different treatments. Therefore, by evaluating the effects of this brown seaweed-based feed additive on both

dung beetle resource selection and reproductive success, this project provides insight into whether the addition of this additive to cattle diet inadvertently affects dung beetle populations.

19 Simon Legault[1], Didier Labarre[2], Alice De Donder[2], Gabriel Ayotte Breton[2], Jacques Brodeur[1]
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The use of pesticides in cranberry production in Quebec: Current status

The MAPAQ's 2020-2030 Sustainable Agriculture Plan (PAD) aims, for 2030, a 15% reduction in the ~ 3.3 million kilograms of active pesticide ingredients sold on average annually since 2006, and a 40% reduction in associated risks. However, we do not have a precise, quantitative portrait of past and current pesticide uses per crop, and the associated risks to human health and the environment. Based on detailed records obtained for 77 cranberry producers from the Centre-du-Québec region, we compiled an inventory of recent (2018-2023) pesticide (insecticides, herbicides, fungicides) uses in terms of kilograms of active ingredients per hectare and number of treatments per year. Using the SAgE pesticides platform, we also calculated the health and environment risk indices (IRS and IRE) associated with each phytosanitary treatment. Inter-annual variations in pesticide use help to identify the circumstances (e.g., climatic conditions, new pests, pesticide availability) that influenced the use of chemical control. These results will serve as a benchmark to assess future successes in pesticide reductions in cranberry production. In addition, our methodology can be applied to other crops of importance.

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Conditions optimales d'irradiation pour la mouche des semis *Delia platura*

La technique de l'insecte stérile (TIS) représente une excellente alternative à l'utilisation d'insecticides pour le contrôle des mouches des racines *Delia antiqua* et *D. radicum*. Cependant, la présence de dommages parfois importants associés à une troisième espèce du même groupe, la mouche des semis *D. platura,* constitue un frein à l'utilisation des mouches stériles par certains producteurs. L'objectif de ce projet consiste à évaluer le potentiel de la TIS pour le contrôle de la mouche des semis. Une première étape cruciale lors de l'établissement d'un programme TIS consiste à déterminer la dose d'irradiation optimale pour l'espèce ciblée, ainsi que l'âge optimal des pupes pour l'irradiation, afin de minimiser son impact négatif sur la compétitivité sexuelle des mâles. Selon la dose utilisée et le stade de développement de l'insecte, ce processus peut affecter les cellules somatiques et entrainer une réduction de la longévité ou de la vigueur sexuelle, ce qui peut rendre les mâles moins aptes à entrer en compétition avec les mâles non irradiés pour l'accouplement des femelles. Des résultats sur l'évaluation simultanée de l'effet de la dose (0, 20, 30, 40 Gy) et de l'âge des pupes (6, 8, 10 et 12 jours) sur le taux d'émergence des adultes, la stérilité des mâles et des femelles, et la compétitivité des mâles de *D. platura* seront présentés. Les implications pour le développement d'un programme TIS pour la mouche des semis seront aussi discutés.

21 Steve Lamothe[1], Geneviève Labrie[2,3,4], Caroline Provost[1]
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Effet du sarrasin en culture de couverture pour lutter contre les vers fil-de-fer

Très peu de moyen de lutte sont disponibles pour lutter efficacement contre les vers fil-de-fer dans les cultures horticoles ou grandes cultures. L'utilisation du sarrasin en culture de couverture a démontré des réductions importantes de ces ravageurs dans plusieurs projets canadiens et une réduction de 92% de population du genre *Limonius* a été observée au Québec sur un site d'étude entre 2019 et 2022. Un objectif de ce projet était d'identifier les effets délétères du sarrasin pour les principales espèces de vers fil-de-fer retrouvées dans le mais sucré. Des essais en laboratoire ont été réalisés en 2022 (38 jours) et 2023 (72 jours) où des individus des genres *Melanotus*, *Hypnoidus*, *Agriotes* et *Limonius* ont été soumis à des traitements de plantes de couvertures avec de l'avoine ou de sarrasin afin d'évaluer leur survie. En 2022, la mortalité était plus importante pour *Agriotes* en présence d'avoine. En 2023, les tests en laboratoire ont démontré des taux de survie similaires pour les deux plantes pour les espèces de *Agriotes* et *Limonius*, une tendance non significative à avoir une plus grande mortalité avec le sarrasin pour *Hypnoïdus* et une plus grande mortalité a été notée pour *Melatonus* en présence de sarrasin. En combinant les 4 espèces, le sarrasin a causé significativement plus de mortalité que l'avoine. En complément avec d'autres essais incluant des cultures de sarrasin, les résultats de ce projet permettront à terme de proposer une stratégie de lutte avec le sarrasin contre les vers fil-de-fer dans le maïs.

22 Suzanne Blatt[1]
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Rootstock preferences in European Apple Sawfly, *Hoplocampa testudinea* Klug, Hymenoptera: Tenthredinidae

European Apple Sawfly, *Hoplocampa testudinea* Klug, is a well established pest of apple throughout Eastern Canada and Europe. While pesticides are effective, the best time to apply these is during bloom when adults have emerged and are mating. Previous studies evaluating cultivar preference using damage at harvest have revealed a significant difference between cultivars in Europe and North America. Selecting cultivars which show lower impact from *H. testudinea* is one option to reduce damage from this pest. Deeper examination of the oviposition preference and larval performance of *H. testudinea* across cultivars in Nova Scotia disclosed that cultivar can significantly influence the amount of damage observed at harvest. With the majority of apple cultivars being grafted onto a rootstock, we hypothesized that rootstock would have minimal impact upon the observed cultivar preference. Using Honeycrisp and Modi plantings, we examined preference across rootstock for oviposition by females, performance of the larvae and compared these with damage at harvest and fruitlet chemistry during development. Results from both Honeycrisp and Modi showed females to preferentially select certain rootstocks for oviposition. Fruitlet chemistry during development differed across rootstocks with a significantly greater number of fruitlets affected by *H. testudinea* dropping from the tree. The relationship between fruitlet chemistry and larval performance was not the same across rootstocks as observed across cultivars. Fruitlet acidity and soluble solids were strong drivers of larval performance with cultivars but not rootstocks. The relationship between rootstock and cultivar *for H. testudinea* management is discussed.

23 Wim van Herk[1], Jocelyn Smith[2]
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Wireworm species associated with corn and soybean agroecosystems in Ontario, Canada

Wireworms, the larvae of click beetles (Coleoptera: Elateridae), are often the target of insecticide seed treatments commonly used in corn and soybean production in North America, but relatively little is known as to the species, life history, and economic impact of wireworms present in these agroecosystems. An extensive survey was conducted in corn and soybean fields in Ontario, Canada, from 2014 to 2017 to document species distribution and co-occurrence, and to identify risk factors related to their abundance. In total, 4,332 specimens were collected from 1,245 different sampling records. Dominant species collected included *Limonius agonus* (Say)—comprising 71.5% of the specimens—as well as *Hypnoidus abbreviates* Say), *Melanotus similis* (Kirby), *M. cribulosus* LeConte), *M. depressus* (Melsheimer), *M. communi* (Gyllenhal), *Agriotes mancus* (Say), *Aeolus mellillus* (Say), and *Hemicrepidius* pp (Germar). Multiple wireworm species were found to commonly occur within the same field and the same sample. Path analysis to investigate whether site, soil, and agronomic characteristics influenced wireworm distribution and abundance identified several significant relationships, which varied with species. These results provide critical information that can be used to improve integrated pest management of the major wireworm genera found in corn and soybean agroecosystems in Ontario.

24 Sandrine Corriveau-Tousignant[1], Alexis Latraverse[1], Tanya Copley1, Sébastien Boquel[1]
[1]CÉROM

Understanding bean leaf beetle damage in soybean for a better integrated pest management program

Bean leaf beetle (BLB), *Cerotoma trifurcata*, is a soybean pest first detected in Quebec in 2018. Originally found in few soybean fields, cases have since increased, suggesting it's spreading in the province. While adult beetles can cause foliar damage, the main concern is pod feeding which can reduce yield and/or grain quality. Although economic thresholds exist in the United States and Ontario, none have been validated for Quebec, and it's unclear if these thresholds account for grain quality loss or diseases transmitted by BLB. The aim of the study is to establish an action threshold for BLB in soybean based on pod damage and considering yield, grain quality loss, and disease risk. BLB were introduced into soybean cages in the field to generate a range of pod damage. Pod and grain damage were then quantified, and yields measured. Healthy and damaged/discolored seeds from damaged pods were cultured on agar plates to assess disease presence and seed viability. Preliminary results showed a positive relationship between the proportions of damaged pods and grains. Damaged/discolored seeds were more likely to carry disease and had lower germination rates than healthy grains, suggesting that BLB pod feeding creates entry points for diseases. This suggests that grain downgrading at harvest may be predicted through in-season scouting, allowing timely actions to reduce economic losses, especially for high-value soybeans.

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Alternative control method against the striped cucumber beetle, *Acalymma vittatum*, in cucumber greenhouses

The production of greenhouse cucumbers represents a significant part of the agricultural income of the country and the province. However, this crop is vulnerable to pests and pathogens that invade the growing environment. The striped cucumber beetle (SCB), *Acalymma vittatum*, is the pest that causes the most damage to cucurbit crops in greenhouses, as it carries the bacteria responsible for bacterial wilt, *Erwinia tracheiphila*. Currently, the only available control methods consist of manually removing individuals or adding nets to greenhouse openings. It therefore appears necessary to develop an alternative control method against SCB in cucumber greenhouses. In this sense, a few projects carried out at the Mirabel Agri-Food Research Center (MARC) in recent years made it possible to test attractive methods with commercial kairomones and repellent methods with kaolin clay. The promising results suggest that a push-pull strategy specific to this pest could be developed and employed with the use of repellent compounds for optimal control of SCB in greenhouses. The specifics objectives of this project are to identify and test repellent molecules such as essential oils and kaolin clay and to test different combinations of SCB control methods in cucumber greenhouses.

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Biocontrol potential of entomopathogens (EPF) against Grape Mealybug in Canadian vineyards

In this study we evaluated the efficacy of two commercially available entomopathogenic fungi (EPF), *Beauveria bassiana* strain GHA (BotaniGard) and *Metarhizium brunneum* strain F52 (Lalguard) on the Grape Mealybug, *Pseudococcus maritimus* (GMB), an insect pest in Canadian vineyards. Damage to the plant is caused by feeding activity of GMB and virus transmission of Grapevine leafroll-associated virus 1 and 3 (GLRaV-1 and -3). Mealybugs were collected from a Niagara vineyard and a colony of GMB was established on sprouted potatoes. Two concentrations, low and high, of each EPF treatment were uniformly sprayed on GMB (2nd instars) infested potatoes. Concentrations used were 62 and 125 µL/50 ml distilled water for *Beauveria bassiana* and 25 and 250 µL/50 ml distilled water for *Metarhizium brunneum*. Observations of insect mortality were carried out over a period of 10 days post treatment, using a magnifying lens and a light microscope. Both products displayed mycoinsecticidal activity on the mealybugs tested. The higher dosage resulted in higher mortality rates (80%), observed seven days after application. In Ontario's vineyards, GMB is controlled mainly by a synthetic, systemic insecticide. The EPFs used in this laboratory trial exhibit promising potential and could represent a new and sustainable plant protection strategy for the control of GMB infestations in vineyards. Additional trials on other life stages of GMB are recommended and vineyard trials should be considered with both products.

27 Jean-Philippe Parent[1], Benoît Lacasse[1]
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Blowing your Japanese beetle worries away with pneumatic control

Japanese beetle is a major exotic invasive pest of multiple high value crops and its range is ever expanding despite quarantine and control efforts. While adults mostly damage crop indirectly through leaf skeletonization, they can also directly damage the fruit in some crops. Developing alternative pest control strategies is key to help growers who can be swarmed by this pest. In this study, we try to establish the potential of pneumatic dislodging as a form of physical pest control against Japanese beetle in grapevine. We used a sprayer blasting high velocity wind on Japanese beetle infested grapevines on a 100 m row. On the other side of the row, two people carried a large mesh pouch with a 0.4 m2 opening and followed the tractor to capture dislodged individuals. The number of Japanese beetles present on the row before and after the passing of the sprayer, the number of Japanese beetles, both parasitized and healthy, present in the net, and all other accidental bycatches were counted. This approach dislodged 64.7 % and captured 58.9 % of the Japanese beetles present in the row. The vast majority of insects captured in the mesh pouch were Japanese beetles (66 %), and barely 1 % of bees. Overall, this approach appears to have potential to be a good alternative to chemical pest control of Japanese beetle and needs to be further studied and improved to make it economically viable.

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Pheromone- or floral-baited traps? What approach is the best for monitoring western corn rootworm (Coleoptera: Chrysomelidae) beetles

Western corn rootworm (*Diabrotica virgifera virgifera* LeConte) (WCRW) is an important corn pest in North America. In Canada, WCRW have been recorded in Ontario and Quebec since 1975 and more recently in Nova Scotia, Manitoba and British Columbia. Between 2019 and 2021, four trap types, baited with sex pheromone or floral lures, were tested in British Columbia, Ontario and Quebec to evaluate their potential for both monitoring and mass trapping. The results indicate that some trap types (i.e. PAL, PALs, and Delta) baited with pheromone and floral lures can be used for the early detection of male and female WCRW. Differences in trap catch depended in part on beetle sex.

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Bioremediation of chlortetracycline by the black soldier fly: toward durable management of livestock feed contaminated with antibiotics

Black soldier fly (*Hermetia illucens*) larvae enable waste management through bioconversion of various organic matters and their upcycling into animal feed and soil fertilizers. Substrate with low economic value are prime targets for upcycling, notably the livestock feed waste containing antibiotics. However, before these types of inputs can be incorporated into black soldier fly production, the innocuity of final rearing products (larvae and frass) must be addressed to meet regulatory standards. We conducted nutrition experiments (30°C, 60%RH) with 5 days old neonates (400 ind./diet, n=3/diet) fed (30 mg diet/larvae/day) during 10 days on a pre-consumption organic waste diet, supplemented with 20% and 30% soy or corn meal.

Each diet had a condition with and without chlortetracycline added to the meal at a concentration of 220mg/kg. Larvae were also reared on a control laboratory diet called Gainesville. The inclusion of chlortetracycline did not impact negatively the larval growth and the bioconversion performance. The presence of the antibiotic in the final rearing products (larvae and frass) using qualitative (S.T.O.P. test) and quantitative (HPLC) methods are currently being investigated. These results will determine the feasibility of utilizing waste contaminated with antibiotics in black soldier fly productions. The implementation of new circular economical models could not only reduce some of the production costs of insect farming, but also help reduce the antibiotic resistance resulting from the disposal of this type of waste.

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Impacts of three organic amendments on cucurbits resistance against its pest *Acalymma vittatum* (Fabricius) (Coleoptera : Chrysomelidae)

The stripped cucumber beetle (SCB) is a big problem for cucurbit growers, mainly because they propagate the bacterial wilt. With the upcoming sale ban of many pesticides in Quebec in 2025, solutions are needed for growers. To try to keep the SCB under its economical harm threshold, we evaluated the effects of 3 different amendments on the resistance capacity of cucurbits against this pest. Tests were made with vermicompost, mealworm frass, black soldier fly frass and a control. According to literature, vermicompost may be able to keep the SCB under the economic threshold and the chitin found in frass could stimulate defensive metabolite production in plants. Our goal was to observe if there was any impact from our amendments on the amount of SCB found or the bacterial wilt on plants or fruits. We applied them directly on the field or mixed them with the transplants soil to see if they were affecting the SCB populations and the presence of bacterial wilt. The different treatments were randomly distributed between 40 plots (20 plots for direct sowing and 20 plots for transplants). For 12 weeks, we counted SCB on squash plants and flowers once a week. By the end of the season, we took fruits from each plot for yield evaluation. We noted their weight, signs of bacterial wilt and separated marketable fruits from unmarketable ones.

31 Daniel Cormier[1], Franz Vanoosthuyse[2], Harnaivo Rasamimanana[3]
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L'ajout du Btk au granulovirus CpGV réduit la lutte biologique au carpocapse de la pomme

Dans les vergers de pommiers du Québec, deux ravageurs majeurs sont présents au même moment durant l'été et un mélange d'insecticides dans la cuve de pulvérisation pourrait être envisageable. Ces deux ravageurs se retrouvent au stade larvaire, un stade propice à l'utilisation de bioinsecticides par ingestion. Le virus de la granulose, CpGV et la bactérie *Bacillus thuringiensis* subsp. *Kurstaki* (*Btk*) sont les bioinsecticides les plus utilisés pour lutter respectivement, contre le carpocapse de la pomme et la tordeuse à bandes obliques. En laboratoire, nous avons évalué l'effet de ces deux bioinsecticides individuellement et en mélange sur la mortalité des larves du carpocapse. Celles-ci ont été déposées sur une diète artificielle traitée avec les bioinsecticides seuls ou en mélange. La mortalité totale, qui comprend la mortalité induite par le virus et due à des causes inconnues, était significativement plus élevée dans le traitement au CpGV que dans les traitements au *Btk* et au CpGV + *Btk*. Par ailleurs, en considérant uniquement la mortalité induite par le virus, la mortalité était significativement plus élevée pour le CpGV seul que pour le mélange CpGV + *Btk*. La réduction de la mortalité des larves observée avec le mélange pourrait avoir un impact négatif sur la population de carpocapses dans les vergers, pour les larves ingérant les deux bioinsecticides, mais pas pour

celles ingérant uniquement les granules du virus. Cependant, l'impact serait minime, car les bioinsecticides mélangés ont causé 94 % de mortalité des larves, contre 100 % lorsque le CpGV était appliqué seul.

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LeafHope: A Comprehensive Toolkit to Reduce Insecticide Use and Greenhouse Gases in Canada

The LeafHope project addresses the environmental and economic challenges faced by Canadian agriculture, particularly in the cultivation of strawberries, blueberries, and canola, which collectively represent a yearly economic value of $31B. The cultivation of these crops often relies heavily on fertilizers and insecticides, contributing to GHG emissions and groundwater contamination. A primary concern is the impact of leafhopper pests that transmit diseases to these crops. In response, a multidisciplinary team of 18 academics has proposed the LeafHope project, aiming to devise sustainable agricultural methods to significantly reduce synthetic insecticide use while ensuring high yields. The project has garnered the support of over 140 growers, 8 grower associations, and industry leaders, with a combined in-kind contribution of $1M. The LeafHope insecticide reduction toolkit is expected to revolutionize Canadian agriculture by reducing pesticide use and GHG emissions, placing Canada at the vanguard of global sustainable agriculture. Moreover, the initiative plans to fill existing knowledge gaps concerning the effects of climate change on insect migratory patterns, population dynamics, and insecticide resistance. The project's novel and comprehensive approach leverages cutting-edge technologies for pest management, making it distinct from previous endeavors. Overall, this initiative represents a holistic and forward-thinking response to the multifaceted challenges faced by Canadian agriculture in a rapidly changing climate. We are excited to present the LeafHope project to the Canadian entomological community in order to connect with potential partners, collaborators, and new talent eager to join us in making a difference in Canada.

33 Scott Clem[1,2], Samm Reynolds[3], Andrew Young[3], Blair Fitzgerald[3]
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Syrph-ing continents: a comprehensive review of long-distance hover fly migration (Diptera: Syrphidae)

A significant number of hover fly species (Diptera: Syrphidae) are now known to exhibit migratory behaviour, and its wider significance is starting to be recognized and understood in scientific circles. In this review, we summarize the past 150+ years of global hover fly (also called flower flies in North America) migration research from >60 published studies. We outline the different methodologies used for studying these migratory phenomena, the biological mechanisms for migration, the associated ecological and economic impacts and the potential consequences of climate change on these migratory flies. Forty-six species of hover fly, mostly from Europe, are considered migratory and the most well studied of these species are discussed in detail. Recent literature has investigated hover fly migration in North America, Asia, the Middle East, and Australia and we review all known migratory pathways from these works. The migratory behaviour of hover flies has substantial impacts on ecosystem services and can be linked to long-distance gene flow for flowering plants through pollen transport along migratory paths. These insects are also likely to be contributing and redistributing their biological control services at a continental scale on an annual basis,

which has major consequences for the management of crop pests (e.g. aphids). The expanded use of technology will continue to reveal exciting insights and improve our understanding of hover fly migration. Meanwhile, improved public awareness and greater appreciation of true flies will lead to increased scientific research to expand our global knowledge on hover fly migration.

34 Mireia Cassi[1], Arthur Danneels[1]
[1] CRAM

Ressources Florales pour les Pollinisateurs : Analyse au Sein des Cultures de Solanacées

La biodiversité joue un rôle crucial dans les écosystèmes agricoles en fournissant des services essentiels tels que la pollinisation. Cependant, les populations de pollinisateurs sont en déclin. Dans ce contexte, nous présentons des résultats préliminaires d'un projet de trois ans visant à fournir des recommandations simples et efficaces pour l'aménagement de bandes florales, dans le but de favoriser la préservation des pollinisateurs. Nous présentons ici la première étape de ce projet, qui vise spécifiquement à analyser la composition et la configuration de la végétation à petite et moyenne échelle. Cet objectif a pour but d'évaluer la disponibilité des ressources pour les pollinisateurs dans les cultures de solanacées biologiques.

Pour ce faire, nous avons échantillonné 16 fermes maraîchères biologiques au Québec à trois moments différents au cours de la saison de production des solanacées. Dans chaque ferme, nous avons examiné trois quadrants de 1 m², situés dans les bandes florales à proximité des cultures. Toutes les espèces végétales présentes dans ces quadrants ont été identifiées, et pour chaque espèce, nous avons noté le stade phénologique ainsi que le pourcentage d'espace occupé. De plus, nous avons évalué le paysage environnant dans un rayon de 150 mètres autour des cultures.

Ces résultats, qui seront présentés lors du congrès, constituent une première étape vers la compréhension des interactions entre les pollinisateurs et les ressources disponibles, essentielles pour optimiser l'aménagement des bandes florales et soutenir la pollinisation dans les cultures de solanacées.

35 Kévin Matte[1], Frédéric McCune[1], Valérie Fournier[1], Marc J. Mazerolle[1]
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Résilience des colonies de bourdons (*Bombus impatiens*) dans différents environnements face aux changements climatiques

Le déclin à grande échelle des pollinisateurs affecte grandement l'agriculture. En effet, ils assurent la reproduction et les rendements de plusieurs cultures. Les changements climatiques et la hausse des températures, l'une des causes de ce déclin, nuisent au développement de plusieurs espèces d'apidés, dont les bourdons. Ceux-ci sont parmi les pollinisateurs sauvages les plus efficaces au Québec. Le but de ce projet est d'évaluer les différentes stratégies d'aménagement offrant une meilleure résilience aux colonies de bourdons face aux changements climatiques. Le projet nous permettra de mieux comprendre les capacités et les comportements des bourdons face à la hausse des températures en milieu naturel. Nous nous démarquerons donc des études précédentes ayant analysé les enjeux face aux hausses de températures que ce soit sur le développement, la nutrition ou le comportement des bourdons, puisqu'elles ont pratiquement toujours eu lieu en milieu contrôlé. Notre projet aura lieu dans deux milieux distincts : des cannebergières et des champs de grandes cultures. Sur chacun de ces sites, trois environnements différents seront analysés : en plein champ, en bande fleurie et en bande fleurie arborée. Des colonies de bourdons placées dans ces environnements seront soumises à des régimes thermiques différents, soit la température ambiante, +3 °C et +6 °C. Ces températures correspondent aux hausses anticipées pour le sud du Québec si les changements

climatiques continuent dans la même direction. Les résultats attendus permettront de recommander des aménagements optimaux pour augmenter la résilience des colonies de bourdons en milieu agricole face aux changements climatiques.

36 Alexa Brunet[1], Jessica Gillung[1]
[1]McGill University

Wild pollinator functional diversity across landscapes in Quebec's cranberry agroecosystems

The cranberry industry is of great importance to Quebec's community and economy. To satisfy current agricultural demand and fulfill crop pollination needs, cranberry farmers in the Centre-due-Québec region rely heavily on the pollination services of rented honey and bumble bees. However, due to rising costs and declines in available managed colonies, farmers now welcome more sustainable practices; namely, protecting and enhancing the region's wild pollinator communities. Wild insect pollinators living in landscapes near cranberry agroecosystems provide important pollination services, yet now face habitat loss and population decline as a result of agricultural intensification. This study aims to assess the provision of cranberry pollination services by wild pollinators across a gradient of natural landscapes in the Centre-du-Québec region. Malaise traps were set in different habitats during the cranberry flowering seasons of 2022 and 2023, and collected nearly 5500 wild pollinators. Studying the functional traits and diversity of these wild pollinators will highlight their ecological importance and usefulness as cranberry pollinators. Obtained results will pioneer an entomological perspective on functional diversity, and encourage the conservation of natural landscapes around cranberry agroecosystems.

37 Samantha Dizon[1], Jessica Gillung[1]
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The Impact of Quebec Cranberry Farming Practices on Pollinator Diversity

The relationship between agriculture and pollination plays a crucial role in ecosystem functioning, food production, and biodiversity conservation. One important agricultural sector in Canada that heavily relies on pollination is the Quebec cranberry industry with many farmers renting managed bees to maximize crop yield. However, environmental stressors are causing declines in these populations with agricultural intensification being a key contributor. Therefore, by encouraging farmers to implement sustainable agricultural practices that promote the conservation and diversity of wild pollinators, farmers can take advantage of the efficient and free pollination services they provide. My project aims to determine how current agricultural practices within Quebec cranberry farms impact the taxonomic and functional diversity of wild bee and flower fly pollinators. In collaboration with local cranberry farmers and the Quebec Cranberry Growers Association, insect samples were collected using butterfly net transects, pan traps, and blue vane traps in the Centre-du-Québec region. My research will pave the future for a more sustainable cranberry industry by providing farmers with a research-based guide on how changes in their agricultural practices could better support native pollinator biodiversity and their pollination services.

38 Michael Tremblay[1]
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Quantifier l'exposition liée aux résidus de pesticides dans le pollen et le nectar de plantes sauvages et cultivées pour les pollinisateurs indigènes

Le déclin des populations de pollinisateurs indigènes est en partie attribué à l'intensification agricole faisant augmenter l'usage de pesticides. Cette étude vise à déterminer les concentrations de pesticides auxquelles les pollinisateurs sont exposés, soit en 1) quantifiant l'exposition des pollinisateurs aux résidus de pesticides retrouvés dans les fleurs de différentes cultures entomophiles et des fleurs sauvages en bordure de champ et en 2) déterminant s'il existe une corrélation entre les concentrations de pesticides retrouvées dans le pollen et le nectar et calculer un facteur de conversion pour chaque culture. L'échantillonnage est effectué dans trois cultures (pomme, canneberge et courge), avec dix sites répartis sur cinq fermes pour chacune d'elles. La collecte est effectuée au début de la floraison, en pleine floraison et à la fin. Les fleurs sauvages sont récoltées à trois distances du bord de champ, en ne conservant que la corolle et la morphologie interne. Le principal résultat attendu est une quantification des risques de contamination par les pesticides via le nectar et le pollen de certaines cultures et des fleurs sauvages en bordure de champ. Un facteur de conversion sera établi afin d'estimer la concentration retrouvée dans le nectar via celle mesurée dans le pollen. Des recommandations porteront sur le choix des pesticides à moindre risques ainsi que sur des mesures préventives concernant leur application.

39 Brianne Symak[1], Caleb Bryan[1], Sean Prager[1]
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Effects of Chronic Chromium Exposure on Bumble Bee Buzz Response

Insects comprise the majority of animal diversity and abundance, yet their decline has been documented for several decades. Various factors contribute to this trend, all ultimately linked to reduced resource availability and quality. Plants can absorb contaminants from the surrounding environment and store them in their nectar and pollen, thus exposing pollinators to soil- and water-borne pollutants. Heavy metals have become a common environmental contaminant due to several human activities, like agrochemical applications and intensive industrialization, causing sublethal effects among numerous bee populations. Social bees, such as bumblebees (*Bombus* spp.), particularly rely on their cognitive abilities to gather adequate food for their colony. Therefore, altered foraging behaviours could lead to decreased offspring output, or complete colony collapse due to starvation. This project explores the effect of chromium exposure on bumblebee cognition by analyzing their defensive buzz response to assess a) threat perception, b) buzzing patterns, and c) cessation of agitation through visual and acoustic cues. Preliminary results indicate significantly longer buzz duration in high-dosed (15ppm) bees as compared to unexposed individuals after 7 days of exposure. These data suggest higher energy expenditure in chromium-exposed bees. This could indicate reduced forager efficiency in bumblebees as more time and energy is spent responding to a threat rather than foraging. Further examination will include buzz pattern comparisons, body size analysis, and energy expenditure estimates of chromium dosed bees.

40 Jess Vickruck[1], Pamela MacKinley[1], Abby Malayny[2], Almeera Ahmed[2], Amy Parachnowitch[2], Stephen Heard[2]
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Wild bee community composition and floral use across different habitats in Atlantic Canada

Wild bees make large contributions to pollination globally, yet our knowledge of their abundance and distribution in Maritime Canada is not well understood. We sampled wild bees across different habitat types in NB, PEI and NS to categorize wild bee abundance and distribution, as well as associated floral resources during the summer of 2022. In addition, at a subset of sites, we examined the pollen collected off of the bodies of the bees to learn which flowers wild bees were using in agricultural settings. Wild bee species richness and abundance was higher in agriculture and pasture sites than in forests. We also show that wild bees are foraging from a number of different flowers, mostly from agricultural field edges. These results highlight the different responses of wild bee communities to land use change. Further research aims to investigate implications for insecticide exposure in these habitats, as it appears wild bees may be drawn to high risk areas in Maritime Canada.

41 Jens Roland[1], Sherri Fownes[1], Steve Matter[2]
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The 2021 "Heat Dome" in western Canada had no effect on alpine *Parnassius smintheus* butterfly populations

Extreme weather events are predicted to occur more frequently as global climate warms. From June 26 - July 1, 2021, an extreme heat anomaly, referred to as the "Heat Dome", occurred over western North America. Maximum daily temperature far exceeded previous records in British Columbia and Alberta in all regions including the alpine zone. Such extreme events can have deleterious effects on physiology, behaviour, survival and ultimately, on the dynamics of animals. We have studied population dynamics of alpine *Parnassius smintheus* butterflies in 21 populations at Kananaskis, Alberta, over the past 29 years. The occurrence of the "Heat Dome" in 2021 provided and excellent opportunity to evaluate population response to this extreme short-term weather event. At our study site at Jumping Pound Ridge, AB, daily maximum temperature during the "Heat Dome" was almost 20°C higher than long-term average daily maxima for the same dates, and exceeded the previously recorded maximum by 5°C for several days. Despite these extreme temperatures, populations did not decline; in fact, they increased slightly relative to the long-term trend. *P. smintheus* butterflies pupate in the soil in June and early July, a strategy that likely protects this non-mobile life-stage from such weather extremes during this time of year.

42 Abbie Mullins[1,2], Sean McCann[3], Catherine Scott[1,4]
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Candy stripers on the Rock: Habitat and resource usage of introduced candy-striped spiders in St. John's, NL.

The candy-striped spider (*Enoplognatha ovata*) is a colourful cobweb weaver that primarily hunts on flowering plants. Native to Eurasia, it was first recorded in St. John's in 1958 and has since spread across the island of Newfoundland. To understand how candy-striped spiders may impact native arthropod communities, we examined which habitat types and plants they prefer, and determined their abundance

relative to native crab spiders with similar habits. In summer 2023, we sampled 10 sites in the St. John's area. We found that *E. ovata* is extremely abundant, with an average of 3.4 individuals/m2 across all habitat types and outnumbering native crab spiders by over 10:1. They also overwhelmingly prefer to hunt on goldenrods and brambles relative to their availability in a habitat. Candy-striped spiders may have a negative effect on native arthropods as a predator of insect pollinators that visit common wildflowers and as a competitor of native spiders.

43 Ella Daly[1], David Renault[1]
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Predation by an invasive Coleoptera: comparing experimental feeding trials with inferred interactions

Dietary breadth and preferences are important determinants of the ecological impacts of invasive predators. However, it can be difficult to directly study predation and impacts of invasive insects in-situ in remote and logistically challenging environments like the sub-Antarctic. Laboratory based experiments can be used to study prey preference and feeding-related behaviours of these species, but there is uncertainty regarding whether results from such experiments translate into real, complex ecosystems. To better understand the impacts of the invasive beetle *Merizodus soledadinus* in the sub-Antarctic Kerguelen Archipelago, we performed laboratory experiments on prey preference and the feeding behaviour of both individuals and groups of this species. In addition to this, we also examined long-term macroinvertebrate abundances in invaded and uninvaded communities to infer ecological interactions involving *M. soledadinus* using poisson lognormal models. We compared the results of these two methods to gain insights into the ecology and controls on *M. soledadinus* predation in local communities. We showed that despite readily consuming almost all larval forms of native species across Diptera, Coleoptera, and Lepidoptera in laboratory experiments, in real communities *M. soledadinus* consumes a smaller selection of species. Our results lend caution to the direct application of food choice studies in understanding predation in real ecosystems and improve our understanding of a voracious invader in an ecologically fragile region.

44 Nolan Boyd[1], Emily Bacon[1], Lillian Ricker[1], Gemma Rawson[1], Alina Rutherford[1], Madeline MacNeil[1], Laura Ferguson[1]
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Mosquito surveillance in the Maritime provinces under the lens of climate change

In the Maritime provinces of Canada, climate change is increasing temperatures and introducing more variable precipitation, higher levels of humidity, and shorter, warmer winters. These changes in environmental conditions will impact the distribution and abundance of insects, such as mosquitoes. Because mosquitoes are important vectors of disease to humans, domestic animals, and wildlife, it is important to track changes in these populations. The last mosquito surveillance across the Maritimes occurred over 20 years ago, and thus there are gaps in our understanding of mosquito populations and the introduction of invasive species. Our objective is to update the database of mosquitoes in the Maritime provinces and provide insights into their distributions as a new baseline for continued surveillance in the face of climate change. Thus far, we have sampled over 260 sites in New Brunswick, Prince Edward Island, and Nova Scotia, in 2023 and 2024, through collecting larvae from stagnant water sources (i.e. ephemeral ponds, roadside ditches, bogs, and artificial containers), and collecting adult mosquitoes using light traps baited with CO_2, as well as human landing captures. In 2023, we identified over 17,000 individual mosquitoes and found four

new species records for New Brunswick and six new species records for P.E.I. We have also observed the expansion of the invasive species, *Aedes japonicus,* throughout all three provinces. These data will allow us to move forward with preparing for the future of tracking changes in mosquitoes and mosquito-borne diseases in the Maritimes.

45 Josée Doyon[1], Simon Legault[1], Jacques Brodeur[1]
[1]IRBV/Université de Montréal

Evaluation of pupation rate and overwintering success in *Istocheta aldrichi* (Diptera: Tachinidae), a parasitoid of the Japanese beetle (Coleoptera : Scarabaeidae)

The tachinid fly *Istocheta aldrichi* (Mesnil) is a solitary parasitoid of adult Japanese beetles, *Popillia japonica* (Newman). Native from Japan, the parasitic fly was first released in 1920 in the United States of America to control Japanese beetle populations. *Istocheta aldrichi* was first observed in Québec in 2009, and in Ontario in 2013. We evaluated the pupation rate of *I. aldrichi* in function of host sex, host size and superparasitism (number of eggs laid per host). We also determined the overwintering success of diapausing pupae. Parasitized Japanese beetles were collected in a vineyard in St-Paul-d'Abbotsford (Montérégie) in 2023 and were reared under laboratory conditions. Sub-samples of diapausing *I. aldrichi* pupae were buried outside at 20 cm deep, from September 1st to May 20th, and checked for adult emergence the next summer. There was no effect of Japanese beetle sex or parasitoid egg number on the pupation rate of *I. aldrichi*. Female Japanese beetles yielded heavier *I. aldrichi* pupae than males (22.4 mg for females vs. 13.4 mg for males). Furthermore, for superparasitized hosts, there was a reduction in *I. aldrichi* pupal weight when more than five eggs were laid on the host. Among the 437 pupae that overwintered, only 52 % emerged. These preliminary results aim at providing a better understanding of the biology of *I. aldrichi* and at developing a reliable rearing method.

46 April Sharpe[1], Andie McKee[1], Laura V. Ferguson[1]
[1]Acadia Univeristy

Examining the effects of the ingestion of polystyrene microplastic spheres on mosquito cold tolerance

The ability to tolerate low temperatures determines the range limits and abundance of insects in northern latitudes. However, for insects with aquatic life stages, such as mosquitoes, exposure to the growing concentration of microplastics in these habitats could cause stress or ice nucleation in the body that decreases these thermal limits. To determine if microplastics reduce cold tolerance in mosquito larvae, we exposed first instar larvae of the species *Aedes aegypti*, *Culex pipiens*, and *Culex territans* to a very high (20 000 spheres/mL), high (200 spheres/mL), and moderate (20 spheres/mL) concentration of 3 µm diameter, dark red, polystyrene microplastic spheres in 8 mL of water for approximately two weeks under light and temperature conditions that mimicked late summer/early autumn in Nova Scotia. Upon reaching the fourth instar, we measured the supercooling point and chill coma recovery time of each larva. We also exposed an additional species, *Culiseta melanura*, which overwinters as larvae, to 24 weeks of winter conditions with a high concentration of microplastics, and then measured the chill coma recovery time. The supercooling point of unexposed *Cx. pipiens* was higher than those exposed to very high concentrations of microplastics, and the larvae of plastic-exposed *Cu. melanura* were slower to recover from cold exposure. Thus, a very high concentration of microplastics may cause injury or interrupt the ability to acclimate to low temperatures,

resulting in decreased cold tolerance. However, lower concentrations appear to have little to no effect on the thermal physiology of these species.

47 Lisa Lumley[1], Victoria Giacobbo[1]
[1]Alberta Biodiversity Monitoring Institute; University of Alberta

Alberta's Oribatida: Mites galore in 2022-24

Oribatid mites are typically diverse and abundant in soils and make important contributions to soil structure and functioning. The Alberta Biodiversity Monitoring Institute (ABMI) includes oribatid mites as an indicator group for monitoring changes in biodiversity and habitat at 1656 permanent sites distributed in a 20 km systematic grid across Alberta. As of 2021, there were 384 oribatid mite species and morphospecies recorded for the province of Alberta. Here, we report the most recent oribatid mite discoveries from soil collections sampled in 2022-2024 at ABMI's monitoring sites. This includes new records for Alberta and ABMI, a species that may need a new specific epithet, cryptic and sexually dimorphic species, and geographical curiosities.

48 Ana Livia Oliveira[1], Emma Despland[1]
[1]Concordia University

Tracking Twinkles: Fireflies as Indicators of Urban Greenspace Quality

Fireflies are valuable bioindicators of urban greenspaces due to their sensitivity to artificial light and preference for less urbanized, wooded areas. Their presence often signals a well-managed, biodiverse environment. In the summer of 2024, we conducted a community science project exploring the relationship between environmental factors and firefly abundance. We measured canopy cover, artificial light, organic matter, water presence, land use type, and vegetation height. By September 2024, we received 100 responses through our online form and selected 86 within the Montreal area for analysis. Fisher's Exact Test revealed significant associations between firefly abundance, land use type, artificial light, and organic matter. No significant links were found with water presence, vegetation height, or canopy cover. These results indicate that fireflies are broadly distributed across diverse urban habitats. The findings also underscore the importance of maintaining organic matter and reducing light pollution to support urban biodiversity. Data collection will continue in the coming summer to deepen our understanding of firefly populations in Montreal.

49 Daniel Erasmus[1], Shayden Hiebert[1], Isaiah Reynolds[2], Dezene Huber[1]
[1]University of Northern British Columbia, [2]Stellat'en First Nation

DNA barcoding reveals high levels of biodiversity for Ephemeroptera, Plecoptera, and Trichoptera in the Stellako River, BC.

Worldwide, habitat loss and anthropogenic disturbance have caused a dramatic decline in the entomofauna biomass and species, including aquatic taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPTs). The Stellako River on the traditional territory of the Stellat'en First Nation (northern British Columbia) is well known for the rainbow trout (recreation angling) and sockeye salmon (First Nation sustenance) that inhabit the river. Both rainbow trout and juvenile sockeye salmon relay primarily on EPTs as food. In this study, the biodiversity of the EPTs was catalogued by capturing specimens using sweep

netting, kick netting, and Malaise traps. DNA barcoding revealed 17 Ephemeroptera, 12 Plecoptera, and 27 Trichoptera species. Two Trichoptera species, *Protoptila coloma* (Glossosomatidae) and *Hydroptila hamata* (Hydroptilidae), are new species records for Canada and British Columbia respectively. A third Trichopteran, *Hydroptila amoena* (Hydroptilidae), was identified using taxonomic keys and is a new species record for British Columbia. *Hydropsyche alternans* (Hydropsychidae) was found to be most abundant population among the EPTs present, and due to its generalist life cycle, may play an important role as a keystone species in the Stellako River.

50 Alannah Z. Penno[1], J.M. Shrimpton[1], Dezene P.W. Huber[1]
[1]University of Northern British Columbia

The collection of a caddisfly of conservation concern creates a classification conundrum: The first record of *Apatania comosa* Denning 1949 or *Apatania chasica* Denning 1954 (Trichopera: Apataniidae) in Canada

Genetic sequencing for a larval Trichoptera specimen collected in the Williston Reservoir, British Columbia, in 2016, returned a close match to two Apataniidae species: a 99.46% match to an *Apatania comosa*specimen and a 98.57% match to an *Apatania chasica* specimen. DNA barcoding was used to determine the identification due to larvae of these species being undescribed and undefined in any published morphological keys. The collection location of this specimen represents a large expansion of the known range of both *A. comosa* and *A. chasica*, as well the need for a conservation status reassessment for *A. comosa,* which are considered imperiled (NatureServe). The close genetic sequencing results of this specimen brings into question whether *A. comosa* and *A. chasica* are indeed separate species, and the possibility that they form a single species should be considered. The under-described nature of multiple Apataniidae species larvae highlight the need for increased sampling and identification efforts to define the diagnostic morphological characteristics of these species, and to improve our understanding of this family of caddisflies.

51 Guillaume Saint-Jacques[1], Étienne Normandin[1], Colin Favret[1]
[1]Université de Montréal

Mealworm (Coleoptera: Tenebrionidae: *Tenebrio molitor*) Strains Exhibit Different Levels of Resistance to Pathogenic Bacterial Infection

Tenebrio molitor (Fam. Tenebrionidae) is currently being evaluated as a future replacement source of nutritional animal protein, as it is relatively easy to mass produce. As in almost all agricultural production, different mealworm strains exhibit variation in growth and fecundity. Challenges in mass producing insects include the potential of pathogenic infection. We seek to measure the natural resistance of different mealworm strains to such diseases. We infected mealworm larvae with the gram-negative bacterium *Serratia marcenscens* and quantified changes in growth and mortality of insects from 10 different strains. We discuss the repercussion to mealworm farming of natural resistance to disease. Future trials will investigate if mealworm disease resistance can be augmented by probiotic nutritional supplementation.

52 Anthony Piot[1], Marianne Potvin[1], Justin Wood[2], Melanie Wills[2], Karine Thivierge[3], Roger Levesque[1]

[1] Institut de Biologie Intégrative et des Systèmes, Université Laval, [2] G. Magnotta Lyme Disease Research Lab, Department of Molecular and Cellular Biology, University of Guelph, [3] Laboratoire de santé publique du Québec

Identification of microbiome diversity in Ixodes scapularis from Canada via long read sequencing

Background: Climate change has facilitated the northward expansion of *Ixodes scapularis*, commonly known as the black-legged tick, into Canada. This tick species is a known vector for various parasitic, bacterial and viral pathogens, influencing both human and animal health. The microbiome of ticks plays a crucial role in their biology and their capacity to harbor and transmit pathogens, yet our understanding of the interplay between tick microbiomes and pathogens remains limited.

Methods: To address this knowledge gap, we conducted a study using engorged *I. scapularis* specimens collected in Canada. We employed Oxford Nanopore long-read sequencing on the PromethION platform to analyze tick lysates. Taxonomic identification of the sequenced reads was performed using Kraken2, allowing for a comprehensive assessment of the tick microbiome diversity and associated pathogens.

Results: Our study successfully detected pathogens within the tick microbiome without the need for prior DNA amplification. We provided a detailed description of the microbial species present in the tick microbiome, including their relative abundances. This high-resolution data offers new insights into the diversity and prevalence of pathogens in ticks.

Conclusion: The presented method advances our ability to describe and monitor tick-borne pathogens in Canada, while also facilitating the reconstruction of metagenome-assembled genomes. Our findings enhance the understanding of the interaction between tick microbiomes and pathogen presence, providing valuable information for tracking and managing tick-borne diseases in the region.

53 Jade Savage[1], Jérémie Bouffard[1], André-Philippe Drapeau Picard[2]

[1]Bishop's University, [2]Insectarium de Montreal

Ceci n'est pas une tique: which arthropods are misidentified as ticks by the public?

eTick, a Canadian image-based tick identification platform, has received well over 80,000 submissions made by the public since 2017. However, nearly 5000 of these submissions involve organisms or structures that are not ticks. This indicates that some people will often mistake benign taxa for medically relevant ticks, an issue which may in turn lead to unwarranted stress. Processing of these non-tick submissions also requires a valuable time commitment from eTick human resources. Given that Canada is witnessing rapid changes in the distribution and abundance of several tick species (and the pathogen they may carry), documenting what and why non-target taxa are commonly misidentified as ticks should provide directions for the development of better tick recognition tools for the public and, in turn, reduce the submission rate of non-target taxa to the eTick platform.

Using a sub-sample of non-tick eTick submissions from Quebec, 556 arthropods were identified at least to the class level. Most were insects (76%), followed by arachnids (23%). Coleoptera were the most submitted arthropod order (46%) followed by Hemiptera (26%) and Araneae (12%). Of the submissions that could be identified to the generic level, weevils in the genus *Otiorhynchus*, Japanese beetles (*Popillia japonica*), and spider beetles (*Mezium* spp.) were the most represented. Likely explanations for the high prevalence of these taxa in our data set are discussed and suggestions for the development of better tick identification outreach tools are presented.

54 Simon Coroller[1]
[1]Université de Sherbrooke

Apprendre à reconnaître des espèces avec un jeu vidéo : Le cas d'Animal Crossing New Horizons

Pendant les confinements liés à la pandémie de COVID-19, de nombreuses personnes ont utilisé les jeux vidéo pour maintenir des liens tout en respectant la distanciation sociale. Un jeu vidéo "Animal Crossing", sorti en mars 2020, a battu des records de ventes et de téléchargements. Il se concentre sur la vie dans un environnement naturel, la construction de maisons, ainsi que la capture, l'exposition et la vente d'espèces pour progresser. Nous avons examiné si les joueurs acquéraient des compétences d'identification des espèces et si ces compétences se transféraient à la réalité. Nous avons utilisé les résultats d'un sondage mené de fin mars à début avril 2020 sur 200 personnes (72 joueurs et 128 non-joueurs). Les participants devaient identifier des espèces à partir de photos, incluant des organismes présents dans le jeu et d'autres qui n'y figurent pas. Nous nous attendions à ce que les joueurs obtiennent de meilleurs résultats pour les espèces présentes dans le jeu, mais des scores similaires à ceux des non-joueurs pour les autres espèces. Les analyses multivariées ont montré que les joueurs identifiaient mieux les espèces réelles présentes dans le jeu. Le rôle des espèces dans le design du jeu influençait cette capacité, par exemple, les plantes principalement décoratives étaient moins bien reconnues. Les participants auto-évaluaient correctement leur niveau de connaissance naturaliste. Les jeux vidéo, à condition de contenir des informations rigoureuses scientifiquement, peuvent participer à l'apprentissage de savoirs écologiques comme l'identification des organismes et pourraient être utilisés comme outils éducatifs en biologie de la conservation.

55 Amélie Quesnel[1], Pierrick Bloin[1], Antoine Lantin[1], Christian Hébert[2], Richard Berthiaume[1]
[1]Société de protection des forêts contre les insectes et maladies (SOPFIM), [2]Ressources naturelles Canada

Parasitoid Perspectives: Regional Variability in Spruce Budworm Guild and the Impact of *Bacillus thuringiensis* var. *kurstaki* in Québec

Outbreaks of the spruce budworm (*Choristoneura fumiferana* Clemens) (Lepidoptera: Tortricidae) historically occur every 30 to 40 years, persist for 5 to 25 years and cause significant mortality—up to 85%—of balsam fir (*Abies balsamea* L.), depending on the spatial composition and variability of forest stands. In Québec, the current outbreak, which has been ongoing since 2006-2007, continues to spread and threaten boreal ecosystems. Management of spruce budworm populations involves aerial spraying of *Bacillus thuringiensis* var. *kurstaki* (*Btk*). However, understanding the ecological mechanisms driving these outbreaks, including the effects of *Btk* on the parasitoid communities, remains crucial. Therefore, this study aims to investigate the regional variability in spruce budworm parasitoid species communities and parasitism rates for six regions along a longitudinal gradient. To achieve this, we reared spruce budworm sixth instar larvae and pupae collected from *Btk*-treated and untreated coniferous forests. At this point, more than 1,900 parasitoids have been identified, divided into 15 different species. Preliminary results suggest that the parasitism rates of spruce budworm larvae and pupae increased with *Btk* applications and are similar across the longitudinal gradient. This research will continue in 2025 to further elucidate these patterns and attest to intra-annual differences.

56 Jeffrey Vogt[1], Ché Elkin[1], Celia Boone[2], Dezene Huber[1]
[1]University of Northern British Columbia, [2]British Columbia Ministry of Forests

Climate-adapted silvicultural management and arthropod community ecology: long-term monitoring in BC's sub-boreal spruce zone

Like other northern ecosystems, northern British Columbia's spruce (*Picea* spp.) and subalpine fir (*Abies lasiocarpa*) forests are experiencing rapid, accelerating climate change. We know little about the associated arthropod communities or how they will respond to forest management aimed at mitigating negative climate impacts. The Adaptive Silviculture for Climate Change (ASCC) project is a network of long-term silvicultural experiments set up across North America. One such experiment was recently established in the University of Northern British Columbia's John Prince Research Forest (JPRF) within the sub-boreal spruce biogeoclimatic zone in BC's central interior. The JPRF ASCC trial consists of five silvicultural treatments representing potential management responses to climate change: no treatment (~25-30 m2/ha basal area retention), resistance (15 m2/ha basal area retention), resilience (10 m2/ha basal area retention), transition (5 m2/ha basal area retention), and clear-cut. Four replicates of each treatment were established, with each replicate being a 10 ha block. In 2023 and 2024 - one and two years following harvesting treatments - we began long-term arthropod community monitoring surveys using pitfall traps for ground-dwelling arthropods and coloured pan traps for pollinators. Morphospecies analyses (Carabidae, Staphylinidae, Elateridae, Muscidae, Heleomyzidae, parasitic Hymenoptera, Formicidae, and Arachnida) of the pitfall trap samples showed increases in alpha diversity in clear-cuts and resilience treatments. Gap structure, incorporated into some treatments, also influenced diversity. Ongoing monitoring of these plots will help to guide climate and biodiversity maintenance strategies for forest managers.

57 Mads Andersen[1,2], Amanda Roe[3], Yuehong Liu[3], Antonia Musso[4], Serita Fudlosid[1], Fouzia Haider[1], Maya Evenden[4], Heath MacMillan[1]
[1] Carleton University, [2] Aarhus University, [3] Natural Resources Canada, [4] University of Alberta

The freeze-avoiding mountain pine beetle survives prolonged exposure to stressful cold by mitigating ionoregulatory collapse

Insect performance is linked to environmental temperature, and surviving through winter represents a key challenge for temperate, alpine, and polar species. To overwinter, insects have adapted a range of strategies to become truly cold hardy. While the mechanisms underlying the ability to avoid or tolerate freezing have been well- studied, little attention has been given to the challenge of maintaining ion homeostasis at frigid temperatures in these species, despite this limiting cold tolerance for insects susceptible to mild chilling. Here we investigate how prolonged exposure to temperatures just above the supercooling point affects ion balance in freeze-avoiding mountain pine beetle (*Dendroctonus ponderosae*) larvae in autumn, mid-winter, and spring, and relate it to organismal recovery times and survival. Hemolymph ion balance was gradually disrupted during the first day of exposure, characterized by hyperkalemia and hyponatremia, after which a plateau was reached and maintained for the rest of the seven-day experiment. The degree of ionoregulatory collapse correlated strongly with recovery times, which followed a similar asymptotical progression. Mortality increased slightly during extensive cold exposures, where hemolymph K^+ concentration was highest, and a sigmoidal relationship was found between survival and hyperkalemia. Thus, the cold tolerance of the freeze-avoiding larvae of *D. ponderosae* appears limited by the ability to prevent ionoregulatory collapse in a manner similar to chill-susceptible insects, albeit at much lower temperatures. Based on these results, we propose that a prerequisite for the evolution of insect freeze-avoidance may be a convergent or ancestral ability to maintain ion homeostasis during extreme cold.

58 Thilina Thilina Hettiarachchi[1], Chaminda De Silva Weeraddana[1], Ramya Wijesundara[1], Alejandro C. Costamagna[1]
[1]Department of Entomology, University of Manitoba

The effect of short-term drought and flooding conditions on oviposition of wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae).

Climate change poses new challenges to wheat crops, making it crucial to understand its impact on pests. The wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), is a significant pest in wheat-growing regions in the Canadian Prairies. In laboratory studies, we assessed the effect of short-term (3 days) drought and flooding treatments to assess oviposition. These two experiments were conducted separately using control plants that were watered daily. Oviposition was assessed using choice and no-choice experiments. Intact wheat spikes were enclosed in a 2L transparent plastic bottle, and four females and four males were released into these oviposition cages for three days. After that, wheat spikes were dissected to assess the oviposition of wheat midge adults. Choice experiment data were analyzed using paired t-tests, and no-choice data were analyzed using two sample t- tests. Both in the choice (n = 17) and no-choice experiments (n =13), significantly fewer eggs were laid on plants in the drought treatment. In choice (n = 9) and no-choice experiments (n = 8 - 10), slightly more eggs were laid on plants in the flooding treatment. Follow-up tests are ongoing to evaluate larval performance on these treatments. These changes in oviposition behaviour may be influenced by volatile organic compounds (VOCs) emitted by plants; therefore, future experiments will focus on analyzing VOCs from these plants.

18:00 LeafHope project meeting
Invited guests only - Personnes invitées seulement

19:00 Student Mixer - Réception des étudiants, Brasserie INOX/Pub, 655, Grande-Allée Est
19:00-22:00

This year, for the Student Mixer, you'll be welcomed into the first microbrewery in Quebec City and the second oldest in the province, INOX. It's just a few steps east of the Concorde on Grande-Allée. The organising committee has prepared games and quizzes with delicious prizes to be won. What's more, no less delicious food will be served in bite-size portions, and one drink will be provided per person.
Cette année, pour la Réception des étudiants, vous serez reçus dans la première microbrasserie de la ville de Québec et la second plus ancienne de la province, l'INOX. Celle-ci se trouve à seulement quelques pas à l'est du Concorde sur la Grande-Allée. Le comité organisateur vous a préparé des jeux et des quiz où de délicieux prix seront à gagner. De plus, de la non moins délicieuse nourriture sera servie sous forme de bouchées et une consommation sera fournie par personne.

Tuesday October 22, 2024 - Mardi 22 octobre 2024

8 :30 Plenary Session #4 - Session plénière #4

Krieghoff – Suzor-Côté

Alberto Urbaneja[1], Meritxell Pérez-Hedo[2]
[1] Centro de Protección Vegetal y Biotecnología, Instituto Valenciano de Investigaciones Agrarias (IVIA), Carretera Moncada-Náquera km 4,5. 46113 Moncada, Valencia, Spain
[2]Instituto de Biología Molecular y Celular de Plantas (IBMCP), Consejo Superior de Investigaciones Científicas, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain

Balancing the scales: the case of zoophytophagous predators in sustainable agriculture

Zoophytophagous predators, such as predatory mirid bugs, play a dual role in pest control by feeding on both plant material and insect prey, making them valuable components of Integrated Pest Management (IPM) programs. These predators have demonstrated effectiveness against key pests in horticultural crops, including whiteflies, thrips, and lepidopteran eggs. Additionally, their plant-feeding behavior triggers systemic plant defenses, which reduce pest attractiveness and enhance the recruitment of natural enemies, such as parasitoids. This dual capability makes them a powerful tool for reducing pest populations and increasing plant resilience to herbivores and diseases. Moreover, thanks to the phytophagous behavior of mirids, a new pest management strategy has been developed based on plant communication. Recent research has shown that plants attacked by these predators can signal neighboring plants to activate their defenses, creating a proactive defense system. This breakthrough has led to the identification of specific volatile organic compounds (VOCs) that trigger these defense responses, which can now be applied in the field through polymeric dispensers. However, the use of these predators is not without challenges. Their phytophagous behavior can cause plant damage, especially when prey availability is low, potentially leading to economic losses in crops like tomatoes. Interestingly, certain species highly valued as natural enemies in some regions are considered pests in others, highlighting the complexity of their behavior and impact on different agricultural systems. Careful management and monitoring are therefore required to balance their benefits with potential drawbacks.

Keywords: Volatile compounds, Pest control, Inter-plant communication, phytophagy, Plant defenses

Diversity, Genomic and populations - Diversité, génomique et populations (1)

Lismer-Leduc-Fortin

9:30-10:30

Moderator: Pierre-Marc Brousseau

9:30 Donovan Bosnich[1], Bryan Brunet[2], Jennifer Gleason[2], Ram Duwal[2], Catherine Cullingham[3]
[1]Carleton University & AAFC, [2]AAFC, [3]Carleton University

The GbS Showdown Between the Blueberry and Cranberry Aphid in a Phylogenetic Wild West

Canada's blueberries are under threat from an incurable disease known as Blueberry Scorch, caused by Blueberry Scorch Virus (BlScV), which is spreading throughout British Columbia. The culprit behind these rampant levels of BlScV infection is the blueberry aphid, *Ericaphis fimbriata*, whose winged adults carry the virus from plant to plant in their salivary glands. Despite its agricultural importance, *E. fimbriata* is currently

difficult to distinguish morphologically and genetically from the cranberry aphid, *Ericaphis scammelli*, as previous molecular sequencing work has not been precise enough to delineate the evolutionary boundaries between the two species. This taxonomic ambiguity complicates pest management efforts, particularly in accurately identifying *E. fimbriata*. To address this challenge, my study utilizes Genotyping by Sequencing data to characterize the genetic population structure of this pest complex using single nucleotide polymorphisms. Additionally, the genetic data was subjected to several phylogenetic estimation approaches, producing several species trees with consistent patterns. The resulting phylogenetic trees clearly outline the evolutionary separation between *E. fimbriata* and *E. scammelli,* as well as revealing diverging population structures between western and eastern populations of *E. fimbriata*. By providing a more concrete species definition for *E. fimbriata*, more informed pest-management decisions can be made to control the spread of BlScV at the vector level, ultimately protecting Canada's blueberry industry.

9:45 Joshua Molligan[1], Jordanne Jacques[1], Soham Mukhopadhyay[1] Edel Perez-Lopez[1],
[1]Université Laval

Genomic Insights into *Empoasca fabae*: Characterizing the Mitochondrial Genome with Next-Generation Sequencing

This study presents the assembly and annotation of the complete mitochondrial genome for the leafhopper species *Empoasca fabae* Harris, 1841, using high-throughput Illumina sequencing data. The mitochondrial genome was obtained from a contig-level assembly, measuring 14,873 bp in length with a base composition of A (38.8%), T (39.1%), C (11.7%), and G (10.4%). This mitogenome comprises 13 protein-coding genes (PCGs), 22 transfer RNA genes (tRNAs), and two ribosomal RNA genes (rRNAs), along with a unique D-loop region. Most PCGs initiate with an ATN start codon, while two begin with TCG and GTG. Phylogenetic analysis confirmed the placement of *E. fabae* within the subfamily Typhlocybinae, clustering with other members of the *Empoasca* genus. This research highlights the first complete mitochondrial genome of *E. fabae* and the first for the *Empoasca* genus in North America. Interestingly, *E. fabae* appears to be highly divergent from closely related mitogenomes reported for other members within the *Empoasca* genus. This works demonstrates the feasibility of *de novo* mitogenome assembly and annotation using high-throughput Illumina sequencing data. Additionally, these findings pave the way for further genomic studies to enhance our understanding of evolutionary relationships within the genus and inform pest management strategies in agriculture.

10:00 Jessica Lario[1, 2], Lisa Lumley[1, 2], Heather Proctor[1]
[1]Department of Biological Sciences, University of Alberta, [2]Alberta Biodiversity Monitoring Institute, University of Alberta

Do oribatids go with the flow? Assessing evidence for hydrochory of oribatid mites in the North Saskatchewan River in central Alberta.

The North Saskatchewan River (NSR) is a complex network connecting large portions of land, providing a mechanism for long-range dispersal that organisms could use to travel great distances. In the past, research has focused primarily on the hydrochory of propagules or aquatic invertebrates. There has been limited research on terrestrial organisms using these systems for passive dispersal, such as oribatid mites. These terrestrial arthropods are found in soil environments and are important indicators of soil health. Several species have been found only in the NSR valley, within and downstream of Edmonton. This pattern could be due to limited research, and they may be an endemic species to central Alberta, or it could be an

indication of introduction through urban run-off from Edmonton. This project aims to determine the diversity of species found within the NSR riparian zone across central Alberta and determine if this pattern suggests oribatid mites could be using the river for dispersal. Soil samples were collected upstream, downstream, and within Edmonton, and extracted oribatid mites were identified to the species level. Preliminary findings show an increase of species richness and abundance within Edmonton, and a larger increase downstream of Edmonton relative to upstream. This increase may result from the lack of research on the distribution of oribatid mites across central Alberta or suggest introduction through soil run-off from Edmonton. Findings from this study can be applied to other organisms that could use hydrochory for long-distance transportation.

10:15 Marc-Antoine Poulin[1], Colin Favret[1], Pierre Legendre[1]
[1]Université de Montréal

Exploratory Analyses of a Weevil Population

The initial analyses of a project on the dynamics of diversity in a weevil community in Panama. Located in a forest that has been extensively studied over the past 50 years, we have a wealth of environmental data at our disposal. With more than a decade of weekly weevil observations, the presentation will demonstrate several methods of processing temporal data. The changes in trophic groups, the impacts of climatic phenomena over time, and the direction of ecosystem changes will be presented to illustrate the different ways of analyzing community changes.

Ecology - Écologie (5) Jean-Paul Lemieux

9:30-10:30
Moderator: Maxime Lefebvre

9:30 Olajide Fatukasi[1], Asha Wijerathna[1], Malinda Thilakarathna[1], Maya Evenden[1]
[1]University of Alberta

Herbivory and development of pea leaf weevil, *Sitona lineatus* (Coleoptera: Curculionidae) in response to Rhizobium-field pea symbiosis

Pea leaf weevil (*Sitona lineatus* L.) is a major pest of field peas and faba beans (Fabaceae). Economic damage to these legumes is caused by *S. lineatus* adults and larvae that feed on foliage and the rhizobia-containing root nodules, respectively, thereby causing reduced plant nitrogen and crop yield. The rhizobia-plant interaction may affect pea leaf weevil herbivory and development by influencing plant food quality and chemical defense. We tested the hypothesis that *Rhizobium*-field pea interactions influence *S. lineatus* foliar feeding, larval development, and field pea yield. Field pea plants received one of four treatments in each of three experiments assessing foliar feeding, larval development, and yield: 1) inoculated with the wild-type *Rhizobium leguminosarum*, WT3841; 2) inoculated with a mutant *R. leguminosarum*, MT3940 that does not fix nitrogen; 3) treated with nitrogen; and 4) control plants that received only water. After 5 weeks, male and female *S. lineatus* were introduced into each pot containing the variously treated plants and were allowed to feed for 4 days. There was no treatment effect on adult *S. lineatus* herbivory, which could be due to a trade-off between nutritional food quality and chemical defense. Wild-type *Rhizobium* strain, however, significantly supported field pea yield, and *S. lineatus* development from egg to adult stage compared to the mutant-type, and other treated plants. Lower crop yield and development of *S. lineatus* on plants inoculated with the mutant-type, MT3940 could be due to smaller nodule size and a lack of fixed nitrogen compared to wild-type, WT3841 treatment.

9:45 Clarissa Capko[1], Graham Ansell[1], Angela Gradish[1], Rebecca Hallett[1]
[1]University of Guelph

Phenology of the Switchgrass Gall Midge (*Chilophaga virgati* Gagné) in Ontario

Switchgrass (*Panicum virgatum* L.) is a perennial biomass crop grown in Ontario and Québec for livestock bedding, feed, and biofuel. In 2020, the switchgrass gall midge (SGM*, Chilophaga virgati* Gagné; Diptera: Cecidomyiidae) was discovered in Ontario and now threatens ~1,000 ha of Ontario switchgrass. Knowledge of SGM biology is limited to two studies from South Dakota, where damage was shown to cause nearly 100% seed loss and reduce overall biomass. Information regarding its life cycle and phenology in Ontario is critical to understanding the potential economic impact of SGM, and for the development of monitoring and management practices. In this study, we sampled switchgrass tillers in southern Ontario weekly, beginning in February, to determine the presence and timing of all life stages of SGM. Adult sampling was accomplished using a novel emergence cage design placed within the field. Additionally, quadrat sampling was conducted late in the growing season to describe the distribution and density of the midge within the field. Information on the presence and abundance of parasitoid species associated with the midge is also described. This research contributes to the currently limited body of information on the biology and ecology of SGM, and to the development of pest management strategies needed by switchgrass producers to minimize the impact of this newly discovered pest.

10:00 Carina Lopez[1], Boyd Mori[1]
[1]University of Alberta

***Contarinia nasturtii-Arabidopsis thaliana*: a model system to study gall insect-plant interactions**

Swede midge, *Contarinia nasturtii* (Kieffer) (Diptera: Cecidomyiidae), is an invasive species that threatens agricultural production of Brassicaceae crops in Canada. Swede midge larvae manipulate their host plant to create galls—abnormal plant tissue deformations produced in response to salivary secretions—which can cause yield losses up to 85% in Brassicaceae crops. A model system to understand the mechanisms involved in host plant selection and manipulation by this insect would enhance our knowledge of this pest and possible management strategies. This project aims to develop a unique model system with *C. nasturtii* and *Arabidopsis thaliana* wherein insect-plant interactions can be thoroughly studied and will begin to explore the defense responses manipulated by swede midge. In this study, we used a series of no-choice tests with *A. thaliana* at three distinct growth stages and infested each plant with a density of 8:8 (F:M) midges for three durations to determine the optimal plant growth stage and duration for infestation. An additional no-choice test using *A. thaliana* at two growth stages and a density of 20:20 (F:M) midges was tested to determine the optimal adult midge density. Initial experiments found an extremely short adult life span, and therefore a further experiment was conducted to evaluate the effects of water access on the longevity and survival rate of individual male and female *C. nasturtii* adults. Ultimately, this research will begin to elucidate the mechanisms of midge manipulation of the plant and the role of plant defense compounds in response to *C. nasturtii*.

10:15 Kanishka M. Senevirathna[1], Erin O. Campbell[2], Julian R. Dupuis[3], Boyd Mori[1]
[1]Department of Agricultural, Food, and Nutritional Science, 4-10 Agriculture/Forestry, University of Alberta, Edmonton, AB, T6G 2P5, Canada, [2]Ottawa Plant Laboratory, Canadian Food Inspection Agency, Ottawa, ON, K2H 8P9, Canada, [3]Department of Entomology, University of Kentucky, Lexington, KY, 40546-0091, USA

Tracing genetic diversity and population structure of wheat midge (*Sitodiplosis mosellana*) in North America

Understanding the genetic structure of pest populations across their natural range is essential for implementing species-specific management plans. Monitoring the movement and potential routes of agricultural pests is one of the first lines of defense of those plans. This study focuses on the population genetics of the orange blossom wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), a major invasive pest of wheat (*Triticum aestivum L.*) on the Canadian prairies. Using ddRADSeq, we examined the genetic diversity of wheat midge populations across North America. We analyzed 162 samples from 29 locations across North America using 2,164 single nucleotide polymorphisms. Our findings reveal that wheat midge populations in the Prairies form a genetically cohesive group, while samples from Quebec constitute a distinct, separate group. This suggests diverse wheat midge populations across North America with potential interconnections within the Prairies, indicating the migration of individuals between these populations. The observed population structure may point to multiple independent invasion events of wheat midge in North America, with Prairie populations similar to populations from the northern USA rather than Quebec. Further research with a larger and more diverse sample set is needed to draw definitive conclusions. Understanding the genetic diversity and connectivity of wheat midge populations is vital for effective pest management strategies, such as developing midge-tolerant wheat cultivars and targeted insecticide applications, which can exert selective pressure on midge populations and help mitigate crop damage.

Symposium Biological Control programmes in Canada: advancements in using «Good» to combat «Bad» (1)

Organized by Meghan Vankosky and Véronique Martel

9:45-10:30

Moderators: Meghan Vankosky and Véronique Martel

9:45 Tim Haye[1], Tara Gariepy[2]
[1]CABI, [2]Agriculture and Agri-Food Canada

Foreign exploration for candidate biological control agents: 75 years of scientific partnership between Canada and CABI

Foreign exploration for efficient, co-evolved biological control agents is the key for classical biological control of invasive insect pests and weeds in Canada. Developing biological control programs for invasive species requires the development of new knowledge on the diversity, biology and host range of their natural enemies in the regions of origin, so that decisions on importation of natural enemies to Canada can be based on sound scientific information. The information to be developed is required under NAPPO regulations for the importation of entomophagous biological control agents. Since many invasive pests and weeds originate in Europe and Asia, it is necessary that research activities in support of the control of these invasives in Canada are conducted in the countries of origin where potential natural enemies for their control exist. Given the relatively high cost of attempting to conduct this work 'in house' through research missions or

establishment of a research facility presence in Europe and/or Asia, Canada and CABI started their scientific partnership 75 years ago. Among the many targets for classical biological control is the apple leaf-curling midge, *Dasineura mali*, an exotic pest of apple trees in Canada. Several parasitoids from Europe were introduced to Canada in the 1980s. The emergence of *D. mali* as a pest in British Columbia renewed interest in biological control and apple orchards were surveyed in Nova Scotia, Ontario, and British Columbia, starting in the mid-2000s. The survey results and renewed foreign exploration efforts for natural enemies for importation biological control are reviewed.

10:15 Rob Bourchier[1], Rosemarie De Clerck-Floate[1], Chandra Moffat[1], Dave Ensing[1], Michael McTavish[2], Ian Jones[2], Jennifer Baici[2], Sandy Smith[2]
[1]Agriculture and AgriFood Canada, [2]University of Toronto

Implementation of biological control of invasive plants in Canada

Canada has a long history of successful public-good research targeting the suppression of introduced invasive plants with arthropods as biological control agents. Over 89 insect species have been released for the suppression of more than 37 introduced invasive plant species since 1951, including recent notable successes with leafy spurge, diffuse knapweed, purple loosestrife, houndstongue and Dalmatian toadflax. The release and establishment of a biocontrol agent in Canada is the culmination of 10 to 15 years of cooperative work with international consortia that follows a seven-step process to: identify promising agents, conduct host-range testing for safety and impact, release and establish agents, and monitor spread and long-term impact. This presentation will detail the steps to getting a biocontrol agent established in Canada, review Canada's ongoing international collaboration with the Centre for Agriculture and Bioscience International (CABI) and update the present status for key new weed-biocontrol projects in Canada.

Environment - Environnement

Borduas

10:00-10:30
Moderator: Grant Vanderberg

10:00 Katelyn Stokes[1], Paul Manning[1]
[1]Dalhousie University

The impact of insect activity on greenhouse gas fluxes from the dung of domesticated and wild mammals

When microorganisms feed on organic matter within mammalian dung, they generate greenhouse gases (GHGs) including carbon dioxide, methane, and nitrous oxide. The relative concentrations of these GHGs are influenced by microorganisms in the mammal's gut and diet, and interactions with other organisms (e.g. dung beetles, Coleoptera: Scarabaeoidea). Dung beetles burrow through dung, introducing oxygen and increasing the surface area of the dung; this influences GHG emissions from the dung of pastured cattle, but few studies have explored the potential for wild animals. Here, we use a laboratory experiment to determine how a common introduced dung beetle (*Colobopterus erraticus)* affects GHGs produced from the dung of eastern coyote (*Canis latrans*), American black bear (*Ursus americanus*) and moose (*Alces alces*). Lastly, we explore how potential changes in GHG emissions are reflected in the suitability of different dung sources as a nesting and food resource by comparing dung burial rates and reproductive output.

10:15 Bennett Grappone[1]
[1]University of Alberta

Different Types of Dead Animal Attract Different Communities of Arthropod Scavengers

The carcasses of different types of vertebrates offer different physical and chemical microhabitats to the small arthropod scavengers that feed and reproduce in them. In order to characterize these different communities, pitfall traps baited with dead mice, frogs, fish, and birds were used to collect insect specimens in different habitats throughout Central Alberta in 2023. Analysis of specimens collected shows that some insects prefer specific types of carrion while others are generalists, and that dead amphibians attract a smaller group of scavengers than birds, fish, or mammals. These preferences may cause some species to compete for resources more often than others, and could influence the decomposition rates of small animal carcasses.

10:30 -10:45 Break - Pause

Diversity, genomic and populations - Diversité, génomique et populations (2)

Lismer-Leduc-Fortin

10:45-12:00

Moderator: Pierre-Marc Brosseau

10:45 Apolline Maurin[1], Audrey-Anne Durand[1], Claude Guertin[1], Philippe Constant[1]
[1]INRS - Centre Armand Frappier Santé Biotechnologie

Le dynamisme du microbiome associé au truand des vergers à graines de pin blanc

Conophthorus coniperda (Schwarz), est un insecte ravageur des vergers à graines de pin blanc. Il s'attaque aux cônes et entraîne ainsi l'arrêt de leur développement et leur chute. Cet insecte, dit cryptique, entreprend ensuite son cycle de développement à l'intérieur de ces cônes, à même le sol. Pour survivre, il interagit vraisemblablement avec un ensemble de microorganismes dont le dynamisme lui permet de s'adapter à un environnement pouvant être jugé hostile. Les communautés microbiennes associées au scolyte seraient donc soumises à un ensemble de paramètres biotiques et abiotiques qui les modèlent. Afin de l'étudier, des cônes contenant des insectes ont été récoltés régulièrement pendant un an dans le verger de Verchère, à Saint-Amable. En parallèle, un certain nombre de paramètres biotiques et abiotiques ont été mesurés, tels que la température, l'humidité, la densité de cône, leur taille, l'épaisseur de neige, etc. L'ADN microbien du scolyte et de ses cônes ont ensuite été extraits, amplifiés et séquencés. Les analyses préliminaires ont permis de dresser, pour la première fois, un portrait du microbiome du scolyte des cônes du pin blanc. De plus, il semblerait que les communautés microbiennes du cône, soient directement influencées par les changements de saison alors même que celles de l'insecte présentent une certaine stabilité. De tels résultats nous rapprochent un peu plus du développement d'un moyen de lutte biologique efficace contre ce ravageur.

11 :00 Catherine Hébert[1], Colin Favret[1]

[1]Université de Montréal, Institut de recherche en biologie végétale

Megabarcoding the Mymaridae (Hymenoptera: Chalcidoidea) of Quebec's forests

Fairyflies (Hymenoptera: Mymaridae) are particularly abundant in forest environments. Nonetheless, these microscopic egg parasitoids are little-studied and their richness is underestimated, especially in Quebec. DNA barcoding could facilitate their identification, but most of the sequences in reference databases are unidentified at the species level. This project aims to discover the diversity of Mymaridae in Quebec's temperate forests while building a reference DNA sequence bank. To achieve this, we sampled ten sites from mixed deciduous-conifer and maple-dominant forests. Voegtlin-style suction traps were installed, and weekly samples were taken from May to October 2023. A total of 8,905 microhymenopterans were collected, representing 22 families. Of these, 3,462 (38.9%) were mymarids. DNA from 2,139 Mymaridae specimens was extracted using a non-destructive protocol. PCR amplification and Illumina multiplex sequencing were performed on a short sequence (309 bp) of the mtCOI gene. BLAST searches identified at least 12 mymarid genera. DNA sequences have further been classified into molecular operational taxonomic units (MOTUs) using the *Assemble Species by Automatic Partitioning* (ASAP) and the *Refined Single Linkage* (RESL) algorithms. They delimited between 43 and 116 putative mymarid species. Since 94 species are known from Canada and 46 from Quebec, our results suggest many more to be recorded, including many undescribed species. The next step will be to add existing and new names to those MOTUs. Validation of the use of DNA barcoding to delimit Mymaridae species could speed up the taxonomic process in future faunistic studies.

11:15 Wei Han Lau[1], Aaron J. Bell[2], Kiara S. Calladine[2], Rowan L. K. French[3], Diego S. Souza[4], C. Barry Knisley[5], Jay Shetterly[6], John H. Acorn[7], Felix A. H. Sperling[1]

[1]University of Alberta, Department of Biological Sciences, [2]University of Saskatchewan, Department of Biology, [3]University of Toronto, Department of Ecology and Evolutionary Biology, [4]Field Museum of Natural History, [5]Randolph-Macon College, Department of Biology, [6]NA, [7]University of Alberta, Department of Renewable Resources

Phylogeography and Elytral Colour Distribution of *Cicindela formosa*

The Big Sand tiger beetle (*Cicindela formosa*) is one of the largest tiger beetles found in North America. Due to its narrow ecological tolerance for open dune complexes, *C. formosa* is at risk of extinction in the west. One subspecies native to Canada, *C. f. gibsoni*, is recognized as threatened, while *C. f. gaumeri* faces similar threats in Colorado. Elytral colour patterns in *C. formosa* are highly variable and forms the basis of subspecies delimitation in *C. formosa*. However, these patterns are potentially unreliable for delimiting evolutionary significant units (ESUs) due to their adaptive significance, and ESUs within *C. formosa* remain untested despite the threat this species faces. In this study, we use mitochondrial DNA barcodes and genome-wide SNPs from double digest restriction-site associated sequencing (ddRAD-Seq) to survey the genetic diversity of the species across its full range. In addition, we employ the R packages *recolorize* and *patternize* to capture elytral pattern variation to compare genetic and morphological diversity in this species. Our results lay the groundwork for rigorously delimiting ESUs within *C. formosa* to aid current conservation strategies and inform the taxonomy of this tiger beetle.

11:30 Savannah L. Burroughs[1], Catherine E. Scott[1], Chris M. Buddle[1]
[1]McGill University

Natural history and behaviour of the Beringian pseudoscorpion (*Wyochernes asiaticus*)

Pseudoscorpions are an understudied yet diverse group of predatory arachnids that live throughout the world under bark, leaf litter, and rocks. The Beringian pseudoscorpion, *Wyochernes asiaticus* (Chernetidae), is the northern-most species in North America. It can be found living gregariously under rocks near streams in areas of the Yukon, Alaska, and Siberia that remained unglaciated during the last ice age. Its life history and tolerance for cold temperatures and inundation have been described, but its natural history and behaviour remain virtually unknown. In summer 2024 we surveyed and observed ten populations of *W. asiaticus* along the Dempster Highway, YT. We used a mark-recapture approach to document population structure, site fidelity, and short-distance dispersal for three populations. We also observed predation and feeding, reproduction and development, as well as other inter-and intraspecific interactions. Through photographs and videos we will provide a rare glimpse into the lives of these tiny and fascinating animals, describing many behaviours for the first time. By sharing the rich natural history data we were able to glean from these observations, we hope to inspire wonder and provide a reminder of the great rewards of taking time to simply sit and watch.

11:45 Pierre-Marc Brousseau[1], Anouk Simard[2], Maxim Larrivée[3], Jean-Philippe Lessard[1]
[1]Université Concordia, [2]Gouvernement du Québec, MELCCFP, [3]Insectarium de Montréal

Diversité fonctionnelle des araignées épigées le long d'un gradient latitudinal au Québec

Les changements climatiques ont des impacts importants sur la structure des communautés d'arthropodes. Une des conséquences potentielles est une modification des interactions trophiques menant à une perturbation des services écosystémiques tel la pollinisation et la décomposition. Les prédateurs sont particulièrement sensibles aux changements climatiques et il a été démontré que leur diversité fonctionnelle peut être associée à la diversité des proies en milieu non perturbé. Ainsi, connaître leur diversité fonctionnelle sur un gradient latitudinal peut aider à comprendre les impacts potentiels des changements climatiques sur les réseaux trophiques. L'objectif de cette étude est de caractériser la diversité fonctionnelle des araignées dans 92 sites au Québec échelonnés sur un gradient latitudinal de 17.2°. Les araignées sont particulièrement intéressantes pour ce genre d'étude, car elles sont diversifiées et leur richesse spécifique demeure relativement stable sur le gradient latitudinal. Nous avons mesuré cinq traits liés à l'alimentation telle la taille des chélicères et la grosseur des yeux de 180 espèces d'araignées. Nos résultats montrent que la grosseur des yeux est le seul trait qui semble relié au gradient latitudinal, ceux-ci tendant à être plus gros dans le nord, probablement en réaction à un milieu plus ouvert. La diversité fonctionnelle ne varie pas sur le gradient latitudinal, mais nous observons moins de variation entre les sites dans le nord. Cette stabilité fonctionnelle suggère que les mêmes niches écologiques sont occupées tout le long du gradient et laisse supposer que l'accès aux ressources ne soit pas un frein au déplacement latitudinal des araignées.

Ecology - Écologie (6)

Jean-Paul Lemieux

10 :45-12 :00

Moderator: Maxime Lefebvre

10 :45 Thilina Thilina Hettiarachchi[1], Chaminda De Silva Weeraddana[1], Ramya Wijesundara[1], Alejandro C. Costamagna[1]

[1] Department of Entomology, University of Manitoba

The effect of short-term drought and flooding conditions on oviposition of wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae)

Climate change poses new challenges to wheat crops, making it crucial to understand its impact on pests. The wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), is a significant pest in wheat-growing regions in the Canadian Prairies. In laboratory studies, we assessed the effect of short-term (3 days) drought and flooding treatments to assess oviposition. These two experiments were conducted separately using control plants that were watered daily. Oviposition was assessed using choice and no-choice experiments. Intact wheat spikes were enclosed in a 2L transparent plastic bottle, and four females and four males were released into these oviposition cages for three days. After that, wheat spikes were dissected to assess the oviposition of wheat midge adults. Choice experiment data were analyzed using paired t-tests, and no-choice data were analyzed using two sample t- tests. Both in the choice (n = 17) and no-choice experiments (n =13), significantly fewer eggs were laid on plants in the drought treatment. In choice (n = 9) and no-choice experiments (n = 8 - 10), slightly more eggs were laid on plants in the flooding treatment. Follow-up tests are ongoing to evaluate larval performance on these treatments. These changes in oviposition behaviour may be influenced by volatile organic compounds (VOCs) emitted by plants; therefore, future experiments will focus on analyzing VOCs from these plants.

11:00 Leah Jackson[1], Ed Gage[2], Randy Gage[2], Erin Campbell[1, 3], Felix Sperling[1]

[1]University of Alberta, [2]Texas Museum of Entomology, [3]Canadian Food Inspection Agency

Systematics of the Great Spangled Fritillary butterfly (*Speyeria cybele*)

The taxonomic rank of species remains a fundamental unit in the study of biodiversity. However, speciation processes are diverse, making it challenging to delimit species. This difficulty is conflated by methodological issues including the use of too few characters, low sample sizes, and prior name changes unsupported by empirical data. The Great Spangled Fritillary, *Speyeria cybele,* is a North American butterfly that provides a challenging case study in species delimitation that has remained uncertain since its original description in 1775. Some authors have treated *S. cybele* as a single variable species with transitions in colour pattern across its range. Others recognize western and eastern populations as two distinct species divided by the Rocky Mountains, with western populations being split off as *Speyeria leto*. However, prior taxonomic and phylogenetic studies of this butterfly have used too few characters or limited sampling of populations to supported a clear resolution, and have not sufficiently quantified morphological variation. Our study used whole-genome single nucleotide polymorphisms (SNPs), mitochondrial DNA (mtDNA) sequences, and wing colour pattern and size data to assess the population structure of *S. cybele*. *Speyeria cybele* appears to be a single species containing four main genomic groups that admix when populations are in contact, with two major mtDNA haplotypes and clinal morphological variation across its range.

11:15 Joel Kits[1]

[1]Agriculture and Agri-Food Canada

Taxonomy of the Nearctic Paralimnini (Hemiptera, Cicadellidae, Deltocephalinae)

The leafhopper tribe Paralimnini is a diverse group with about 140 genera and 920 species currently recognized globally. They feed on grasses and sedges and are often abundant and diverse in grasslands, wetlands, and other habitats. The Nearctic region holds a significant portion of this diversity, with over 250 species in 36 genera. The tribe includes some of the best known groups of Nearctic leafhoppers which have been the focus of taxonomic and ecological research. However, about a third of the genera lack recent taxonomic treatments and the species in these group are difficult to identify and study. I will review my recent and ongoing revisionary studies on several of these lesser-known genera. This work, including discoveries of new species, new characters for identification, and various taxonomic changes, will lead towards a more complete understanding of the diversity of the tribe in the Nearctic region.

11:30 Thomas Jeanne[1], Maxime Lefebvre[1]

[1]IRDA

Métagénomique et séquençage à haut débit pour l'étude de la diversité des groupes taxonomiques d'arthropodes du sol : vers une valorisation des échantillons de sol de l'IRDA

Les sols sont des habitats très variés qui abritent une grande diversité d'organismes vivants. Ces derniers jouent des rôles essentiels dans les chaînes trophiques et les services écosystémiques. Cependant, l'intensification des pratiques agricoles peut altérer significativement ces communautés, affectant ainsi la santé des sols et les fonctions écosystémiques associées. Au cours des dernières années, l'IRDA a mené une vaste étude sur l'état de santé des sols agricoles du Québec (EESSAQ), en collectant un large éventail d'échantillons provenant de divers types de cultures, de pratiques agricoles, couvrant les principales séries de sols au Québec. Ces échantillons recueillis sur 424 champs et totalisant 3314 prélèvements, contiennent une grande quantité d'ADN environnemental permettant de caractériser les communautés microbiennes et eucaryotiques.

Jusqu'à présent, les ADN de ces échantillons ont principalement été étudiés par des approches de séquençage à haut débit pour étudier la diversité microbienne des sols. Cependant, ils pourraient être valorisés davantage en explorant l'impact des pratiques agricoles sur d'autres groupes taxonomiques, notamment les arthropodes du sol.

Une analyse des principales classes et familles d'arthropodes, en fonction des pratiques agricoles, sera présentée et mise en contraste avec les types de sols et un gradient d'intensification des perturbations. Bien qu'il existe des limitations d'identification taxonomique, cette valorisation additionnelle des données issue de la diversité des eucaryotes offre de nouvelles perspectives pour étudier plus rapidement et à moindre coût les bénéfices des techniques de préservation des sols sur les arthropodes, encourageant ainsi l'adoption de pratiques agricoles durables axées sur ces services écosystémiques essentiels.

11 :45 Marla Schwarzfeld[1], Victoria Nowell[2], Monica Young[1], Laura Kostyniuk[1]

[1]Agriculture and Agri-Food Canada, [2]Natural Resources Canada

Fantastic cunaxids - phylogeny and natural history of a small but mighty predator

The mite family Cunaxidae consists of tiny predators that are common in soil and litter environments. While they are easily collected, surprisingly little is known about them, and the majority of species in Canada

remain undescribed. In this talk, I will provide an overview of the first molecular phylogeny for the family, discuss their species diversity, and describe some forays into cunaxid genomics, a bit of natural history and some cool cunaxid behaviour.

Entotechnology - Entotechnologie

Borduas

10:45-12:00

Moderator : Grant Vanderberg

10:45 Guyllaume Dufresne[1], Marie-Hélène Deschamps[1, 2], Grant W. Vandenberg[1], Catherine Bolduc[3], Christopher Warburton[3], Nabeel Alnahhas[1]

[1]Département des sciences animales, Faculté des Sciences de l'Agriculture et de l'Alimentation, Université Laval, [2]Chaire de Leadership en Enseignement en production et transformation primaire d'Insectes Comestibles (CLEIC), [3]Entosystem, Drummondville, Québec, Canada

Small-scale rearing for the development of genomic resources in Black Soldier Fly (*Hermetia illucens,* Linnaeus, 1758)

The rapidly growing black soldier fly (BSF) industry could benefit from high-performance strains to optimize large-scale production. Unfortunately, polyandry makes classical methods of genetic selection difficult to implement in BSF. Using molecular tools could help establish BSF breeding programs. We hypothesized that creating multiple families of known genealogy would provide the genetic material needed to develop a single nucleotide polymorphism (SNP)-based parentage assignment panel. Control of the genealogy for 24 families (A = 12 from a laboratory colony, B = 12 from an industrial colony) over 5 generations was done by maintaining the imagoes in complete darkness from emergence until mating. Only one mating couple of each family was kept as the parental couple of the next generation. We observed a decrease in the oviposition rate at site B (G1: 60.9 ± 3.0 mg, G5: 53.0 ± 4.0 mg) and a growth in hatching time at both site A (G1: 2.29 ± 0.07 day, G5: 2.91 ± 0.07 day) and site B (G1: 2.40 ± 0.07 day, G5: 2.68 ± 0.10 day). No significant trends were observed for the mean larval weight at day 5 (A: 75.6 ± 8.0 mg; B: 54.3 ± 7.0 mg) and day 10 (A: 233.6 ± 15.4 mg; B: 209.3 ± 17.3 mg). Five generations was not enough to draw meaningful conclusions however, some traits seemed to trend in specific directions. This underlines the need for implementing multi-traits monitoring in BSF breeding programs. Inbreeding analysis using the SNP panel could help in understanding the impact of selection programs on different production parameters.

11:00 Leylia Petryk[1, 2, 3], Colin Favret[1, 2], Étienne Normandin[1, 2]

[1]Université de Montréal, [2]IRBV, [3]McGill University

Strain differences and genetic diversity in the Cytochrome C Oxidase I (CO1) gene of *Tenebrio molitor*

The commercial production of mealworms (*Tenebrio molitor*) as an alternative protein source for humans and animals is on the rise. Studies have shown that different populations of *Tenebrio molitor* have significantly different performance but there is currently little research available on the genetic structure of this species. This study aims to improve our understanding of the genetic diversity and genetic differences between populations of *Tenebrio molitor* to support the optimization of its commercial mass production. The genetic structure of twelve populations of Tenebrio molitor from various laboratories and farms was analyzed by comparing the sequence of a 265bp region of the Cytochrome c oxidase subunit I gene (CO1). The results showed that certain populations had a unique genetic profile but the overall level of dissimilarity between most populations was low. The most genetically distinctive population in this study was the German

strain which likely suffered from inbreeding. The results from this study and others like it paired with studies on the performances of different strains will be instrumental in supporting the development of successful large-scale *Tenebrio molitor* productions.

11:15 Catherine Bolduc[1], Christopher Warburton[1]
[1]Entosystem

Entosystem's large-scale insect production plant: Challenges and successes.

After a full year of production at our new Drummondville plant, we've gained valuable insights from both our challenges and successes. At Entosystem, we upcycle food waste into proteins, oils, and fertilizers through the remarkable efficiency of black soldier fly larvae, diverting waste from landfills and transforming it into valuable products. Founded in 2016 in Sherbrooke, the company initially operated in a 10,000-square-foot pilot plant. In 2023, we transitioned our rearing operations from Sherbrooke to a 100,000-square-foot facility in Drummondville—ten times larger. Scaling up to this size presents challenges for any company, particularly one based on a biological process. The past year has been quite eventful, but despite the obstacles, we're proud to have successfully diverted 8,000 tonnes of organic matter from landfills, reared nearly 250,000 insect growth bins, and produced 200 tonnes of dried larvae. In this presentation, we'll discuss the biggest challenges we encountered while scaling up our insect production, including both insects rearing and the operational management of the plant. We will also share our insights on the key factors we believe must be controlled for successful insect breeding and plant operations before starting large-scale production.

11:30 Grant Vandenberg[1], Daipiero Gomez[1], Marie-Hélène Deschamps[1]
[1]Université Laval

CARNIF3: Canadian Research Network of Insects for Food, Feed and Fertilizer

The edible insect industry holds immense potential to revolutionize food systems and organic residue upcycling, offering sustainable alternatives to traditional protein sources and reducing the environmental footprint of food production. By fostering collaborations that drive innovative solutions, Canada can position itself as a global leader in this emerging field. Alongside international initiatives such as the Academic Society for Insects as Food and Feed (ASIFF) and with the mission to "promote excellence in research and development, as well as the training of highly qualified personnel for the responsible management of edible insects as food, feed, and fertilizer in Canada," an initiative from Université Laval's CLEIC (Chaire de leadership en enseignement en production et transformation primaire d'insectes comestibles) has been underway since 2023 to establish a Canadian network of researchers and stakeholders related to the production and use of insects and their derivatives for human and animal nutrition, as well as for fertilization. Open to academia, industry, and governmental institutions, the network represents a critical step toward uniting the diverse expertise required to harness the opportunities of the insect industry in a sustainable and responsible way. This presentation will showcase the work carried out to consolidate the network, including meetings, committee formation, and the generation of bylaws. It will also serve to communicate the network's goals and invite new participants to join.

11:45 Florent Pechereau[1], Marie-Hélène Deschamps[1, 2], Marc-André Hébert-Briand[1, 3, 4], Benoit Choquet[1, 5], Christopher Warburton[1, 6], Yves Fournier[1, 7], Jennifer Larouche[1, 8], Yan Martel-Kennes[1, 9]

[1]Table Filière des Insectes Comestibles (TFIC), [2]Université Laval, [3]Entologik, [4]AETIQ, [5]Hagen Industries, [6]Entosystem, [7]Centre de Développement Bioalimentaire du Québec (CDBQ), [8]Ribozome, [9]Sollio Agriculture

Une nouvelle planification stratégique pour le développement des insectes comestibles comme alimentation animale au Québec

Au Québec, selon un portrait actualisé de l'industrie des insectes comestibles, 30 producteurs d'insectes et 16 transformateurs étaient en activité en 2022. Cette industrie est en pleine expansion et plusieurs défis doivent être relevés, tels que la réglementation, l'optimisation des processus, l'approvisionnement, l'acceptabilité sociale, la formation d'une main-d'œuvre qualifiée et l'accès aux marchés.

Le ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) favorise l'établissement d'industries innovantes en finançant et en supervisant la formation d'une table de concertation qui permet la collaboration entre les industries et un développement optimisé de l'industrie. Cette table de concertation regroupe 47 intervenants tout au long de la chaîne industrielle (gestion des déchets, production et transformation des insectes, distribution, recherche, transfert de technologie, éducation, organismes de sensibilisation et gouvernement). En 2023, le TFIC a mis en œuvre une nouvelle planification stratégique pour 2023-2026, structurée autour de trois axes principaux (coordination, développement des affaires et développement des marchés). Plusieurs comités de travail (Développement sectoriel, Assurance qualité, Communication et Frass) s'occupent des obstacles communs, promouvoir le réseautage et produire de la documentation en libre accès. Parmi les réalisations notables : la rédaction et la publication d'un document sur la définition et l'application des frass au Québec, l'organisation de la première Journée d'Entomoculture en avril dernier et la publication sur son site internet de réponses aux FAQ sur les aspects réglementaires.

Les activités du TFIC devraient contribuer à la croissance durable et à la pérennité des insectes comme aliments et aliments pour animaux au Québec.

Symposium Biological Control programmes in Canada: advancements in using «Good» to combat «Bad» (2)

Organized by Meghan Vankoski and Véronique Martel

10:45-12:00

Moderators: Meghan Vankoski and Véronique Martel

10:45 Jennifer Baici[1], Sandy Smith[1], Michael McTavish[1], Rob Bourchier[2]

[1]University of Toronto, [2]Agriculture and Agri-Food Canada /Agriculture et Agroalimentaire Canada

Leaf damage and oviposition as a monitoring tool for *Ceutorhynchus scrobicollis* on *Alliaria petiolata* in central Ontario

Garlic mustard (*Alliaria petiolata*) is a European biennial herb that has invaded large portions of temperate North America. Biocontrol is a commonly used tool to manage invasive plants and several species of weevil (Family: Curculionidae) have been identified as potential biocontrol agents for this species, namely *Ceutorhynchus scrobicollis*. This species of root-crown feeding weevil has been demonstrated to increase plant mortality, reduce aboveground biomass, and alter plant architecture.

C. scrobicollis has been released in several locations in Canada to aid in the management of garlic mustard. However, many aspects of the survival and dispersal of this species in a novel landscape remain unknown. Long-term monitoring of biocontrol agent populations is essential in understanding the potential efficacy of the agent as a management tool. As such, we were interested in exploring the feeding characteristics of *C. scrobicollis* under different density treatments to estimate ongoing insect survival at existing and future release sites.

We used time-series photographs to measure qualitative and quantitative aspects of *C. scrobicollis* feeding damage on first- and second-year garlic mustard plants under four insect density treatments in King City, Ontario.

Preliminary results indicate that there is a positive relationship between insect density and the amount of *C. scrobicollis* feeding damage on first-year plants. We also found that *C. scrobicollis* feeding patterns were easily discernable from those of other generalist herbivores, indicating that agent feeding damage can be used as a reliable metric of insect presence and density in this biocontrol system.

11:00 Michelle Franklin[1], Paul Abram[1], Yonathan Uriel[1], Jade Sherwood[2], Gary Gibson[3], Hannes Baur[4, 5], Tim Haye[6]

[1]Agassiz Research and Development Centre, Agriculture and Agri-Food Canada, [2]The University of British Columbia, [3]Ottawa Research and Development Centre, Agriculture and Agri-Food Canada, [4]Natural History Museum of Bern, [5]Institute of Ecology and Evolution, University of Bern, [6]Centre for Agriculture and Biosciences International

Looking for the 'good' agents - exploration for indigenous and exotic natural enemies for management of the invasive strawberry blossom weevil

The Eurasian strawberry blossom weevil, *Anthonomus rubi* (Herbst) (Coleoptera: Curculionidae) was detected in British Columbia (BC), Canada in 2019 and is now established in BC and Washington State, USA. This weevil is a pest of plants from the rose family, including economically important berry crops, where it lays its eggs inside of developing flower buds and clips the stem below. Here we explore the potential to use a classical biological control approach to manage the invasive *A. rubi* population in Canada. Knowledge of the natural enemy complex of *A. rubi* was lacking and therefore we started by searching for new parasitoid associations in the invaded range and undertook foreign exploration in ten European countries to look for parasitoid associations from the native geographic range. We collected weevil-infested clipped buds over four years from known host plants in both the native and invaded range. In the invaded range, we discovered and newly described *Pteromalus quadridentatus* Gibson (Pteromalidae) as a larval parasitoid of *A. rubi*; however, parasitism levels are low (1-3%). In Europe, we reared and identified parasitoids from the families Braconidae (Ichneumonoidea) and Eupelmidae, Eurytomidae and Pteromalidae (Chalcidoidea), with braconid parasitoids being most abundant. Overall, observed parasitism rates were also low in the native range of *A. rubi*, though over 20% parasitism was observed at a few collection locations. Future efforts will be needed to expand the geographic range of our foreign exploration surveys to more fully encompass its native range and determine the host specificity of candidate agents for introduction.

11:15 François Dumont[1], Peter Mason[2], Simon Lachance[3], Eric Lucas[4], Hector Carcamo[2]
[1]CRAM, [2]AAC, [3]Collège La Cité, [4]UQÀM

Lutte biologique contre les punaises ternes (*Lygus* sp.)

Les punaises ternes (*Lygus* sp.*)* sont des ravageurs indigènes qui endommagent plusieurs cultures au Canada. Dans l'est du Canada et les Prairies, l'espèce principale est *Lygus lineolaris*, tandis que *Lygus hesperus* est plus courante dans l'ouest. La gestion des *Lygus* dans les cultures repose principalement sur l'utilisation d'insecticides. Des approches non chimiques, comme la lutte biologique implique des guêpes parasitoïdes, mais leur taux de parasitisme naturel est faible, nécessitant l'introduction de parasitoïdes européens pour une meilleure efficacité. Plusieurs prédateurs se nourrissent des punaises Lygus, mais ne fournissent pas une régulation adéquate des populations sur le terrain. Des recherches actuelles visent à développer une stratégie de lutte biologique inondatif en synchronisant l'activité des prédateurs *Nabis americoferus* et *Orius insidiosus* avec les stades clés des *Lygus*. De plus, des souches de champignons pathogènes, comme *Metarhizium robertsii* et *Beauveria bassiana*, ont un potentiel prometteur pour la lutte biologique des *Lygus*, notamment en utilisant des stratégies innovantes de biovectorisation par les pollinisateurs. Les travaux futurs devraient inclure la surveillance continue de la dispersion de *P. digoneutis* et de son impact sur les populations de *L. lineolaris* dans les systèmes de culture de l'est du Canada, ainsi que l'évaluation de l'efficacité des pratiques de gestion des habitats pour améliorer les niveaux de parasitisme et de prédation. Il est également essentiel de mesurer l'efficacité des prédateurs à réguler les populations de Lygus à l'échelle de la ferme et du paysage, et de comprendre les effets non létaux des prédateurs sur les *Lygus*.

11:30 Chandra Moffat[1], Hester Williams[1], Sonja Stutz[2], Phil Weyl[2], Francesca Marini[3]
[1]Agriculture and Agri-Food Canada, [2]CABI, [3]BBCA

Potential for indirect biocontrol for the invasive insect, spotted lanternfly, via direct biocontrol of the weed Tree of Heaven

Biological control programmes generally target one or a few closely related organisms to provide direct control of invasive (or otherwise damaging) species. However, opportunities exist for indirect biocontrol by reduce populations of an organism which is relied upon or used heavily by the target invasive species. Spotted lanternfly (*Lycorma delicatula*, SLF) is an highly invasive insect species that established in the USA in 2014. Feeding on over 70 plant species, and presents a high risk to Canadian agriculture as well as forestry, ornamental and natural resource sectors. While SLF has been directly targeted for biocontrol, no suitably host-specific candidate agents have yet been identified in foreign exploration.

While spotted lanternfly's impacts are most heavy in agriculture, it has a strong association with select hardwood trees of Asian origin as part of its lifecycle. One such tree is the highly invasive Tree of Heaven (*Ailanthus altissima*, ToH), which has reached high densities in some parts of Canada, often overlapping with grape production areas such as BC's Okanagan Valley and southwestern Ontario. ToH has a number of severe environmental impacts in grassland, riparian, foreshore and urban environments. In 2019 we began investigating the feasibility of a biocontrol program for ToH in Canada, building upon prior work done in the USA. To date, two candidate agents are being considered for release in Canada. If approved and successful in reducing the spread density of ToH, this weed biocontrol programme could indirectly serve as biocontrol for SLF, by limiting its establishment and spread in Canada.

11:45 Chris JK MacQuarrie[1]
[1]Canadian Forest Service

Ce n'est pas facile d'être vert: Biological control of the emerald ash borer in Canada

The emerald ash borer was discovered in Canada in 2002 and over the past 20 years has managed to invade the country from coast to coast. The result has been significant mortality of ash trees across eastern Canada and wholesale changes in ecosystem structure and function. The biological control program against EAB began in 2012 with the goal of determining if introduced species could establish in Canada and exert long-term control which would permit the recovery of ash and ash ecosystems. As of 2024, three parasitoid species have been introduced at sites stretching from the eastern shore of Lake Superior to the Atlantic coast of Nova Scotia. Most of these introductions have been successful and some of the resulting populations have dispersed and established outside of the original release locations. This suggests that introduced biological control agents are successfully feeding on endemic populations of EAB. The next phase of research on EAB biocontrol in Canada will determine if biological control has been successful at impacting the population dynamics of the pest, and if ash and ash ecosystems are able to recover.

12:00-14:00 **Editorial Board meeting, The Canadian Entomologist** Pilot room
Réunion du comité éditorial, The Canadian Entomologist
Invited guests only - Personnes invitées seulement

12:15-13:30 **Assemblée générale annnuelle SEQ** **Borduas**
ESQ Annual general meeting

Ecology - Écologie (7)

Jean-Paul Lemieux

13:45-15:15
Moderator: Lisa Lumley

13:45 Hadil Elsayed[1], Sheila Colla[1]
[1]York University

Assessing insect responses to anthropogenic threats in protected areas

Rapid global declines in insect biomass and diversity are threatening essential ecological functions and many ecosystem services that humans rely on. This global decline is a multifaceted dilemma that is impacted by land-use change and climate change. Protected areas act as important habitat refugia for insects in highly human-affected landscapes. With the increasing impacts of anthropogenic threats, these areas are important for the long-term conservation of insects and wildlife biodiversity at large. In the early 1990s, insects were collected using malaise traps in various protected areas within the Long Point World Biosphere Reserve. To assess the impacts of anthropogenic threats such as climate change and landscape changes on insects in protected areas, this sampling was replicated from 2021 - 2023 for a comparative analysis of changes in insect biomass between the two time periods. Biomass of insects showed varying trends between the two time periods. Certain taxa such as Coleoptera, Diptera, and Lepidoptera showed significant decreases in biomass between the two periods. Increased environmental stressors, mainly related to vegetation and climate, were shown to be the drivers of these observed changes in biomass. This study shows that even within protected areas, insects are facing large declines as a cause of the increasing impacts of anthropogenic threats.

14:00 N J Holliday[1]
[1]Dept of Entomology, University of Manitoba

Is *Chlaenius cordicollis* (Coleoptera: Carabidae) a frequent flier?

In the literature, the beach-dwelling ground beetle, *Chlaenius cordicollis*, is said to fly frequently, although specific references are to flights in captivity. In four decades of study on the shores of Lake Winnipeg, Manitoba, *C. cordicollis* was never seen flying. In one year, four flight interception traps were deployed throughout the adult activity season on a beach where there were many *C. cordicollis*. A total of seven beetles were caught, all in June — a time when mating and oviposition are in progress. Maximum temperatures during the relevant trapping periods were ≥ 23 °C. In 5-minute trials in the laboratory in June, females flew at temperatures of 23, 25 and 30 °C, but not at 20 °C; males flew at 25 and 30 °C. At temperatures where both sexes flew, males flew in 14% of trials and females flew in 52% of trials. Most flights ended when the beetle hit the 30-cm high wall of the arena and dropped to the arena floor; many beetles then took off again. For beetles that flew, the average number of take-offs was about 5.5 for both sexes. In similar trails in fall with new generation beetles of undetermined sex, for the 12 % of trials in which flight occurred, the average number of take-offs per trial was 2.

14:15 John Soghigian[1], Huiqing Yeo[1]
[1]University of Calgary

At the edge of an invasion: Population genomics of *Culex pipiens* in Alberta

Culex pipiens, the northern house mosquito, is considered one of the most problematic vectors of disease in temperate regions of the world. This mosquito is well adapted to urban environments, where it can be a major vector of West Nile virus and other pathogens to humans and other animals. Moreover, it is one of several mosquitoes whose ranges are expected to expand significantly in response to climate change. Until recently, its distribution in Canada was thought restricted to coastal British Columbia and eastern provinces. Recently, this mosquito was found in Alberta. Here, we report preliminary analyses on the population genomics of *Culex pipiens* in Alberta from low-coverage, whole-genome sequencing of individuals from two municipalities. We discuss our results in the context of the invasion history of this species in Alberta as well as the potential public and veterinary health implications of the range expansion of this important vector mosquito.

14:30 Julio Rivera[1, 2], Merlin Guerrero[1], Lexie Ziss[3]
[1]Université de Montréal., [2]Montreal Insectarium, [3]John Abbott College

The French Connection: insights into the geographic origin of alien populations of *Mantis religiosa* L., 1758 in southern Ontario, Canada, through DNA barcodes (Mantodea: Mantidae)

Understanding the geographic origin of an alien insect species helps predict its adaptability and spread within its new environment. At the close of the 19th century, individuals of the European praying mantis, *Mantis religiosa* L., 1758, were collected for the first time on the southern shore of Lake Ontario. Over the following 125 years, the species became widespread in southeastern and southwestern Canada and much of the USA. But where exactly did it come from? In this study, we summarize the known invasive history of *M. religiosa* in Canada and use the DNA barcoding gene (COI) as a molecular marker to infer the geographic source of alien populations of this charismatic predator in southern Ontario. Our analyses revealed

considerably low genetic diversity in the sampled populations, with only two coexisting haplotypes (or lineages): one matches a haplotype restricted to Western Europe, particularly France, and the other is a more widespread haplotype present in Eastern, Central, and Western Europe (including France). These results shed new light on the origin of this North American population of *M. religiosa* and highlight the utility of the DNA barcoding gene as a useful tool for tracking the global spread of alien predatory species.

14:45 Rylee Isitt[1], Stephen Heard[2], Deepa Pureswaran[1]
[1]Natural Resources Canada, [2]University of New Brunswick

Phylogeography and pheromone variation in the spruce beetle (*Dendroctonus rufipennis* Kirby)

The North American spruce beetle (*Dendroctonus rufipennis* Kirby) uses aggregation pheromones to attract conspecifics. The chemical composition of this pheromone blend varies regionally. The spruce beetle also exhibits distinct clades, two of which are broadly sympatric across the boreal forest. To determine if this genetic variation coincides with variation in pheromone blends, we extracted pheromone samples and mitochondrial COI sequences from beetles collected in Alberta and New Brunswick. By comparing clade membership to pheromone blends, we found that geographic origin, rather than clade membership, best explains pheromone variation. Beetles from the same clade but different regions produced more dissimilar pheromone blends than beetles from the same regions but different clades. We suggest that pheromone variation may be driven by regional environmental factors, or by minor differences in genetics (e.g., a small number of SNPs) that do not correlate with overall population structure. Although there are significant differences in pheromone blends within and between regional spruce beetle populations, this variation does not appear to represent barriers to gene flow sufficient to produce distinct pheromone races.

15:00 Erin O. Campbell[1], Philip D. Batista[2], Véronique Lévesque-Tremblay[3], Catherine Béliveau[3], Kathia Bernier[3], Kateryna Romanenko[3], Ward B. Strong[2], Katherine P. Bleiker[3], Dezene P.W. Huber[4], Christopher I. Keeling[3]
[1]Canadian Food Inspection Agency, [2]BC Ministry of Forests, [3]Canadian Forest Service: Natural Resources Canada, [4]University of Northern British Columbia

The genome and population structure of the spruce beetle, *Dendroctonus rufipennis* (Kirby, 1837)

Spruce beetle is a significant native transcontinental pest of North American spruce. Although normally attacking windthrown and weakened trees, healthy trees are being killed with higher populations, such as those resulting from climate change. We assembled the genome using a combination of Nanopore, 10X proximity ligation, and Hi-C sequencing. The resulting assembly contained 271 Mbp with a scaffold N50 size of 16 Mbp in 6 sequences. The 16 largest scaffolds represented the chromosomes of the 14 AA + Xy karyotype. Sex chromosomes were confirmed by sex-based read coverage and PCR tests. Benchmarking Universal Single-Copy Orthologs (BUSCO) analyses identified 99.3% complete orthologs in the genome assembly and 95.7% complete orthologous proteins within the 17,787 predicted gene models. We manually curated the cytochrome P450 and carboxylesterase gene families. To explore the population structure, we used ddRADseq to identify 12,191 SNPs from specimens taken from locations in Alberta (AB), British Columbia (BC), Nova Scotia (NS), Alaska (AK), Colorado (CO), New Mexico (NM), Utah (UT), and Wyoming (WY). Principal component analysis identified three primary genomic clusters: one for BC, AB, and WY; a second for CO, UT, and NM; and a third for NS and AK. The CO, UT, and NM populations were highly

differentiated from all other sampled populations. These genome and population data provide rich resources for studying the biology of this beetle across its range.

Symposium: Biological Control programmes in Canada: advancements in using «Good» to combat «Bad» (3)

Organized by Meghan Vankoski and Véronique Martel

13:45-15:15

Moderators: Meghan Vankoski and Véronique Martel

13:45 Ian Jones[1], Sandy Smith[1], Kathleen Ryan[2], Naomi Cappuccino[3], Brent Sinclair[4], Rob Bourchier[5]
[1]University of Toronto, [2]SilvEcon, [3]Carleton University, [4]Cornell University, [5]Agriculture and Agri-Food Canada

Cold hardiness as a factor affecting the success of the swallow-wort biological control agent *Hypena opulenta*

Hypena opulenta (Christoph) (Lepidoptera: Erebidae) is a biological control agent for invasive swallow-worts in North America. First released in Canada in 2013 and the United States in 2017, the insects are established in multiple sites across the introduced range, however, population sizes remain too low to impact the target weed. Previous field experiments have identified high rates of winter pupal mortality as a potential factor limiting *H. opulenta* population sizes in their introduced range. In this talk, I will describe laboratory experiments conducted to characterize the cold tolerance strategy of *H. opulenta*, and the effects of environmental factors like soil moisture on the insects cold hardiness.

Cold tolerance experiments revealed that *H. opulenta* is a freeze tolerant species. The presence of an inoculating agent (silver iodide) on the pupae increased the supercooling point from -18.8±0.7°C to -2.7 ± 0.2°C, suggesting that the species is susceptible to inoculative freezing in wet conditions. Longer cold exposures resulted in increased mortality of *H. opulenta*, however, inoculative freezing at higher temperatures appeared to increase the likelihood of insects surviving these long cold exposures.

Our results suggest long periods of extreme cold may be contributing to slow population growth of *H. opulenta* in their introduced range. Characterizing the cold-hardiness of *H. opulenta* may aid the selection of future release sites, and facilitate predictions of where and when existing populations may spike. Future work should explore the role of soil moisture related mortality factors not directly associated with cold. For example, drowning or hypoxia associated with ice encasement.

14:00 Lucas Roscoe[1], Michael Stastny[1], Jeff Fidgen[1], Glen Forbes[1], Jeff Ogden[2]
[1]Natural Resources Canada - Canadian Forest Service, [2]Nova Scotia Department of Natural Resources and Renewables

Biological control and the hemlock woolly adelgid in Atlantic Canada: Objectives and initial activities in Nova Scotia

Introduced from Asia, the hemlock woolly adelgid (HWA) has killed millions of eastern hemlock in eastern United States, and has been spreading in Nova Scotia and Ontario. Its infestations pose a threat to the forest and riparian ecosystems supported by hemlock in eastern Canada; but, uniquely, this insect is also native to the Pacific Northwest, including British Columbia, where its populations are regulated by native predators. Beginning in 2018, we combined phenological surveys with field studies to elucidate the effect of

native natural enemies in Nova Scotia on HWA populations, demonstrating that little mortality is exerted by this predator complex. Classical biological control with multiple agents has been proposed to help control the complex two-generation life cycle of HWA, and to complement limited-scale chemical options. Based on extensive research on the biological control of HWA in the United States, in 2023 we conducted caged and open releases of *Laricobius nigrinus* Fender, collected from native HWA populations in coastal BC, at replicate sites in southwestern NS. Here, we present the role *L. nigrinus* and other specialist predators can fulfill in HWA population regulation, and the research objectives for long-term Integrated Pest Management of HWA in Nova Scotia.

14:15 Jocelyn Smith[1], Haley Catton[2], Hector Carcamo[2], Tracey Baute[3], Julien Saguez[4], Lauren DesMarteaux[2], Peter Mason[2], Timothy Skuse[2]
[1]University of Guelph, [2]Agriculture and Agri-Food Canada, [3]Ontario Ministry of Agriculture, Food, and Agribusiness, [4]CEROM

Biological Control of Cereal Leaf Beetle *Oulema melanopus* (L.) (Coleoptera: Chrysomelidae) in Canada

The cereal leaf beetle (CLB), *Oulema melanopus* (L.) **(**Coleoptera: Chrysomelidae), is an invasive defoliating pest of cereals and grasses that has dispersed to Canada from the United States at least twice. CLB established in southwestern Ontario in the 1960s and expanded east to Quebec, New Brunswick and Nova Scotia. In western Canada, CLB was discovered in BC in 1998, and has spread across the Prairies. Biological control of CLB has been key to manage this occasional pest. *Tetrastichus julis* (Walker) (Hymenoptera: Eulophidae) was introduced into the United States in the 1960s, spread into parts of southern Canada, and has been a successful biological control agent of CLB larvae. At least one other ichneumonid parasitoid released into the USA has been found in Canada for the first time, signaling an adventive movement of hundreds of kilometers. The historical and current state of CLB parasitism by *T. julis* in Canada will be reviewed. In addition, annual surveys of cereal pests conducted in Ontario wheat in 2021-2024 have provided novel insights into the state of biological control of CLB and true armyworm (TAW), *Mythimna unipuncta* Haworth (Lepidoptera: Noctuidae) in Ontario cereals.

14:30 Jacques Brodeur[1], Simon Legault[1], Josée Doyon[1], Paul K. Abram[2], Jean-Philippe Parent[2]
[1]Université de Montréal, [2]Agriculture and Agri-food Canada

Biological control of the Japanese beetle: The Canadian experience

Native to Japan, *Popillia japonica* (Coleoptera: Scarabaeidae), is invasive to North America. In Canada, populations are now well-established in southern Ontario, Quebec, New Brunswick, Prince Edward Island and Nova Scotia. Japanese beetles were detected in Vancouver, British Columbia beginning in 2017, and a multi-agency team has since undertaken efforts to eradicate these populations. Adult and larval beetles have different diets, but both cause aesthetic damage and yield losses in ornamentals and agricultural crops. The lack of co-evolved natural enemies in the invaded range has contributed to challenges associated with managing Japanese beetles. Some generalist predators have been identified, but do not appear to impact pest populations. Entomopathogens have shown promise as biological control agents, but their adoption has so far been limited by several biological and economic factors. In Japan, the Japanese beetle is of minor economic importance. This is attributed to biological control exerted by native natural enemies, the most effective of which is thought to be the parasitoid fly *Istocheta aldrichi* (Diptera: Tachinidae). More than a century ago, this solitary, host specific, adult parasitoid was released in the USA. Following repeated

introductions from 1920 to 1950, the parasitic fly spread to and established in several states. Japanese beetles parasitized by *I. aldrichi* were first observed in Quebec in 2009 and in Ontario in 2013. We will review aspects of its biology (life-history parameters, distribution, seasonal occurrence) and potential as a biological control agent of the Japanese beetle in Canada.

14:45 Michael McTavish[1], Ian Jones[1], Jennifer Baici[1], Sandy Smith[1], Rob Bourchier[2]
[1]University of Toronto, [2]Agriculture and Agri-Food Canada

Biological control of introduced Phragmites in Ontario using stem boring moths (*Archanara neurica* and *Lenisa geminipuncta*)

Introduced *Phragmites australis australis* is considered one of the most invasive plants in North America. Field releases of the stem-boring moths *Archanara neurica* and *Lenisa geminipuncta* (Lepidoptera: Noctuidae) as classical biological control agents for introduced *Phragmites* began in Ontario in 2019. This presentation will provide a brief overview of the first years of the biological control program for introduced *Phragmites* in Ontario, including protocols for and insights from agent rearing, release, and monitoring. As of fall 2024, we have released approximately 30,000 insects across 50 sites. Insect damage has been detected at over 90% of the release locations with negative impacts on introduced *Phragmites* at release points. For sites that are two- or three-years post-release, damage has been observed each year, indicating the agents are able to survive, reproduce, and disperse locally within introduced *Phragmites* populations. Going forward, the program is focused on further assessing agent impacts on the target weed and on methods of redistributing agents from "nurse sites" to scale up biological control releases to a province-wide scale.

15:00 Frédéric Jean[1], Véronique Martel[2]
[1]Canopée dronautique, [2]Natural Resources Canada

The Use of UAS in Biological Control in Canada

The authors of the chapter on the use of UAS in the new book "Biological Control Programmes in Canada, 2013-2023" will be sharing their experience from over the past 10 years in using remotely piloted aircraft to release beneficial insects. The presenters will highlight the advantages of using UAS technology in scaling up the use of beneficial insects, spreading them faster over larger areas compared to manual methods.

Symposium : Insectes forestiers: de la connaissance à la pratique

Organisé Par Évelyne Barrette

13:45–15:15

Modératrice : Cynthia Deschênes

13:45 Évelyne Barrette[1]
[1]Ministère des Ressources naturelles et des Forêts

Survol des activités de surveillance des insectes et maladies des arbres dans les forêts québécoises

La Direction de la protection des forêts (DPF) a pour mandat d'assurer une protection efficiente des forêts contre le feu, les insectes et les maladies, dans une perspective de développement durable des

ressources forestières pour le bénéfice des populations. Le Service de la gestion des ravageurs forestiers (SGRF) de la DPF procède annuellement à la récolte et à l'analyse des données sur les insectes et maladies des arbres. Lors de cette présentation, vous découvrirez comment les différents réseaux de surveillance permettent de dépister et localiser les insectes forestiers et les maladies à caractère épidémique et de suivre leur évolution et leurs impacts dans le temps. Les contributions du SGRF à divers projets et collaborations à partir des données récoltées dans ses réseaux seront présentées.

14:00 Nicolas Bédard[1]
[1]Centre de Foresterie des Laurentides

From the collection to the forest: improving biodiversity data management

In this presentation, we invite you to explore the evolution of the René-Martineau Insectarium, from its origins in entomological research to its growing impact on biodiversity studies in forestry. Over the years, insect collections have played a key role in unlocking the complexities of forest ecosystems, but their tremendous size and traditional management methods have made it challenging to fully tap into their potential. Join us as we discuss our efforts to align our biodiversity program and data management with innovative strategies focused on centralizing and digitizing entomological data.

14:15 Christian Hébert[1], Jonathan Boucher[1], Jean-Michel Béland[1], Jacques Ibarzabal[2], Éric Bauce[3], Junior Tremblay[4], Cyriac Mvolo[5], Isabelle Duchesne[6]
[1]Centre de foresterie des Laurentides, [2]UQAC, [3]Université Laval, [4]Environnement et Changement Climatique Canada, [5]Centre canadien de la fibre de bois - Edmonton, [6]Centre canadien de la fibre de bois – Québec

Éviter de récupérer les zones sévèrement affectées par le longicorne noir après feu améliore la durabilité de l'aménagement des forêts brûlées

À la suite des feux historiques de l'été 2023, les enjeux économiques que présentent les coupes de récupération ont rapidement été ramenés à l'avant plan. En effet, les arbres tués par le feu ont une valeur commerciale élevée pour l'industrie du bois d'œuvre, jusqu'à ce qu'ils soient fortement infestés par le longicorne noir dont les profondes galeries diminuent la valeur. Nos recherches montrent qu'il est possible d'atténuer l'impact économique du longicorne noir en évitant de récupérer le bois des secteurs les plus sévèrement affectés par l'insecte, tel que prédit à partir de cartes écoforestières et d'estimés de sévérité du feu obtenus par imagerie satellitaire. Ces secteurs sont aussi des zones riches pour la biodiversité car le longicorne amorce la décomposition du bois et est donc associé à plusieurs espèces. Il représente aussi une source de nourriture importante pour le pic à dos noir. Il est donc possible de concilier les enjeux économiques et environnementaux en évitant de récupérer les arbres des zones les plus affectées par le longicorne noir. Cependant, si la récupération devait se poursuivre sur plusieurs années en raison du développement de nouveaux marchés, comme les biocarburants/biomatériaux, il faudrait identifier des indicateurs de durabilité de l'aménagement des forêts brûlées. Une espèce comme *Gnathacmaeops pratensis*, un longicorne inscrit sur la liste rouge de plusieurs pays européens, montre un grand potentiel à cette fin. Cette espèce est toujours présente dans les brûlis 6-10 ans après feu alors que la plupart des autres espèces sont devenues indétectables.

14:30 Sandrine Picq[1], Yunke Wu[2], Richard Hamelin[3], Michel Cusson[4]
[1]Laurentian Forestry Centre, Canadian Forest Service, Natural Resources Canada, [2]United States Department of Agriculture, APHIS, PPQ, Science and Technology, Forest Pest Methods Laboratory, [3]Department of Forest and Conservation Sciences, the University of British Columbia, [4]Département de biochimie, de microbiologie et de bio-informatique, Université Laval

Genomics-based assessment of the geographic origins of European spongy moths (*Lymantria dispar dispar*) intercepted in unregulated regions of Canada.

The European spongy moth (ESM, *Lymantria dispar dispar*) is one of the most important pests of broad-leaf trees in northeastern North America, with an economic cost estimated at US $3.5 billion per year. Since its accidental introduction from Europe in Massachusetts in 1860s, the ESM spread to neighboring states and provinces, resulting in a distribution that currently extends from North Carolina to south-eastern Canada on the east coast and to Minnesota inland. Despite control efforts to limit the spread of this forest pest, egg masses or moths are regularly intercepted by Canadian Food Inspection Agency (CFIA) agents in the western provinces of Canada. These introductions result of movements of infested equipment from regulated Canadian or United States regions. Thus, the identification of the geographical origin of these intercepted ESM would allow the CFIA to focus its inspection efforts on source regions in regulated areas and therefore to prevent effectively the spread of the ESM.
To assess the geographic origin of intercepted ESM, we identified the single nucleotide polymorphisms (SNPs) the most performant to correctly assign ESM in their geographic groups of origin previously defined by population structure analysis. These diagnostic SNPs allow us to identify New England as the main geographic source of 13 moths intercepted in 2016 in the western provinces of Canada. Eventually, the diagnostic SNPs will be added to an existing molecular tool named SpongySeq and developed to identify geographic origin of Asian spongy moths intercepted in Canadian ports.

14:45 Kathia Bernier[1], Sandrine Picq[1]
[1]Laurentian Forestry Centre, Canadian Forest Service, Natural Resources Canada, Quebec City, Quebec, Canada

Exploratory study of variations in the eastern spruce budworm's ABCC2 candidate gene associated with Btk resistance in Lepidoptera

The eastern spruce budworm (*Choristoneura fumiferana*; SBW) is a widespread moth species native to North America whose larvae can cause severe defoliation in spruce and fir trees during outbreaks. To better manage these outbreaks, the biological insecticide *Bacillus thuringiensis* subsp. *kurstaki* (Btk) has been used for decades. In some lepidopteran species, intensive spraying of Btk and generalized use of Btk crops were followed by emergence of Btk resistance. In some cases, this resistance was linked to ABC transporter protein mutations which prevent Btk toxins from binding to cell membranes, thus inhibiting cell lysis caused by pore formation. Early work has revealed variations in Btk tolerance between SBW populations in Ontario. More recently, an ABC transporter gene (ABCC2) associated with Btk resistance was detected on the sex chromosome of SBW. The presence of this gene on the sex chromosome provides a genomic context favorable to selection and rapid spread of resistance against Btk. In this context, we propose to investigate SNP variations in this ABCC2 gene between SBW populations and their potential correlation with Btk resistance. Additionally, this study involves resequencing the SBW sex chromosome using Oxford Nanopore technology to elucidate ambiguous regions in the vicinity of the ABCC2 gene, as well as manual validation of genes encoding ABC transporters in the SBW genome to assess their diversity.

15:00 Audrey Nisole[1], Patrick Gagné[1], Paule Huron[2], Véronique Martel[1], Sandrine Picq[1]
[1]Service Canadien des Forêts, Ressources Naturelles Canada, [2]FPL

Évaluation du metabarcoding pour identifier les relations hôte-parasitoïdes chez la tordeuse des bourgeons de l'épinette, *Choristoneura fumiferana*

La compréhension des interactions hôte-parasitoïdes et du taux de parasitisme chez les insectes ravageurs des forêts est essentielle pour leur gestion intégrée. Pour obtenir une telle connaissance, les techniques conventionnelles d'élevage d'insectes suivies d'une identification taxonomique sont largement utilisées mais sont chronophage et nécessitent une expertise taxonomique. Pour pallier ces contraintes, nous avons développé en 2020 une première méthode de diagnostic moléculaire utilisant la technologie Taqman® et la PCR quantitative qui permet l'identification en 2 jours de vingt espèces de parasitoïde (hyménoptère et diptère) affectant communément les chenilles de la tordeuse des bourgeons de l'épinette (TBE), important défoliateur des forêts boréales. Cependant lorsque plusieurs milliers (7 000 - 15 000) de chenilles doivent être traitées chaque année, cette méthode présente également des limites et devient inadéquate. Profitant de la démocratisation du séquençage à haut débit avec la technologie Oxford Nanopore, nous avons adopté une nouvelle méthode appelée le metabarcoding. Cette méthode permet le séquençage en parallèle du barcode COI de milliers de chenilles de TBE et de leurs possibles parasitoïdes tout en gardant l'information hôte-parasitoïde pour chaque chenille. Pour tester cette méthode, nous avons analysé 940 chenilles échantillonnés en 2021 dans 14 différents sites au New-Brunswick. Nous discuterons les résultats obtenus en termes de performance de la méthode et des relations hôte-parasitoïdes observées.Ce projet s'inscrit dans la stratégie d'intervention hâtive appliquée au New-Brunswick.

Symposium: Interdisciplinary advances in insect mass rearing in Canada **Borduas**

Organized by Jacintha Kong and Matt Muzzatti

13:45-15:15

Moderator: Jacintha Kong

13:45 Jake St. Amour[1]
[1]Natural Resources Canada

Insect Production and Quarantine Laboratory - Seventy Years of Mass Rearing Insects

Insects are known for their complicated life histories and feeding systems. Initiating and maintaining a laboratory insect colony is a deeply complex and challenging undertaking. It requires a mix of science, art, and luck to identify and meet the needs of each insect species. The Insect Production and Quarantine Laboratory (IPQL) in the Canadian Forest Service has been a key leader in developing rearing techniques for a diverse number of insects since 1953. We will present a history of insect mass rearing and technological developments that have led to the state-of-the-art multi-insect rearing facility along the shores of the St. Mary's River in Sault Ste. Marie, Ontario. We will highlight key developments and the current contributions of IPQL to forest pest management and research in Canada and globally.

14:00 Omid Joharchi[1]
[1]Anatis Bioprotection Inc., Saint-Jacques-de-Mineur, Québec, J0J 1Z0, Canada

Indigenous Predatory Mite Species: A Multidisciplinary Approach to Addressing Research and Industry Challenges

Mites, a highly diverse group of small chelicerate animals, are found globally and utilize a wide array of food sources. Recently, the use of natural enemies, such as predatory mites, in integrated pest management (IPM) programs has surged. In Canada, however, the majority of predatory mites used are foreign species, with native species remaining under-researched. The extensive use of these natural enemies in greenhouses can lead to their acclimation outside their native ranges, potentially resulting in unintended ecological impacts. A critical challenge is enhancing biological control through the screening of effective native predatory mites while ensuring these species do not adversely affect local ecosystems. Addressing this issue requires a multidisciplinary approach that integrates taxonomy, ecophysiology, genetics, and plant protection.

Key challenges following the identification of new native species include developing effective mass-rearing techniques, evaluating their efficacy, and comparing their performance with that of commercially produced and closely related mite species. The process is hindered by significant limitations, particularly the gap between academia and industry. Industries often resist collaborating on rearing methods due to concerns about the publication of proprietary methods and potential costs associated with licensing. Additionally, practical difficulties in integrating native species into existing pest management systems further complicate scaling up production.

To overcome these barriers, it is essential to establish collaborative, interdisciplinary frameworks involving academic institutions, government, and industry. Effective partnerships can address the challenges of industrial mass rearing and foster innovation in native mite production, ultimately enhancing pest control and reducing reliance on foreign species.

14:15 Marie-Hélène Deschamps[1], Grant Vandenberg[1]
[1]Université Laval

Three years later, the current status of the Educational Leadership Chair in the Production and Primary Processing of Edible Insects

Food waste upcycling by mass rearing of edible insects is a rapidly emerging sector that is shaking up conventional agri-food production and regional waste management systems. Many issues are still to be anticipated to allow the sector to emerge. Industry, governments and researchers must use new knowledge and skills to identify high-potential insect species; identify and validate the potential of inputs; develop innovative techniques for rearing insects; process and stabilize insect products; integrate insect products into livestock feed; demonstrate the economic feasibility of different production models; and measure the social acceptability of these new products on the market. Until now, there were no universities in Canada that provide training in the production of insects for food and feed. The Chair's mission aims to develop training activities in the field of edible insect farming as well as to identify and put into practice solutions to combat food waste through edible insect production. The activities of the Chair focus on education and training, knowledge transfer and, research and development to optimize production techniques, upcycle different types of organic residues and develop economic models in line with Québec’s regional specificities. The presentation will provide an overview of the various objectives of the Chair and an update on their evolution. The creation of the chair was made possible by a unique program established at Université Laval and 14 partners who have provided a total of $635,000 in funding over a five-year period.

14:30 Gabriel Mott[1], Matthew J. Muzzatti[1], Tharshi Nagalingam[1]
[1]Aspire Food Group

Elimination of entrenched pests from commercial insect rearing facilities

Invertebrate pests are a persistent challenge in all farming operations, whether the product is corn, cows, or crickets. However, many of the tools that can be used against pests in typical agricultural settings are not feasible in insect agriculture. Farmed insects are uniquely vulnerable to arthropod pests in a way that has no analog to other farming systems. Large scale insect agriculture requires the modification of existing integrated pest management techniques as well as the development of novel approaches. The black larder beetle (*Dermestes ater* (Coleoptera: Dermestidae)) is a common pest of commercial insect rearing facilities. This case study explores a five years effort over multiple cricket rearing facilities to eliminate *D. ater* infestation. Full extirpation of the pest required testing and iterating on barrier systems, behavioral and operational changes, rigorous monitoring, resource control, and a host of other tools. To the authors' knowledge this is the only example of elimination of a dermestid population from a commercial cricket rearing facility anywhere in the world. The robust paradigms and tools that the team developed have subsequently helped control other pest infiltrations including the red flour beetle (*Tribolium castaneum* (Coleoptera: Tenebrionidae)) and scuttle flies (Phoridae). This presentation also analyzes real-world examples of pest control failures in insect agriculture and its impact on insect farming.

14:45 Émile Vadboncoeur[1], Marie-Hélène Deschamps[2], Sue Bertram[1], Heath MacMillan[1]
[1]Carleton University, [2]Université Laval

Temperature has a stronger effect than diet on growth and development in two farmed cricket species

Insect farming could help meet the growing demand for protein. Crickets are commonly raised for food and feed. The two parameters set by insect farmers with the most influence on cost and production yield are temperatures and diets. To better maximize resource use, it is therefore crucial to measure the performance of farmed insects under a range of temperatures and diets to assess their optima and critical limits. We reared *Gryllodes sigillatus* and *Acheta domesticus* individually from hatch until six weeks of age at different temperatures (26, 29, 32, 35, 38 or 41°C; n=30) while being fed a diet containing a ratio of 1:1.2 protein to carbohydrate (P:C). We also reared both species individually at 32˚C feeding them different practical diets (2.2:1; 1.8:1; 1.4:1; 1:1.2; 1:2.3; 1:4.5 or 1:6.3 P:C; n=30). We measured mass and instar weekly, modelled growth using logistic regression and development (instar) with linear regression, and compared model parameters to identify treatment differences. Temperatures increased or decreased survival, timing of molts and adult mass, while only extreme diets affected these parameters. A yield metric, amalgamating survival, growth and development, showed that 35˚C maximized yield. Yield was similar across a wide range of diets. Overall, rearing temperature has a much larger effect on performance than the P:C of the diet. Even if we can't exclude interactions between diet and temperature, results suggest that crickets can be reared on variant diet compositions with little impact on production, while temperatures can be leveraged to optimize yield within a production schedule.

15:00 Jacinta Kong[1], Matthew Muzzatti[1], Heath MacMillan[1], Susan Bertram[1]
[1]Carleton University

Grinding feed does not affect growth, development and survival in individually and group reared edible crickets

Diet strongly influences the growth and development of mass-reared insects. The physical properties of feed such as the particle size may affect insect feeding and digestion and consequently growth, development, and survival. To understand the effects of particle size on the performance of mass-reared insects, however, we must also consider the social environment. Competition for feed particles may drive feeding in mass-reared crickets that is absent for individually reared crickets. To this end, we ground feed to a smaller and more consistent particle size and tested for effects of grinding feed on the growth, development and survival of a commercially farmed cricket species, *Gryllodes sigillatus*, in individually and group reared (500 individuals) contexts. We found feed particle size does not influence cricket growth, development or survival in individually reared or group-reared crickets from hatch to harvest, and group-rearing resulted in heavier crickets later in development, regardless of feed type. We conclude additional fine grinding of feed is not necessary to increase biomass or yield at harvest. On average, crickets are not choosy about particle size are able to acquire sufficient food under competition, even in the presence of uneven particle sizes. Overall, our results demonstrate the need to scale up experiments to understand feed optimization in a mass-rearing context.

15:15-15:30 Break - Pause

Ecology - Écologie (8) Jean-Paul Lemieux

15:30-16:45
Moderator : Lisa Lumley

15:30 Dorothy Travis[1], Glen Brown[1, 2, 3]
[1]Trent University, [2]Ministry of Natural Resources and Forestry Ontario, [3]Wildlife Research & Monitoring Section

Environmental controls on arthropod communities in the Hudson Bay Lowlands, Canada

Climate warming is occurring more quickly at higher latitudes and is having far reaching impacts to ecosystem processes. Arthropods play essential roles in ecosystem functions, particularly as a dietary source in seasonally dependent, sub-Arctic food webs. Arthropods growth and emergence during spring and summer is closely tied to temperature. Warming can lead to earlier seasonal availability of arthropods, potentially causing a mismatch with the timing of consumer demand (Durant et al. 2007). These effects are more pronounced in colder environments where seasonal abundance is limited by fewer growth opportunities. The relationship between habitat heterogeneity and phenological patterns in arthropod availability are not well understood. Further, climate warming may have varying impacts on arthropod availability through interactions with habitat and permafrost thaw that affects the below-ground environment used by arthropods. For example, permafrost thaw processes may manifest differently across various habitats, leading to unpredictability at finer microtopographic scales (fine-scale surface features of a landscape) within wetlands or regions (Zhang *et al*. 2020). To investigate the environmental and microtopographic factors influencing the availability of invertebrates, we analyzed the biomass, abundance,

and phenology of invertebrates collected using emergence and modified Malaise-pitfall traps over two summers at 20 sites within Polar Bear Provincial Park, Hudson Bay Lowlands Ontario. Our fine-scale spatial analysis considered accumulated degree-days, various weather variables, and microtopographic variations across four distinct habitat types.

15:45 Sherri Fownes[1], Stephen F. Matter[2], Jens Roland[1]
[1]University of Alberta, [2]University of Cincinnati

Over-winter egg survival drives dynamics of alpine *Parnassius smintheus* butterflies

We use long-term population monitoring (27 years) of a 21-meadow network of populations, of alpine *Parnassius smintheus* butterflies, combined with experimental manipulation of winter conditions (snow) to determine the role of over-winter egg survival on population dynamics in the Rocky Mountains of Alberta, Canada. Over-winter survival of experimentally planted eggs explained 80-90% of the variation in annual change (R_t) of adult butterfly abundance between consecutive summers. Experimental removal of snow cover resulted in very low, or no, survival of eggs in each year. These patterns support results from long-term population monitoring of *P. smintheus*, wherein the interaction between winter temperatures and snow cover are the best predictors of population change. Results suggest that loss of alpine snow cover due to climate change may place these butterfly populations at risk.

16:00 Patricia MacKay[1], Robert Lamb[1]
[1]Department of Entomology, University of Manitoba

Climate change, an aphid, *Uroleucon rudbeckiae*, and its wildflower host, *Rudbeckia laciniata*, 1999-2023

Five populations of an aphid, *Uroleucon rudbeckiae* (Fitch), and its wildflower host, *Rudbeckia laciniata* L., were assessed in southern Manitoba from 1999-2023. These populations live at the northern edge of their extensive range in the southern half of North America. Temporal trends in host plant densities and life history traits were detected, that might be attributed to climate change. From 1999-2023, the climate at four weather stations near the populations revealed no significant climate change measured as annual mean temperatures or precipitation, but monthly mean temperatures for April declined significantly by 4.1ºC and June temperatures increased significantly by 3.4ºC on average, at the four weather stations. This climate change, particularly the trend of rising temperature in June, was a cause of declining flower stem height and stem density in some plant populations, as determined by partitioning variability between climate change and other causes of annual variation in the traits. The unexpected observation that a moderate rise in June temperature has negative effects on the host plant in southern Manitoba, within 10 km of its northern limit, is discussed. The relative importance and repercussions of direct effects of climate change and indirect effects through the host plant on aphid populations are described.
Corresponding author: Robert Lamb (email: lambmack@mymts.net)

16:15 Lisa Lumley[1], Diana Tirlea[2], Krista Williams[1], Richard Caners[2], Ashley Thorsen[3], Greg Horne[4], Alwynne Beaudoin[2]

[1]Alberta Biodiversity Monitoring Institute; University of Alberta, [2]Royal Alberta Museum, [3]Alberta Biodiversity Monitoring Institute; Royal Alberta Museum, [4]Parks Canada

Oribatid mite subfossils preserved in ice: assessing their utility in palaeoecological reconstruction of alpine environments

Oribatid mite subfossils preserved in peatlands and lake sediments have successfully been used to reconstruct past environments. Their utility in reconstructing past alpine habitats when preserved in ice features, such as glaciers and ice patches, is unknown. Here, we assessed oribatid mite subfossils, pollen, and other macrofossils found in organic matter exposed during the glacial retreat of Fraser Glacier in Jasper National Park, Alberta. Radiocarbon dating reported an age spanning modern to late Little Ice Age (1850-1300). We found fifty-nine oribatid mite subfossils in the sample, of which twenty-five and eighteen specimens were identifiable to species and genus level, respectively. Assessment of the current known distribution and habitat associations of these species indicated that, at the time of sample deposition, the collected site at Fraser Glacier was a treed, moist, and mossy upland habitat with species typical of subalpine to montane sites. The pollen and plant macrofossils provided additional evidence that the forest was dominated primarily by Engelmann spruce and low-herbaceous plants with open areas comprised of disturbances and mesic sites. Further, the results extend the currently documented distribution of several oribatid mite species, of which one species has not been detected since 1980. This provides an opportunity to apply these data to current conservation and biodiversity monitoring efforts, through supplying evidence that increased surveying efforts for extant populations within these range extensions is warranted.

Symposium « Biological Control programmes in Canada: advancements in using «Good» to combat «Bad» (4) »

Organized by Meghan Vankoski and Véronique Martel

15:30-16:00

Moderators: Meghan Vankoski and Véronique Martel

15:30 Paul Abram[1]

[1]Agriculture and Agri-Food Canada

Canadian progress on biological control of spotted-wing Drosophila

For many insect pests, there is no biological control “silver bullet”. Spotted-wing drosophila, *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae) is certainly one of them. Despite two decades of intensive research around the world, biological control is still not a major contributor to managing this invasive pest of soft fruit in agricultural settings. However, due in part to research work done in Canada, there is some hope on the horizon. Canadian research teams have contributed major fundamental advances in understanding the biological control contributions of a variety of parasitoids, predators, and microbes; and in developing the basis for future biologically-based control modalities and their eventual integration into pest management programs. In this talk, I will review the main discoveries and developments coming out of Canadian research labs related to biological control of spotted-wing Drosophila over the last 15 years.

15:45 Rob Johns[1]

[1]Canadian Forest Service

***Orchestes fagi* (L.), Beech Leaf Mining Weevil (Coleoptera: Curculionidae)**

The beech leaf mining weevil, *Orchestes fagi* (Linnaeus) (formerly *Rhynchaenus fagi,* Coleoptera: Curculionidae), is a common native pest of European beech (*Fagus sylvatica* Linnaeus) found throughout Europe. The first record of *O. fagi* in North America was in 2011 on American beech (*Fagus grandifolia* Ehrhart) near Halifax, Nova Scotia, Canada. It has since continued to expand its Nova Scotian range and was recently detected in both Prince Edward Island and southern New Brunswick. Although *O. fagi* outbreaks in Europe tend to be cyclic and rarely cause tree mortality, outbreaks in Nova Scotia are relentless and devastating to American beech. In this talk, I will discuss our current understanding of the challenges and options for managing *O. fagi*, as well as an update on the search for suitable biological control agents for possible introduction into Canada.

Symposium : Insectes forestiers: de la connaissance à la pratique (2/2)

Organisé par Évelyne Barrette
Lismer-Leduc-Fortin
15:30- 16:45
Modératrice : Cynthia Deschênes

15:30 Abdelmadjid Djoumad[1], Cynthia Deschênes[2], Cédric Fournier[2], Michel Cusson[1], Sandrine Picq[1]

[1]Centre de Foresterie des Laurentides, Service Canadien des Forêts, Ressources Naturelles Canada, 1055 rue du PEPS, Québec, Québec, G1V 4C7, Canada, [2]Service de la gestion des ravageurs forestiers, Direction de la protection des Forêts, Ministère des Ressources naturelles et des Forêts, 2700 rue Einstein, Québec, Québec, G1P 3W8, Canada

Développement et adaptation aux besoins opérationnels d'une méthode moléculaire (qPCR) pour dénombrer les larves hivernantes de Tordeuse des Bourgeons de l'Épinette (TBE) collectées lors des inventaires automnaux

La TBE est le principal ravageur des forêts de conifères en Amérique du Nord. Lors des épidémies, cette espèce cause des dommages conséquents aux sapins et épinettes pouvant conduire à leur mort. La lutte contre ce défoliateur nécessite des pulvérisations d'insecticide biologique (Btk), effectuées chaque printemps afin de limiter les dégâts occasionnés. Afin d'optimiser la gestion (quantité d'arrosage, zones à traiter…), un échantillonnage est effectué à l'automne afin de dénombrer les populations de tordeuse (stade L2 en diapause). Cette collecte est suivie du broyage de milliers de branches, de l'extirpation chimique des larves de leur hibernaculum où elles passent l'hiver et de leur comptage manuel. Le travail et le temps considérable nécessaires au dénombrement nous ont conduits à envisager d'autres alternatives. Nous avons ainsi entrepris de développer une méthode de comptage dite « moléculaire ». Basée sur l'utilisation de la PCR quantitative, elle part du postulat qu'il existe potentiellement une corrélation entre la quantité d'ADN extraite d'un échantillon contenant des larves et le nombre de larves présentes dans ce même extrait. Pour vérifier cette hypothèse, nous avons utilisé comme cible le gène mitochondrial codant pour la cytochrome oxydase 1 (COI). Nos travaux ont permis de corroborer cette hypothèse et semblent démontrer que notre approche moléculaire pourrait permettre d'obtenir des dénombrements similaires aux comptages manuels avec, pour finalité, le même type de décision quant aux traitements. Cette approche doit encore être validée

et le défi qui consiste à optimiser cette méthode et l'amener à un niveau opérationnel est en cours d'évaluation.

15:45 Alvaro Fuentealba[1], Alain Dupont[2], Richard Berthiaume[2], Simon Fortier[3], Louis Morneau[3], Éric Bauce[1]

[1]Université Laval, [2]SOPFIM, [3]Direction de la protection des forêts, Ministère des Ressources naturelles et des Forêts (MRNF)

Vulnérabilité et protection de l'épinette de Norvège contre la tordeuse des bourgeons de l'épinette

L'épinette de Norvège (EPO) (*Picea abies* (L.) Karst.) a été plantée à grande échelle à l'extérieur de son aire de répartition naturelle en raison de sa croissance rapide et de la valeur de son bois. Au Québec, plus de 200 millions de semis ont été plantés depuis 1964. Actuellement, plusieurs de ces plantations sont exposées à la tordeuse des bourgeons de l'épinette (TBE) (*Choristoneura fumiferana* (Clem.)). Malgré des résultats parfois contradictoires, on considère que l'EPO et l'épinette blanche (EPB) (*Picea glauca* (Moench) Voss) sont également vulnérables à la défoliation par la TBE. L'objectif principal de cette étude était d'évaluer la vulnérabilité de l'EPO à la TBE. Nous avons également évalué l'efficacité de *Bacillus thuringiensis* (*Btk*) pour protéger l'EPO. La défoliation annuelle causée par la TBE a été évaluée entre 2018 et 2020 dans la région du Bas-Saint-Laurent. De plus, des inventaires ont été réalisés dans plusieurs régions afin d'évaluer l'efficacité des arrosages au *Btk* dans des plantations d'épinettes. Nos résultats démontrent non seulement que l'EPO est aussi vulnérable à la défoliation causée par la TBE que l'EPB, mais aussi que l'EPO peut subir une défoliation plus élevée que l'EPB lors de certaines années (35 % vs 10 % respectivement en 2019, 44 % vs 36 % respectivement en 2021). Les interventions au *Btk* ont montré une faible efficacité pour protéger l'EPO en termes de protection du feuillage (≥ 49,32 % de défoliation dans les plantations traitées). D'autres études doivent être menées pour comprendre les facteurs qui influencent l'efficacité de *Btk* sur l'EPO.

16:00 Richard Berthiaume[1], Alain Dupont[1], Éric Bauce[2], Alvaro Fuentealba[2], Christian Hébert[3]

[1]Société de protection des forêts contre les insectes et maladies, [2]Université Laval, [3]Ressources Naturelles Canada

Comparisons of Btk aerial spraying scenarios against the eastern spruce budworm, based on protection timing and intensity during a complete outbreak episode.

Large-scale aerial spraying operations against the spruce budworm (*Choristoneura fumiferana* Clem.) with the biological insecticide *Bacillus thuringiensis* subsp. *kurstaki* (*Btk*), aims at maintaining trees alive during outbreak episodes. This goal is usually achieved when ≥ 50% of current-year foliage is preserved. However, it is unknown if this standard approach used in Quebec province is always justified, or if less frequent interventions can provide similar results at a lower cost. We conducted between 2010 and 2024 field experiments in Quebec's North Shore region to determine the efficacy of five different protection scenarios in protecting balsam fir [*Abies balsamea* (L.) Mill.], white spruce [*Picea glauca* (Moench) Voss], and black spruce [*Picea mariana* (Mill.) BSP] mixed stands. We hypothesized that less frequent *Btk* applications can provide an adequate level of protection. After twelve years of intervention with *Btk*, our results show a clear effect of protection scenarios on host tree species mortality caused by the spruce budworm. As the protection intensity decreases, the volume of dead balsam fir increases. Moreover, balsam fir mortality remains higher than spruce trees. At this stage of the outbreak, our observations suggest that balsam fir stands could be treated every 2 years, and white spruce every 3 years without significant mortality level

(6,7% and 1,3%, respectively), instead of the standard approach (1,6% and 0,0%, respectively). Based on this study, it is possible to apply the required protection level on a greater forested area at a comparable cost and optimize the benefits of *Btk* spraying programs related to production objectives.

16:15 Eric Bauce[1], Alvaro Fuentealba Morales[1], Richard Berthiaume[2], Christian Hébert[3], Alain Dupont[2], Roberto Quezada Garcia[1]
[1]Université Laval, [2]SOPFIM, [3]Forêt Canada

Impact des épidémies de tordeuses des bourgeons de l'épinette, *Choristoneura fumiferana* (Clemens), sur les volumes ligneux et sur la structure des peuplements 10 ans après épidémie

Un réseau de 422 placettes échantillons de 500 m^2 a été installé pour suivre les impacts à court et moyen terme d'une épidémie de tordeuse des bourgeons de l'épinette (TBE), *Choristonera fumiferana* (Clemens), sur la croissance, les pertes ligneuses, et les caractéristiques des sapinières de la forêt boréale. Les niveaux de protection par arrosage aérien et les essences hôtes ont été pris en considération lors de ces travaux. Dix ans après la fin de l'épidémie, 78 placettes échantillons ont été remesurées et 702 arbres hôtes (Sb,Epb,Epn) ont été récoltés pour analyse de tige.
Les résultats montrent qu'il faut environ 16 ans après l'épidémie pour que les peuplements retrouvent leur volume pré épidémique en sapin baumier, que les traitements aériens au *Btk* sont très efficaces pour réduire les pertes à court et moyen terme, que la TBE avec ou sans protection aérienne de pesticide exerce un effet d'éclaircie par le bas dans les peuplements affectés, qu'elle réduit de la moitié le nombre de tiges marchandes et qu'elle entraîne une augmentation, dix après épidémie, de 20% des diamètres moyens marchands. Les impacts de la TBE sur la structure des peuplements tendent à perpétuer dans le temps le caractère équien des sapinières.

16:30 Véronique Martel[1], Jacques Régnière[1]
[1]Canadian Forest Service

40 years of studying spruce budworm parasitoids: What did we learn?

The spruce budworm, *Choristoneura fumiferana*, is a native outbreaking defoliator causing important damages to balsam fir and spruce. Parasitoids are an important mortality factor, but their importance and diversity change based on different factors. We have followed parasitism in two study sites for 40 years nearby Quebec City, starting at the spruce budworm population collapse and for the endemic period that followed. These long-term datasets, combined with some other lab and field work, have allowed us to gain some important understanding of their ecology. I will present some of our recent work, including three papers in which we modeled the climatic influence on three parasitoid species: *Tranosema rostrale*, *Actia interrupta* and *Meteorus trachynotus*. I will also present analyses showing the competitive interaction between *T. rostrale* and *Elachertus cacoeciae* in our sites.

BANQUET **Krieghoff–Suzor-Côté**
18:30-23:00

Wednesday October 23, 2024 - Mercredi 23 octobre 2024

IPM - Lutte intégrée (5) **Jean-Paul Lemieux**

8:45-10:15

Moderator: Sébastien Boquel

8:45 Jean-Philippe Parent[1], Paul Abram[1]
[1]Agriculture and Agri-Food Canada

Now we're playing with power when vibrating aphids on pepper plants

Vibrational pest control as an alternative to chemical pesticides has been expanding for years, and methods targeting insects known to communicate using substrate-borne vibrations are commercially available. We have been developing a novel vibrational pest control method against aphids for pepper plants in greenhouses. Until now, the biggest issue facing the scaling up of this approach to large pepper plants has been the lack of vibrational power. In this study, we trialed novel shakers that produce vibration at a high energy to vibrate large, commercial-size pepper plants infested with the green peach aphid, *Myzus persicae*. To test this new approach, we built large mesh cages containing four commercial size plants, each infested with 10 adult aphids on 10 different focal leaves. The number of aphids present on focal leaves were measured over 14 days. On the 15th day, we counted aphids on all the leaves of a single plant per cage. The vibrations arrested the aphid population growth when compared to the exponential growth of the non-vibrated plants. On the 15th day, the number of aphids was 92% lower on vibrated plants. As we progress slowly but surely toward applicability of this novel pest control method, we will need to further investigate how to reduce the plant to shaker ratio while maintaining the same effectiveness in a realistic setting to make it commercially viable.

9:00 Daniel Cormier[1], Jessee Tinslay[1], Éric Lucas[2], Franz Vanoosthuyse[1]
[1]IRDA, [2]Laboratoire de lutte biologique, UQÀM

Aphids, Natural Enemies, and Ants Complex in Orchard Flower Strips

Apple orchards are agroecosystems that are regularly disturbed by pesticide applications, which influence insect population dynamics and affect the natural biological control of pests. To promote functional biodiversity and enhance habitat complexity, flower strips were introduced into the alleyways of untreated apple plots in an experimental orchard. The effects of these flower strips on green apple aphid (GAA; *Aphis pomi* and *Aphis spiraecola* complex) colonies, natural enemies, and ant colonies were compared to unmanaged sections of the orchard. Insects were monitored weekly during three growing seasons in both the managed and control plots. Population dynamics of GAA, natural enemies, and ants under both treatments were compared and are discussed.

9:15 Catherine Pouchet[1], Jason R. Tavares[2], Marie-Josée Dumont[3], Gérald Chouinard[1], Mikaël Larose[1]
[1]IRDA, [2]Polytechnique de Montréal, [3]Université Laval

Des filets d'exclusion répulsifs : Une technique à double action pour protéger nos cultures contre le puceron vert du pommier (*Aphis pomi*)

La production de pommes sans pesticide au Canada demeure un défi majeur dû à la persistance de ravageurs et de maladies susceptibles d'endommager nos cultures. Toutefois, il existe certaines méthodes pour réduire la pression exercée par les ravageurs sans avoir recours aux pesticides, dont les filets d'exclusion, qui constituent une méthode alternative efficace contre plusieurs ravageurs. Cependant, les filets traditionnels fabriqués à partir de combustibles fossiles (HDPE) agissent uniquement comme des barrières physiques et peuvent permettre à certains ravageurs problématiques, comme le puceron vert du pommier (Aphis pomi), de se développer à l'abris de ses prédateurs et ainsi affecter la qualité des fruits et le rendement. Pour remédier à ces limitations, notre projet explore l'utilisation de filets en acide polylactique (PLA), un matériau plus durable et biodégradable, dont la surface a été modifiée pour permettre l'adsorption de répulsifs bioactifs ciblant des ravageurs spécifiques. Ces filets ont été testé dans le verger expérimental de l'IRDA afin d'évaluer s'il est possible d'améliorer l'efficacité des filets d'exclusion et de réduire l'utilisation des pesticides contre le puceron vert du pommier. Nos résultats indiquent que les filets imprégnés ont un impact sur le développement des populations de pucerons déjà présentes sous les filets, avec une diminution d'environ 76% par rapport aux filets traditionnels. Ce projet ouvre une avenue intéressante pour améliorer l'efficacité des filets d'exclusion et contrôler efficacement les ravageurs qui peuvent occasionnellement être problématiques sous les filets, tout en réduisant l'impact environnemental de leur production.

9:30 Marc Fournier[1], Maxime Lefebvre[2], Isabelle Couture[3], Éric Lucas[1]
[1]UQAM, [2]IRDA, [3]MAPAQ

Effectiveness of winter rye cover crop against striped cucumber beetle in squash production

The striped cucumber beetle (SCB) is the main pest of cucurbit crops in Quebec. It is a vector of bacterial wilt, a vascular disease that can cause plant death. Yields can be reduced by more than 20% if SCB populations are not controlled. Seed treatments coated with neonicotinoids and foliar applications of insecticide are used to control SCB. Winter rye cover crop is a technique already used by several producers to control weeds and diseases in squash production. Several producers also observed a decrease in SCB populations when they used this technique. No scientific data are available to validated and quantified this phenomenon. The goal of this project was then to evaluate the effectiveness of winter rye cover crop on the dynamics of SCB and the incidence of bacterial wilt. The results demonstrate that SCB are less numerous in winter rye cover crop plots compared to bare soil plots. The frequency of bacterial wilt is also 5 times lower in rye plots. We will discuss the implications of the results for producers.

9:45 Sébastien Boquel[1], Sandrine Corriveau-Tousignant[1], Alexis Latraverse[1]
[1]CÉROM

Winter canola: a new strategy against insect pests in Québec

Winter canola is commonly used in crop rotations in the United States and Ontario but remains underutilized in Quebec due to limited knowledge regarding its winter survival and yield potential. However, it offers several benefits over spring canola, including the potential to mitigate damage from key insect pests (e.g., flea beetles, swede midge) due to a desynchronization between their peak activity periods and the crop's sensitive growth stages. This study compared pest populations and associated damage between winter and spring canola across Quebec. Field assessments were conducted in winter canola plots in fall 2022 and spring 2023, and in spring canola plots in spring 2023, at CÉROM (southern Québec) and in five producer fields across Saguenay-Lac-Saint-Jean, Bas-Saint-Laurent, and Chaudière-Appalaches regions. The findings

revealed that damage from flea beetles and swede midge were generally low or absent in winter canola during its most vulnerable stages (flea beetles: four leaves or fewer; swede midge: elongation) as compared to spring canola. However, other pests were occasionally more prevalent in winter canola. These results suggest that the use of winter cultivars could reduce the need for pesticide usage in canola production while reinforcing its place in a diverse crop rotation.

10:00 Aziz Ullah[1], Priyanka Mittapelly[1], Boyd Mori[1]
[1]Department of Agricultural, Food & Nutritional Science, University of Alberta, Edmonton AB

Insecticide susceptibility and resistance monitoring of flea beetles in canola

Flea beetles (*Phyllotreta* spp., Coleoptera: Chrysomelidae) are major, economically damaging canola (*Brassica napus*) pests in Canada. Feeding damage to seedlings negatively affects plant establishment and growth. Insecticides are the primary means of management. To manage flea beetles, almost all canola is grown from insecticide treated seeds and, if needed, sprayed with foliar insecticides. We carried out three separate experiments to assess the susceptibility of crucifer (*Phyllotreta cruciferae*) and striped (*Phyllotreta striolata*) flea beetles to neonicotinoid and pyrethroid (deltamethrin) insecticides across the Prairies. In the first experiment, we performed bioassays with crucifer and striped flea beetles to assess feeding damage caused to neonicotinoid-based and fungicide only seed treatments compared to untreated canola seedlings. In the second experiment, we used an olfactometer to observe the behavioural responses of the crucifer flea beetle towards the seedlings grown from insecticide treated seed. In the third experiment, we surveyed the susceptibility levels of striped and crucifer flea beetles to foliar pyrethroids (e.g., deltamethrin) across the Prairies. The flea beetles were collected across Prairies in 2022-2024 and bioassays were conducted under controlled conditions. The results showed that there was significantly lower feeding damage and higher mortality when seeds were treated with neonicotinoid seed treatments compared to the controls. However, the level of damage and mortality varied among different flea beetle populations and years. The two-choice olfactometer bioassay results suggests that the seed treatments had a more significant antifeedant effect on flea beetles. Moreover, the flea beetles demonstrated no resistance to the foliar pyrethroids.

Symposium: Methods and tools for wild pollinators research (1/2)

Organized by Sabrina Rondeau and Amanda Liczner
Krieghoff – Suzor-Côté
8:45-10:15
Moderator: Amanda Liczner

8:45 Frédéric McCune[1], Sabrina Rondeau[2], Amélie Gervais[1], Valérie Fournier[1]
[1]Université Laval, [2]Université d'Ottawa

Community Science for Pollinator Monitoring: Insights from the *Abeilles Citoyennes* Project

Despite growing concerns over insect pollinator declines, identifying vulnerable pollinator communities remains challenging due to the time, cost, and expertise required for the collection and identification of wild insect pollinators, particularly bees. This presentation explores how community science can effectively address these challenges through large-scale insect pollinator monitoring, with a focus on the *Abeilles Citoyennes* project (abeillescitoyennes.ca) as a case study. Launched in Quebec in 2019, the *Abeilles citoyennes* initiative aims to track the diversity of wild bees and hover flies throughout the province. From

2019 to 2023, 161 volunteers collected insects at 217 sites across the province. To date, 20,900 bees and 3,700 hover flies were collected and identified to species (2019-2023). A total of 105 volunteers further signed up for the project in 2024. This presentation will detail the project's methodology and highlight the diverse applications of the collected data. In addition, we will discuss the benefits and challenges of the *Abeilles citoyennes* approach and opportunities for improvement.

9:00 Kevin Gauthier[1]
[1]eButterfly

eButterfly : standardized monitoring of butterflies through community science on a global scale

The e-Butterfly project is a collaborative initiative aimed at enhancing butterfly research and monitoring globally through digital tools. This online platform allows enthusiasts, researchers, and citizen scientists to contribute to a central database by recording their butterfly sightings. By collecting and centralizing this data, e-Butterfly provides valuable information on geographic distribution, seasonal variations, and population trends of butterflies.

The value of e-Butterfly for research is significant. Providing real-time access to reliable and extensive data, the project helps scientists monitor changes in ecosystems and assess the impact of environmental factors such as climate change and habitat loss on butterflies. Additionally, the platform fosters international collaboration and public participation, especially with the recent launch of it's mobile app, thereby enriching the quality and quantity of available data. Data from eButterfly has so far contributed to 48 peer-reviewed articles and the project has been cited over 250 times.

In this presentation, we show how, in the long-term, e-Butterfly contributes to a better understanding of butterfly population dynamics and supports conservation efforts by identifying threatened species and suggesting appropriate protection strategies. By involving the public in data collection, the project also raises awareness about biodiversity and the importance of butterflies in ecosystems and as pollinators.

9:15 Julia Meyer[1, 2], Charles-Étienne Ferland[1, 2], André-Philippe Drapeau Picard[2], Sonya Charest[2], Michel Saint-Germain[2], Maxim Larrivée[2]
[1]Institut de recherche en biologie végétale, [2]Insectarium de Montréal | Espace pour la vie

Mission Monarch - Expert: an advanced method to characterize monarch habitats, and monitor monarch presence

Mission Monarch - Expert (MMx) is the new advanced component of the Mission Monarch program. Introduced in 2023, this component was developed to complement the community sciences component known as Mission Monarch (MM). Unlike MM, which targets the general public, MMx is specifically designed for conservation professionals and skilled community scientists. The goal of MMx is to characterize potential monarch habitats and monitor monarch presence and activities while following standard procedures. The MMx monitoring protocol supports two (2) types of monitoring sites: random and non-random. Random sites can be selected from randomly generated sampling points provided by the MMx Sampling Grid. This approach ensures an unbiased characterization of potential monarch habitat and their usage across different site types and throughout their potential breeding range in Canada. After selecting a site, participants can establish the monitoring plot, describe the plot and choose to conduct one or more of the following activities: (**Activity 1**) milkweed and blooming plant survey, (**Activity 2**) immature monarch survey, and (**Activity 3**) adult monarch survey. Once collected, data can be uploaded to the MMx data portal. The successful

implementation of MMx will provide an accurate picture of Canadian Monarch population size and trends, as well as milkweed and nectar resource availability on a national scale. This will allow for effective science-based decision making. The program is aligned with the US-based Integrated Monarch Monitoring Protocol, to allow for trend analyses across the species breeding range.

9:30 Emily Forrester[1], Samm Reynolds[1], Andrew Young[1], Jonathan Schmidt[1]
[1]University of Guelph

Testing the variability in Malaise trap sampling of native bee and flower fly abundance and diversity in agroecosystems

Malaise traps are widely recognized as an effective tool for sampling a variety of flying insects in high abundance. Traditionally, they are used in biodiversity surveys to detect species presence, but they have become increasingly employed for sampling in ecological research. However, this change comes without understanding the stochastic variation associated with the proportions of insects caught in a single Malaise trap or the interaction of multiple traps in one site, which could impact later statistical analyses. My study examines the variance in pollinator sampling using individual Malaise traps in three crop fields in Southern Ontario, Canada. Five Malaise traps were deployed 50 m apart along a single field margin at each farm, with weekly collection from June to July in 2022 and 2023. The species richness and abundance of two study groups, bees (Anthophila: Hymenoptera) and flower flies (Syrphidae: Diptera), were compared between traps using the following variables: species or genera accumulation rate, number of specimens collected, and the number of a target species or genus. Comparisons revealed no standard variance estimate over time or among locations associated with using the traps for this research. The addition of multiple traps has been found to increase the reliability of trap catch when used for sampling pollinator abundance and diversity. Preliminary testing for specific localities is recommended when conducting Malaise trap sampling. By improving sampling methodologies, pollination studies across the agricultural sector that utilize Malaise traps will have increased confidence in their results, leading to more informed and knowledgeable research practices.

9:45 Parker Smale[1], Taylor Kerekes[1], Cole Blair[1]
[1]Wildlife Preservation Canada

Methods in rearing at-risk bumble bees

Bumble bee colonies are notoriously difficult to locate and observe in situ, even moreso for species at-risk or in decline. Thus, rearing ex-situ is often necessary to gather certain life history information about bumble bees; however, it comes with its own obstacles and difficulties. Wildlife Preservation Canada's Conservation Breeding Lab focuses on rearing *Bombus terricola*, which is listed as “special concern”, in hopes of being able to conduct releases to help bolster and establish wild populations. Building on methods published by other researchers, we discuss the lessons learned from our program’s 10 years of trial-and-error methods development: control of environmental variables, promoting colony initiation, feeding and nutrition, and mating and overwintering conditions.

10:00 Caroline Strang[1]
[1]University of Western Ontario

Novel tools for assessing behaviour and cognition in wild bumblebee populations

Bumblebees have a remarkably rich behavioural repertoire, from large-scale navigation to fine motors skills required for flower handling, to complex use of visual and olfactory cues. These behaviours are essential for bees to successfully maintain healthy populations, so our ability to assess these behaviours is also important for monitoring wild bee populations. While there are many means of assessing complex behaviours in the laboratory, those studies are typically limited to commercially produced bees and lack the applicability to wild populations and conditions that are essential for conservation efforts. The recent development of a free moving and non-invasive assessment of bee behaviour, in which a bee is temporary contained in a small tube for testing and then released, serves as a starting point for the development of field assessments for a wide variety of behaviours. I will discuss how this technique can be used to measure locomotor activity levels, responsiveness to different levels of sucrose concentrations, as well as basic visual discriminations. All of these assays can be done in wild bees and allow for the bees to be released at their capture sites following testing. I will also describe a modification to the design that makes assessing fine motors skills possible in wild bees. The fine motor assessment is intended to model behaviours required during flower handling, which will hopefully be useful in identifying sub-lethal impacts of environmental stressors on bees and aid in conservation research.

Symposium: New insights from long-term studies of forest insect population dynamics (1/2)

Lismer Leduc Fortin
Organized by Jens Roland
8:45-10:15
Moderator: Jens Roland

8:45 Brian Van Hezewijk[1], Lara Payne[1], Vince Waring[1]
[1]Natural Resources Canada - Canadian Forest Service

241 - Four decades and hundreds of thousands of traps: Introduction and growth of spongy moth populations in Western Canada.

Since the widespread establishment of spongy moth in Eastern Canada in the 1970s and 80s, an intensive monitoring and eradication program has been in place to prevent the spread of this invasive pest into Western Canada. Over the past four decades, more than 200,000 pheromone traps have been deployed in British Columbia alone capturing approximately 3,700 moths. We used this extensive dataset to examine spatial and temporal patterns of introduced populations and their subsequent growth. From 1986-2013, 376 unique introductions were identified. The annual rate was strongly correlated with periods of widespread defoliation in Ontario and was spatially correlated with human population density in British Columbia. Only 20% of introduced populations exhibited positive growth rates, and most of the others disappeared after a single year. The locations of populations that grew quickly and subsequently required eradication were predicted well by an existing climatic suitability model. The implications for refining the existing detection and eradication strategies for this important pest will be discussed.

9:00 Jens Roland[1]
[1]University of Alberta

Are introduced parasitoids "drivers" or "passengers" in the biological control of introduced winter moth? Forty-two years of population data from Victoria, BC.

Introduced winter moth populations in oakwoods in Canada (Nova Scotia and BC), and in the USA (Massachusetts), have been targets for biological control by the introduction of parasitoids. The apparent success of these introductions was a bit surprising given that long-term studies of native winter moth populations in Britain showed little impact by these parasitoids on host populations there. Here, I examine population data over a 42-year interval from Victoria, BC to determine whether observed decline (and resurgence) is best explained by introduced parasitism or by other agents, in particular by generalist predators on host pupae in the soil. In doing so, I ask the question - do the patterns of interaction support the notion that introduced parasitoids are "drivers" of host dynamics, or are they merely "passengers" - simply using winter moth as a resource.

Introduced parasitoids inflicted the least parasitism in host populations showing the greatest declines, and inflicted the greatest parasitism in populations that declined the least. Predation by generalist predators, on the other hand, (primarily by native beetles), inflicted heavy predation at all sites; reaching levels of 90-100% in sites with the most dramatic declines. I use long-term data to assess the interaction between host abundance and both parasitism and predation, and the consequence of those interactions on host population change.

9:15 Barry J. Cooke[1]
[1]NRCan-CFS-GLFC

Points, plots, provinces, and polemics: the forest tent caterpillar doesn't cycle synchronously at any scale, but why?

Point count data are the gold standard for understanding pointwise process regulation in population ecology. When it comes to forest insects with continental-scale distributions, aerial survey impact data and tree-ring impact data are indispensable for their cost effectiveness in bridging across spatial and temporal scales. The forest tent caterpillar exhibits periodic outbreaks across Canada every decade or so; however, there is no spatial scale over which these fluctuations are well-synchronized. At the national scale, aerial survey data indicate that outbreaks are periodic in aggregate only. Within individual locations, patterns of fluctuation are dominated by singular spike anomalies that are highly asynchronous among regions. Outbreak anomalies tend to focus on single regions, and often fail to spread to cover more than 1/3 of the host area available for defoliation, which is inconsistent with synchronization theory. At plot level, high density networks of tree-ring data show that even at very fine spatial scales, outbreaks tend to have a clustered distribution, and the epicentric foci tend to shift about systematically between outbreak pulses, with gradients in forest structure tending to serve as the primary axis of desynchronization. Reminiscent of Huffaker's orange mites, one is tempted to conclude that the tri-trophic interaction between caterpillars, their host trees, and their natural enemies is not nearly as stable as presumed by the simple theory of coupled harmonic predator-prey oscillation. The hybrid "clockwork-catastrophe" theory of the forest-insect interaction suggests that the bottom-up effects of host on dispersal may be the missing ingredient driving instability at all scales.

Symposium: Prairies Predicaments: Navigating beneficial and insect pest dynamics on the Canadian Prairies (1/2) **Borduas**

Organized by Boyd Mori and Hector Carmaro

8:45-10:15

Moderators: Boyd Mori and Hector Carmaro

8:45 Héctor Cárcamo[1], Geneviève Labrie[2], Valentina Ibarra Galvis[1], Diana Wilches Correal[1], Kevin Floate[1]

[1]Agriculture and Agri-Food Canada, Lethbridge, [2]Université du Québec à Montréal

Interspecific competition between the exotic *Peristenus digoneutis* and native *Peristenus* of southern Alberta, Canada.

Lygus bugs (Miridae) are native pests of many crops throughout North America. In Easten Canada, a European parasitoid, *P. digoneutis* occurs adventively. In the Prairies, *P. mellipes* and *P. howardii* are common native parasitoids. Endemic parasitism levels were low and relocation of *P. digoneutis* was considered to enhance biological control. Our objective was to investigate the potential for competition between the native and exotic *Peristenus*. Native *Peristenus* were reared from local field collections. *Peristenus digoneutis* were from a New Jersey laboratory colony or from field collections in Quebec. Females of the native vs exotic, were allowed to compete for nymphs simultaneously or sequentially after 24 h. Nymphs were reared under summer photoperiod conditions and overwintered in 2018-2019, but in 2023, a PCR molecular method was used to distinguish larvae of *P. howardii* from *P. digoneutis* to avoid the need to wait for adult emergence. Our results for this latter test showed that there were no effects of simultaneous competition on the success of parasitism by the native species. Similar results were observed for *P. mellipes* reared to adults when the two parasitoids were added to the Lygus arenas simultaneously. There were minor reductions in parasitism by *P. mellipes* only when the exotic species was added a day before the native species. It appears that the risk for competitive displacement for native *Peristenus* by *P. digoneutis* is low.

9:00 Tyler Wist[1], Karolina Pusz-Bochenska[1], Sean Prager[2], Keith Hobson[3], Tim Dumonceaux[1]

[1]Agriculture and Agri-Food Canada, [2]University of Saskatchewan, [3]University of Western Ontario

Drivers of aster yellows outbreaks in Canada

Aster leafhoppers, *Macrosteles quadrilineatus*, (Hemiptera: Cicadellidae) are the primary vectors of the aster yellows phytoplasma (AYp) that causes aster yellows disease (AY) in crops. This insect migrates into Canada almost every year but AY outbreaks only occur sporadically. Outbreaks of AY disease in Canadian field crops occur when several factors align including large numbers of migrant leafhoppers with a high percentage infected by AYp. Where are the sources and what factors cause these infected migrations that lead to AY outbreaks and how can we monitor for them? The first step, is to determine the number of spring migrant leafhoppers and their percent infection using our newly developed, rapid molecular test.

9:15 Ethan Hooper[1], Khloe Baas[2, 3], Meghan Vankosky[3]
[1]University of Saskatchewan, [2]University of Regina, [3]Agriculture and Agri-Food Canada

Leveraging pest monitoring programmes to study beneficial insects in Saskatchewan field crops

In Saskatchewan, insect pests of field crops are monitored using protocols developed by the Prairie Pest Monitoring Network. Although the protocols were developed based on economic thresholds for each pest, some of the sampling protocols can also be leveraged to collect information on beneficial and other non-pest insects that use field crop habitats. The protocol for cabbage seedpod weevil monitoring and scouting uses sweep sampling which is particularly well suited for sampling beneficial insects that are captured as by-catch. Since 2017, all insects except thrips have been accounted for from the cabbage seedpod weevil sweep samples, to order and family, and where possible, species. Using samples collected from 2017 to 2023, we have first discuss beneficial insect sampling in canola crops across Saskatchewan, highlighting insights for important beneficial taxa. In 2023, paired canola and wheat fields were sampled throughout the growing season east of Saskatoon, SK using the cabbage seedpod weevil protocol. Using this data, we compare beneficial insect communities in canola and wheat fields and discuss the implications of sampling cereal fields as an avenue to broaden the scope of available data for future analyses.

9:30 Sylvia Neumann[1], Paul Galpern[1]
[1]University of Calgary

How messy fields can affect arthropods, crop yield, and conservation

Since 2015, the Agriculture, Biodiversity and Conservation lab at the University of Calgary has been investigating how 'messy' fields, those with more uncropped areas within and around the edges of the field (non-crop vegetation areas; NCVAs), can serve as reservoirs for pollinators and beneficial insects, can boost yield of crops, and help diversify habitat for other species. Here, we review some of our lab's major findings. The damage that insect pests cause in crops is an ongoing economic and food security issue. Biological control strategies for these crop pests include natural enemies, such as ground beetles. We have found evidence of a spillover effect of beneficials from NCVAs into the crop, but no evidence of spillover for most pest species that were studied. NCVAs had a positive impact on the abundance and occurrence of pollinators.
Proximity to NCVAs has shown evidence of a 'yield-halo', a boost in productivity for the crop, close to the field edge. This minor effect can provide a boost to yield sufficient to offset the cost of not farming an area. The benefits of encouraging growers to preserve existing NCVAs, or to create them in underperforming areas of crop fields, include increased pest predation services to the crop, reduced cost of farming areas that would otherwise lose money, and increased biodiversity and ecosystem health in intensively farmed landscapes.

9:45 Khaldoun Ali[1], Christian Willenborg[1]
[1]University of Saskatchewan

A comparative mechanism drives seed selection decisions in carabid beetles

Numerous ecological factors influence seed choice by carabid (ground) beetles (Coleoptera: Carabidae). Our previous studies have shown that seed selection decisions are driven by seed chemical traits when seed physical traits (e.g. size and mass) are within certain limits. Beyond that, seed selection decisions will be driven by carabid-to-seed mass ratio scaling relationships. Carabids thus can assess the suitability of different seed species before identifying the most suitable seed species among them, but the behavioral

mechanism that underlies this assessment remains unexplored. Here, we offered seed species of different preferability to *Pterostichus melanarius* and *Poecilus corvus* in choice feeding bioassays to test if these carabids would employ a fixed (Luce's Axiom; Luce, 1977) or a comparative (Dawkins' Threshold Model; Dawkins, 1969) mechanism for seed suitability assessment. Seed choice by both species was dynamic rather than fixed, as the value of the preferable seed species changed depending on the seed options (i.e. species) offered and the number of these options (i.e. binary or tertiary choice). Furthermore, the presence of a highly preferable seed species always depressed the value of other seed species for both carabid species. These results closely align with the predictions of Dawkins' Threshold Model, suggesting that carabids identify the preferable seed species by comparing the suitability of different seed species available in the environment. Seed preferences by carabids, therefore, are dynamic and context-dependent and thus, the preferable seed species will differ from one location to another depending on the composition of carabid community and soil seed bank.

10:00 Aldo Rios Martinez[1], Michelle Reid[1], Carol Frost[1], Jennifer Retzlaff[2], Hector Carcamo[3], Boyd Mori[1]

[1]University of Alberta, [2]Alfalfa Seed Commission of Alberta, [3]Agriculture and Agri-Food Canada

Putting the 'I' in IPM: Exploration of biological control agents in alfalfa seed production fields

The classic definition of integrated pest management (IPM) is often touted, but seldomly achieved. The reliance on insecticide to manage multiple insect pest species including *Hypera postica* (Gyllenhal) (Coleoptera: Curculionidae), *Adelphocoris lineolatus* (Goeze) (Hemiptera: Miridae), and *Lygus* spp. Hahn (Hemiptera: Miridae), in alfalfa, *Medicago sativa* (L.) (Fabales: Fabaceae), seed production fields in western Canada has led to significant issues with insecticide resistance. Canada is the second largest producer of alfalfa seed (4.2 M Kg/year) in the world, with most certified production concentrated in the province of Alberta. Biological control agents of the major pest species are present and include alfalfa weevil parasitoids, *Bathyplectes curculionis* (Thomson) (Hymenoptera: Ichneumonidae) and *Oomyzus incertus* (Ratzeburg) (Hymenoptera: Eulophidae), and several generalist predators; however, the distribution of these species and their parasitism and predation rates are currently unknown. Here, we assessed insecticide resistance within alfalfa weevil populations and the distribution of pests and biological control agents throughout southern Alberta to provide a foundation for future management efforts. A survey was conducted to sample insect diversity from seed production fields in 2020 and 2021 and a multiplex PCR assay was developed to identify the parasitoids within weevil larvae. Seasonality of pests and potential biological control agents was inconsistent between years, but parasitoids of alfalfa weevil were found throughout the growing season. Generalist predators were correlated with abundance of *Lygus*and *Adelphorcoris.* Assessing when and where these biological control agents occur will allow growers to adopt management strategies to conserve these species, and, ultimately, reduce pest damage.

10:15-10:30 Break - Pause

IPM - Lutte intégrée (6) **Jean-Paul Lemieux**

10:30:12:00

Moderator: Didier Labarre

10:30 Rachel Rix[1], Gefu Wang-Pruski[1], G Christopher Cutler[1], Yves LeClerc[2]
[1]Dalhousie University, [2]McCain Foods Ltd

Preliminary Survey of Wireworms and Beneficial Beetles in Potato Fields Adopting Regenerative Agricultural Practices and Examination of Wireworm Life-Stage Markers

Regenerative agriculture aims to improve agricultural sustainability by increasing biodiversity through diversified and increased crop rotations and cover crops, improving soil health, and reduced agrochemical inputs. Because changes to field management and planting regimes are likely to shift arthropod community dynamics, it is important to monitor and track pest and beneficial insect populations to inform proactive measures to minimize crop damage and optimize biological control. Furthermore, improved understanding of pest insect developmental phenology may help inform future pest management strategies and tactics, such as RNAi. We present findings of our work in these two areas, focused on wireworms (Coleoptera: Elateridae) at potato farms undergoing a shift to regenerative agriculture. Wireworms are among the most challenging pests in agriculture, causing significant economic damage to a variety of crops, including potato. We examined gene expression data generated from a transcriptome analysis of the most prolific wireworm species in the Maritimes, *Agriotes sputator*, to identify potential molecular signatures across larval stages. We identified marker genes involved in developmental processes including lipid synthesis, cytoskeletal and nervous system development, moulting and stage transition processes, and reproduction. We also conducted a preliminary survey of click beetle/wireworm populations in 12 regenerative potato fields in New Brunswick (NB). We expected to find click beetles from genus *Agriotes*, but instead found click beetles from genus *Hypnoidus*, which are found in NB but are more prolific in Quebec and the Prairies. We found a diversity of beetles from orders Carabidae, Chrysomelidae, Scarabaeidae, Staphylinidae, Coccinellidae, whose populations will benefit regenerative agroecosystems.

10:45 Wim van Herk[1], Bob Vernon[2]
[1]AAFC, [2]Sentinel IPM Services

Isocycloseram, a Novel Isoxazoline Insecticide Seed Treatment for Management of Wireworms (Coleoptera: Elateridae) in Cereal Crops

Populations of several pest species of wireworms are increasing in the key cereal crop production areas of Canada and the United States. To address this problem, a number of new seed treatments are being developed. To be effective, these need to both provide crop protection and significantly reduce populations. We evaluated isocycloseram, the first of a new class of agricultural insecticides known as isoxazolines, as a seed treatment for protection of both wheat and barley crops from the sugarbeet wireworm, *Limonius californicus*, in Alberta, and for the dusky wireworm, *Agriotes obscurus*, in British Columbia. In field trials conducted over four years under extreme wireworm pressure in Alberta, and under moderate-high pressure in BC, isocycloseram applied as a seed treatment at 5.0-7.5 g AI/100 kg seed was effective in protecting crop stand and yield, and significantly reduced wireworm populations. Registration of this new insecticide, expected for the spring of 2025, will provide growers with a new, much needed management tool for the wireworm pest complex.

11:00 Gabriel Ayotte-Breton[1], Didier Labarre[1, 2], Alice De Donder[1]
[1]CRIC, [2]Laboratoire de lutte biologique, Université du Québec à Montréal

Lâchers de nématodes entomopathogènes pour lutter contre l'altise à tête rouge en cannebergière

L'altise à tête rouge *Systena frontalis* (Fabricius) (Coleoptera : Chrysomelidae) est un ravageur possédant un potentiel de dommages élevés dans la canneberge. Aucun bioinsecticides et un seul insecticide conventionnel sont homologués contre l'altise à tête rouge dans la canneberge au Canada. En raison des limites maximales de résidus à l'international, l'insecticide homologué contre l'altise à tête rouge n'est toujours pas accepté par les acheteurs, laissant les producteurs de canneberges sans solutions contre l'altise. Il est donc nécessaire de mettre au point de nouvelles méthodes de lutte contre ce ravageur. Les nématodes entomopathogènes (NEPs) sont des agents de lutte biologique reconnus pour leur efficacité contre une variété de ravageurs, notamment contre les coléoptères.
Les objectifs de ce projet sont de 1) évaluer l'efficacité de deux espèces NEPs disponibles commercialement, *Heterorhabditis bacteriophora* et *Steinernema carpocapsae* contre l'altise à tête rouge; 2) déterminer la dose et la fréquence d'application des traitements pour réduire les populations d'altises en champs; 3) évaluer le coût et la qualité des NEPs.
Les résultats suggèrent que *S. carpocapsae* est plus avantageuse pour contrôler l'altise et qu'il y a un effet dose-réponse sur l'efficacité. Il reste à déterminer le moment propice des applications afin d'optimiser les lâchers de NEPs en cannebergière.

11:15 Chris Cutler[1]
[1]Dalhousie University

Comprehensive study of a system: Integrated Insect Management (IIM) in lowbush blueberry

Life-long entomological study dedicated to specialist or esoteric subjects is crucial for advancement of our discipline and related knowledge-based enterprises. However, there is also great need for generalist entomologists that tackle questions in multiple areas to achieve comprehensive understanding of and solutions for problems in complex systems. This is especially true in agricultural integrated insect management (IIM). IIM, like integrated pest management (IPM), necessitates a certain level of mastery of multiple subject areas and techniques for study of multifarious and dynamic ecological systems, while balancing interpersonal relationships and needs of partners and collaborators across a range of disciplines and professions. As a case study, I will describe some of our efforts with growers and other partners to develop IIM in lowbush blueberry through knowledge gained from studies on insect pest management and ecology, biological control and natural enemy ecology, and pollinator ecology and ecotoxicology. Comprehensive efforts like this ensure effective management of "the good, the bad, and the ugly" insects in agroecosystems.

11:30 William Nusillard[1, 2], Tessie Garinie[2], Yann Lelièvre[2], Sébastien Zito[3], Christine Becker[4], Denis Thiéry[5], Jacques Frandon[6], Jérôme Moreau[2, 7]

[1]AgroParisTech, 91120, Palaiseau, France, [2]Biogéosciences, UMR 6282 CNRS, Université de Bourgogne, 6 Boulevard Gabriel, 21000 Dijon, France, [3]UMR 1287 Ecophysiologie et Génomique Fonctionnelle de la Vigne, INRAE, Institut des Sciences de la Vigne et du Vin 210, chemin de Leysotte, 33882 Villenave d'Ornon, France, [4]Department of Crop Protection, Hochschule Geisenheim University, Von-Lade-Str. 1, 65366 Geisenheim, Germany, [5]INRA (French National Institute for Agricultural Research), UMR 1065 Save, BSA, Centre de recherches INRAe Nouvelle-Aquitaine-Bordeaux, 33882 Villenave d'Ornon Cedex, France, [6]Recherche et Développement, Bioline Agrosciences, 26250 Livron-sur-Drôme, France, [7]Centre d'Études Biologiques de Chizé, UMR 7372, CNRS & La Rochelle Université, 79360 Villiers-en-Bois, France

Trichogramma species, moth pests and multi-stress: perspectives from biological control in Europe

Global change is affecting plant-insect interactions in agroecosystems and can have dramatic effects on yields if it causes non-target pest outbreaks and threatens the use natural enemies of pests for biocontrol. Vineyards are of interest to study multi-stress conditions because agricultural intensification is associated with high use of copper-based fungicides and temperatures are rising due to climate change. We investigated the effects of both temperature increase and copper-based fungicide exposure on the vineyard pest *Lobesia botrana* and the oophagous parasitoid *Trichogramma oleae*. We exposed *L. botrana* larvae to three concentrations of copper under two fluctuating thermal regimes, one current and one future. Eggs produced by *L. botrana* were exposed to *T. oleae*. Our results showed that the survival of *L. botrana* was reduced by the highest copper concentration and improved under the warmer regime. The developmental time of *L. botrana* was strongly reduced by the warmer regime but increased with increasing copper concentration, whereas pupal mass was reduced by both thermal regime and copper. The F1 emergence rate of *T. oleae* was reduced and its development time increased by the combined effects of the warmer regime and increasing copper concentrations. Size, longevity and fecundity of *T. oleae* F1 decreased at high copper concentrations. These effects on the moth pest and its natural enemy probably result from trade-offs between the survival and the development of *L. botrana* under multi-stress conditions and imply potential consequences for future biocontrol. Our study provides valuable data on how pest-biocontrol interactions are affected by multi-stress conditions.

11:45 Syed Usman Mahmood[1], Xiaoduan Fang[1]

[1]Guangdong Key Laboratory of Animal Conservation and Resource Utilization, Guangdong Public Laboratory of Wild Animal Conservation and Utilization, Institute of Zoology, Guangdong Academy of Sciences, Guangzhou, Guangdong 510260, China

Spatial Distribution of Citrus Red Mite (*Panonychus citri* McGregor), Volatile Organic Compound Emissions, and Predator Response in Citrus Orchard of Guangdong, China

Citrus red mites (*Panonychus citri* McGregor) are a critical pest in citrus orchards, causing significant damage to crops. This study assessed the spatial distribution of citrus red mite populations and their influence on volatile organic compounds (VOCs) emissions from infested citrus plants in an orchard in Guangdong Province, China. We used a zigzag sampling method, selecting 15 trees and collecting 11 leaves from each tree across four cardinal directions (east, west, north, and south), both inner and outer canopy layers, and three vertical positions (upper, middle, and bottom). Results showed variation in red mite populations across different orientations. The highest population was recorded in the outer southern canopy (S1: 5.73 ± 9.18),

and the lowest was at the bottom (0.13 ± 0.35). The top canopy had the highest population (5.0 ± 4.74), with decreasing counts in the middle and bottom canopy levels. We also identified significant changes in VOCs, including elevated levels of trans-ß-Ocimene, α-Pinene, and Limonene-6-ol in mite-infested trees. Using an olfactometer, we tested the response of the predatory mite (*Amblyseius largoensis* Muma) to these VOCs and found a strong positive response, indicating the potential of these plant-triggered volatiles to attract natural predators. This study offers valuable insights into the spatial dynamics of mite populations and VOC-mediated predator interactions, providing a foundation for more targeted biological control strategies.

Symposium: Methods and tools for wild pollinator research (2/2)

Krieghoff – Suzor-Côté

Organized by Sabrina Rondo and Amanda Liczner

10:30-11:30

Moderator: Amanda Liczner

10:30 Amélie Morin[1], Valérie Fournier[1], Cole Blair[2], Sheila Colla[3], Taylor Kerekes[2], Frédéric McCune[1], Parker Smale[2], Mathilde Tissier[4]

[1]Université Laval, [2]Wildlife Preservation Canada, [3]York University, [4]IPHC, CNRS-Université de Strasbourg

Non-destructive methods for multidimensional assessment of bumblebee health

Wild pollinators are experiencing significant declines worldwide. In Canada, seven species of bumblebees are endangered, and populations of several common species are decreasing. It is therefore crucial to implement effective conservation measures to support these essential pollinators. Our project is contributing to bumblebee conservation efforts by developing a multidimensional and non-destructive approach for a holistic assessment of individual and population health. This presentation will cover the different methods used to characterize the behavior, nutritional profile, and infectious status of bumblebees. This approach combines a standardized behavioral assessment in their natural environment, with the collection and characterization of the nutritional profiles of their pollen loads, and the collection of their feces for parasitological analysis. Captures and samplings are conducted on wild queens and workers from seven species before their release. The characterization of the nutritional and medicinal profiles of the different pollens collected by at-risk bumblebees will be conducted, in addition to identifying nutritional deficiencies and contaminants in the pollens. Fecal screening using microscopy is conducted for the detection of intestinal pathogens such as *Crithidia spp.* and *Vairimorpha spp.*, and will be paired with genomic analysis to assess infection by viruses. This multidimensional and non-destructive approach, by evaluating the behavioral, nutritional health, and infectious status of wild bumblebees, will inform conservation actions to be implemented to support the most vulnerable populations and species. For instance, floral species that can address nutritional deficiencies or combat pathogens affecting at-risk bumblebees are also being tested and recommended to support the establishment of sustainable agriculture.

11:00 Amanda Liczner[1], Elizabeth Franklin[2], Sabrina Rondeau[1, 3], Nigel Raine[1]
[1]University of Guelph, [2]Cornwall College Newquay, [3]University of Ottawa

Using radio-telemetry to discover habitat selection and movement behaviour of bumble bees

Conserving bumble bee habitat should be an important conservation focus, but what constitutes high-quality habitat for bumble bee species is not well understood. Our knowledge of overwintering and nesting requirements is particularly limited because bumble bees are difficult to observe. Knowledge of these habitat requirements is critical for the conservation of bumble bees. By examining the movement behaviour of organisms, we can determine important aspects of habitat including the selection, of local areas of the landscape, and potentially locating cryptic aspects of habitat such as nesting and overwintering sites. We used radiotelemetry to track Bombus impatiens queens in spring and fall to identify their overwintering and nesting habitats respectively. We found that before overwintering, queens are less active, and focus their time in high floral areas. We suspect this is to build up food storage to survive overwintering. Possible overwintering locations included adjacent to a nesting site, in a garden, and on a grassy hillside. Spring queens by contrast are far more active as they nest search, flying over large areas and many habitat types. Once they establish a nest, queens forage close to their nest site. We also tested the impacts of environmental stressors on the movement behaviour of queens exposed to pesticides, and landscapes differing in floral availability. The results of this study will be important for advancing conservation and recovery initiatives for bumble bees by improving our knowledge of estimations of critical habitat for these important pollinators.

Symposium: New insights from long-term studies of forest insect population dynamics (2/2)

Lismer Leduc Fortin
Organized by Jens Roland
10:30-11:30
Moderator: Jens Roland

10:30 Jacques Regniere[1], Véronique Martel[1]
[1]Canadian Forest Service

Fourty years in Armagh and Epaule: natural enemies and spruce budworm populations during an endless endemic period

In 1985 and 1986, we witnessed the collapse of the spruce budworm outbreak in central Quebec, in two sites called Armagh and Epaule. At the time, we worked under the hypothesis that outbreaks of this insect were semi-periodical (somewhat regular) and responded to second-order density dependent "predator-prey" oscillations strongly influenced by "random" perturbations caused by the vagaries of moth dispersal. We expected to observe a lengthy endemic period composed of two phases: the declining phase during which natural enemies caused heavy mortality on larvae and pupae, followed by the increasing phase during which this mortality would relax and lead to a new outbreak. Instead, we laboured through a protracted 40 year stretch of pretty much same old same old, with persistent heavy mortality and precious few signs of recovery by the budworm populations. That is, until the last few years… But that is not to say we did not learn anything. We learned a lot about spruce budworm population dynamics and the ecology of its key parasitoids and predators since this study started. In this presentation, we brush on the essentials of what was done, what was observed, and what was learned.

11:00 Marc-Antoine Leclerc[1]

[1]Université du Québec à Chicoutimi

Lepidopteran scales have allowed the Holocene reconstruction of the spruce budworm outbreak-wildfire interaction in the mixed boreal forest

Within the context of current climate change, understanding multi-millennial variability in key ecosystem processes such as insect outbreaks and wildfire is fundamental and is possible using paleo-proxies. Lepidopteran scales are a novel, abundant, and well-preserved paleo-proxy that have been recently used to reconstruct spruce budworm outbreaks in the boreal forest of Quebec in eastern Canada. However, the use of lepidopteran scales has not yet been compared to modern, commonly used proxies. A multi-proxy approach comprising lepidopteran scales, aerial surveys, and tree-rings was used to determine whether lepidopteran scales accurately identified large spruce budworm population events. The three spruce budworm proxies were found to converge and complement one another. Finally, large spruce budworm population and wildfire events were reconstructed over the course of the Holocene in the mixed boreal forest using lepidopteran scales and sedimentary charcoal revealing an inverse relationship and a very peculiar oscillation between the two disturbance event frequencies.

Symposium: Prairies Predicaments: Navigating beneficial and insect pest dynamics on the Canadian Prairies (2/2) Borduas

Organized by Boyd Mori and Hector Carmaro

10:30-11:00

Moderators: Boyd Mori and Hector Carmaro

10:30 Jennifer Retzlaff[1], Gail MacInnis[2]

[1]Alfalfa Seed Commission of Alberta, [2]Pollinature - Research and Conservation

Alfalfa Leafcutting Bees: Managing Pollination, Pests and Crop Production

Although crop pollination is often credited to the honey bee, pollination by alfalfa leafcutting bees (ALBs) (*Megachile rotundata* (F.) is essential to produce seed in alfalfa, hybrid canola, and other speciality crops in Canada. Alberta is Canada's largest producer of certified alfalfa seed (*Medicago sativa* (L.), a lucrative crop in the Canadian prairies.

Alfalfa seed production is highly complex to manage, from the perennial nature of the plants which contributes to challenging pest dynamics, as well as the challenges associated with the use of alfalfa leafcutting bees for pollination.

Here we describe pollinator and pest management of ALB's in the alfalfa seed production system, with a specific focus on the parasitoid wasp, *Pteromalus venustus* Walker, one of the most prevalent ALB pests. *P. venustus* is a small chalcidoid wasp that parasitizes ALBs in their prepupal stage and can cause significant bee and economic loss. Controlling this pest presents unique challenges as both pest and host are hymenopterans with tightly synced life cycles, and much research on parasitoid wasps in agriculture is focused on their role as biocontrols. In addition, the registration for the main insecticide used to control *P. venustus* was removed in Canada, leaving producers few options to control this devastating pest. Learn more about ALB production and our research exploring new control options for a pernicious pest of one of Canada's lesser-known crop pollinators.

10:45 Emilio Enrique Tellarini Prieto[1], Marcelo P. Camilli[1], Justin Slobodian[1], Sarah Wood[1], Elemir Simko[1]
[1]University of Saskatchewan - Honey bee Health LAB

Abundance and Diversity of Wild Pollinators in Canola Fields of the Saskatchewan Prairies

Background. Flowering crops rely heavily on wild pollinators for successful reproduction, ultimately contributing to the increased productivity of many globally traded crops. Maintaining sufficient pollinator populations is critical for both preserving plant diversity and ensuring food security. However, agricultural intensification has been linked to concerning declines in pollinator populations. This study investigates the abundance and diversity of wild pollinators in canola fields, a dominant crop across the Saskatchewan prairies.

Method. Over two years, pollinator presence was monitored at 15 sites distributed along an approximately 450 km east-west gradient. At each site, sampling was conducted following three phenological periods of canola crop (pre-bloom, peak bloom, and post-bloom). To capture pollinators, eight sets of pan traps (blue, white, and yellow) and one blue vane trap were deployed for 24 hours during each sampling event. Additionally, we use geographic information system (GIS) to assess land-use patterns within a 5 km radius of each site.

Results. The results are still in process. This study will provide critical information to understand pollinator dynamics in canola-dominated agricultural landscapes and to develop more effective conservation and management strategies.

12:00-12:15 Closing ceremony - Cérémonie de clôture

Krieghoff – Suzor-Côté