Bulletin

Entomological Society of Canada
Société d'entomologie du Canada

Volume 49
Number / numéro 2

June / juin 2017

Published quarterly by the
Entomological Society of Canada

Publication trimestrielle par la
Société d'entomologie du Canada

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Volume 49(2), June / juin 2017

Captions for cover photos can be found on the back cover.
La légende des photos de la couverture se situe sur la couverture arrière.

One of the 50+ *Megarhyssa atrata* (Hymenoptera: Ichneumonidae) observed ovipositing on a single dead limb of a maple tree [Winnipeg, Manitoba, Canada]

Une femelle parmi au moins 50 *Megarhyssa atrata* (Hymenoptera: Ichneumonidae) observées en pleine ponte sur une seule branche morte d'un érable [Winnipeg, Manitoba, Canada]

Photo: Jordan Bannerman

Up front / Avant-propos

Neil Holliday, President of ESC / Président de la SEC

Lynda Holliday

President Neil Holliday waiting to hear from YOU.

Evolution and survival

As the schedule for the Bulletin has a 2-month lag between writing and publication, the June "Up Front" is being written in late April. Daily, at this time of year in southern Manitoba, one witnesses insects coping with a changing environment. Two weeks ago, we had sunny days with temperatures in the mid-teens Celsius, and the early spring flowers were thronged by bees and syrphids. There followed 5 insect-free days with daily maxima below zero and occasional snow. But with a return to more benign conditions, the pollinators reappeared in undiminished numbers. These insects, like many other arthropods, are not only adapted to the changing seasons, but also to the rapid environmental changes experienced in spring and fall as the oscillating polar front triggers alternations of southerly zephyrs and northerly blasts.

Members of the Entomological Society of Canada are familiar with the mechanism that results in adaptations to environment: selection operating on phenotypes expressing pre-existing heritable variation in fitness. Those more familiar with population genetics will realize that a consequence of the Hardy-Weinberg equilibrium is that rare genes mostly reside in heterozygous individuals

Évolution et survie

Puisque le calendrier du Bulletin a un délai de 2 mois entre l'écriture et la publication, l'Avant-propos de juin est écrit à la fin-avril. À cette période de l'année, dans le sud du Manitoba, on peut voir quotidiennement les insectes affronter un environnement changeant. Il y a deux semaines, nous avons eu des jours ensoleillés avec des températures autour de 15 °C, et les fleurs de début de printemps étaient visitées par les abeilles et les syrphes. Il y a ensuite eu 5 jours sans insectes avec des maximums sous zéro et de la neige occasionnelle. Mais avec un retour à des conditions plus normales, les pollinisateurs sont réapparus en nombre croissant. Ces insectes, comme plusieurs autres arthropodes, ne sont pas seulement adaptés aux saisons changeantes, mais également à des changements environnementaux rapides au printemps et à l'automne alors que le front polaire oscillant cause l'alternance entre les zéphyrs du sud et les souffles du nord.

Les membres de la Société d'entomologie du Canada sont familiers avec le mécanisme qui résulte aux adaptations à l'environnement : la sélection qui opère sur les phénotypes qui expriment une variation préexistante transmissible de la valeur adaptative. Ceux qui sont plus familiers avec la génétique des populations réaliseront qu'une conséquence de l'équilibre Hardy-Weinberg est que les gènes rares se trouvent principalement dans les individus hétérozygotes où, s'ils ne sont pas dominants, ils ne sont que rarement détectés ou sujets à la sélection. De tels gènes peuvent être retenus à de basses fréquences pour des centaines ou des milliers de générations. Si l'environnement change, les quelques individus homozygotes d'un gène rare peuvent maintenant avoir un avantage sélectif, permettant une augmentation rapide dans la fréquence du gène et amenant un déplacement des caractéristiques phénotypiques de la majorité de la population. Des exemples

where, if they are not dominant, they are seldom detected or subject to selection. Such genes may be retained at low frequencies for hundreds or thousands of generations. If the environment changes, the few individuals homozygous for a rare gene may now be at a selective advantage, so that a rapid increase in gene frequency occurs and there is a shift in phenotypic characteristics of the majority of the population. Examples related to insecticide resistance in pest insects and herbivores switching from wild to cultivated hosts spring to mind. It is important to remember that, with the exception of a few linked genes, the change in frequency of a newly-favoured gene does not alter the frequencies of genes at other loci. Populations retain enormous reserves of genetic diversity that are mostly hidden, but may become critically important if environmental conditions change. This wealth of genetic diversity is jeopardized by founder effects or other genetic bottlenecks in which relative few individuals provide all the genetic information upon which future selection events can operate.

Scientific societies, such as the ESC, also face environmental change that can threaten their survival. In the last few years, membership in ESC has trended downwards, and is now about 30% less than the average of a decade ago. In that decade many changes have happened both in the Society and in its environment. Among these are multiple changes in the landscape of scientific publishing (on-line publication, open access, a plethora of new avenues for disseminating research results), an increase in alternative scientific societies catering to subgroups of the general entomological population, limits on attendance of federal scientists at Joint Annual Meetings, a move to zero page charges for members and non-members alike, a reduction in the amount of time available for voluntary work for societies, and the replacement of our headquarters and dedicated office manager with an Association Management company. Whether, and to what extent, these individual changes have influenced our membership

liés à la résistance aux insecticides chez les insectes ravageurs et les herbivores qui passent d'hôtes sauvages à des hôtes cultivés me viennent à l'esprit. Il est important de se rappeler que, à l'exception de quelques gènes liés, le changement dans la fréquence d'un gène nouvellement favorisé n'altère pas la fréquence des gènes à d'autres loci. Les populations conservent d'énormes réserves de diversité génétique qui es surtout cachée, mais peut devenir importante si les conditions environnementales changent. Cette richesse de diversité génétique est compromise par l'effet fondateur ou d'autres goulots d'étranglement génétiques par lesquels un nombre relativement faible d'individus fournissent toute l'information génétique sur laquelle les évènements de sélection future peuvent opérer.

Les sociétés scientifiques comme la SEC font également face à des changements environnementaux qui peuvent menacer leur survie. Dans les dernières années, le nombre de membres de la SEC a eu tendance à descendre, et il est maintenant environ 30% plus bas que la moyenne d'il y a une décennie. Durant cette décennie, plusieurs changements ont eu lieu autant dans la Société que dans son environnement. Parmi ceux-ci se trouvent les changements multiples dans le paysage des publications scientifiques (publication en ligne, libre accès, une pléthore de nouvelles avenues pour disséminer les résultats de recherche), une augmentation dans les sociétés scientifiques alternatives qui divisent en sous-groupes la population entomologique générale, les limites de participation pour les scientifiques fédéraux à la réunion annuelle conjointe, un passage vers l'absence de frais de page pour les membres et non-membres, une réduction dans la quantité de temps disponible pour le bénévolat pour les sociétés et le remplacement de notre siège social et gestionnaire de bureau dévouée pour une compagnie de gestion des association. Si, et à quel point, ces changements individuels ont influencé la réduction du nombre de membres est difficile à évaluer. Chacun des changements sous le contrôle du CA de la SEC

reduction is difficult to gauge. Each of the changes under the control of the ESC Board was carefully considered before being chosen. Some of the changes were forced upon ESC by changes in the economics, and economic issues continue to be a problem for the Society: our annual expenditures are consistently higher than our annual income.

The Board of ESC recently devoted much of a meeting to a consideration of scenarios for increasing revenue or decreasing costs, or both. Further work needs to be done on many of these explorations before final financial decisions are made. In addition, the Board has engaged the services of a strategic planning facilitator, who will conduct a full day strategic planning session with the Board in October 2017. Regional societies and ESC committees have been asked to provide input to this process. It is hoped that these two processes will ultimately provide recommendations for the future of ESC that will preserve its essence, increase its value to members and hence increase its membership, and make it financially sound for the long term.

Both strategic planning and financial planning are akin to selection in an evolutionary sense. They act to select among a range of possibilities that are offered for consideration. In evolution, selection is among genes encoding information; in governance of a society, selection is among information in the form of ideas. As with biological evolution, many ideas remain unused and unconsidered for years of routine operation of a society, but may become vital to the society's survival when the environment changes. Similar to biological evolution, a small subset of the population (the Board) does not hold the range of ideas that are present within the population (membership) as a whole.

The ESC needs your help. We need your ideas. What do you value about membership? What would make your membership more valuable to you? What irritates you about the Society? If you are a non-member reading this, what would induce you to join ESC?

a été considéré avec attention avant d'être choisi. Certains changements ont été imposés à la SEC par des changements économiques, et les questions économiques continuent d'être un problème pour la Société : nos dépenses annuelles sont constamment plus élevées que nos revenus annuels.

Le CA de la SEC a récemment dédié la plus grande partie d'une réunion à considérer des scénarios pour augmenter les revenus ou diminuer les coûts – ou les deux. Plus de travail doit être fait sur plusieurs de ces explorations avant que des décisions financières finales ne soient prises. De plus, le CA a embauché les services d'une facilitatrice de planification stratégique qui mènera une session d'une journée complète de planification stratégique avec le CA en octobre 2017. Les sociétés régionales et les comités de la SEC ont été contactés afin de donner leur avis dans le cadre de ce processus. Nous espérons que ces deux processus vont ultimement fournir des recommandations pour l'avenir de la SEC qui préserveront son essence, augmenteront sa valeur pour les membres et ainsi augmenteront le nombre de membres, et la rendront financièrement saine à long terme. Autant la planification stratégique que financière sont apparentées à la sélection dans un sens évolutif. Elles agissent pour sélectionner parmi une gamme de possibilités qui sont offertes pour considération. En évolution, la sélection se fait parmi les gènes qui encodent l'information; dans la gouvernance d'une société, la sélection se fait parmi l'information sous la forme d'idées. Comme pour l'évolution biologique, beaucoup d'idées demeurent inutilisées et non considérées pour des années d'opération de routine d'une société, mais peuvent devenir vitale à la survie de la société quand l'environnement change. Comme pour l'évolution biologique, un petit sous-groupe de la population (le CA) ne détient pas la gamme d'idées qui sont présentes parmi la population (les membres) totale.

La SEC a besoin de votre aide. Nous avons besoin de vos idées. Qu'est-ce que vous

Do you have information about why fellow entomologists are not members? Not all regional entomological society members are also ESC members; how do we increase the proportion that is? Do you have suggestions about reducing ESC costs or increasing revenue? Are you aware of untapped corporate sponsorship opportunities or government funding programs that ESC could use? Let the Board have your ideas; maybe one of them represents the key to the future of ESC in a changing environment. Please send your comments and your input to Neil_Holliday@UManitoba.CA.

appréciez du fait d'être membre? Qu'est-ce qui donnerait plus de valeur à votre adhésion? Qu'est-ce qui vous irrite au sujet de la Société? Si vous n'êtes pas membre et que vous lisez ceci, qu'est-ce qui vous inciterait à joindre la SEC? Avez-vous des informations sur les raisons pour lesquelles vos collègues entomologistes ne sont pas membres? Tous les membres des sociétés régionales ne sont pas membres de la SEC : comment pourrions-nous augmenter la proportion qui l'est? Avez-vous des suggestions pour réduire les coûts de la SEC ou augmenter les revenus? Avez-vous connaissance d'opportunités de financement corporatif non exploitées ou de programmes de financement gouvernementaux que la SEC pourrait utiliser? Faites connaître vos idées au CA; peut-être l'une d'entre elles représente-t-elle la clé pour l'avenir de la SEC dans un environnement changeant. Merci d'envoyer vos commentaires à Neil_Holliday@UManitoba.CA.

Réunion conjointe annuelle des Sociétés d'entomologie du Canada et du Manitoba

Hôtel Fairmont, Winnipeg (Manitoba)
22-25 octobre 2017

PETIT, C'EST BEAU

De la part des Sociétés d'entomologie du Canada et du Manitoba, nous sommes heureux de vous inviter à la **Réunion annuelle conjointe SEC-SEM de 2017 : Petit, c'est beau**. Nichée entre deux très grandes réunions d'entomologie, soit le ICE 2016 à Orlando et la SEA-SEC 2018 à Vancouver, la réunion SEC-SEM à Winnipeg sera sans doute plus petite, mais constituera une excellente opportunité de présenter la recherche entomologique au Canada.

Conférencière principale : Angela Douglas, Université Cornell – "L'interface entre les insectes et les bactéries"

Conférenciers des symposiums pléniers :
- **Keith Summerville**, Université Drake – Symposium en foresterie
- **Dale Clayton**, Université de l'Utah – Symposium sur les ectoparasites
- **Anthony Ives,** Université de Wisconsin-Madison – Symposium sur la dynamique des populations
- **Nigel Raine**, Université de Guelph – Symposium sur la pollinisation

Symposiums additionnels :
- Commission biologique du Canada
- Vitrine aux étudiants gradués – contactez **Miles Zhang** ou **Anne-Sophie Caron**

Vous organisez un symposium ou un atelier? Contactez Paul Fields (président du comité scientifique)
***** Date limite pour la soumission des présentations : 31 juillet 2017 *****

Date limite pour l'inscription hâtive – 11 sept. 2017. Date limite pour l'inscription en ligne – 15 oct. 2017.

Inscrivez tôt

- Membres réguliers - inscription hâtive (350$), inscription tardive ou sur place (450$)
- Membres jeunes professionnels – inscription hâtive (265$), inscription tardive ou sur place (365$)
- Étudiants - inscription hâtive (175$), inscription tardive ou sur place (275$)
- Non membres - inscription hâtive (450$), inscription tardive ou sur place (585$)
- Inscription sur place pour une journée (200$)

Réduction pour les membres : Renouveler/joindre la SEC – 26$ pour les étudiants et 105$ pour membres réguliers.

Hébergement : Fairmont Winnipeg Hotel, tarif réduit – 169$ + taxes (réservez tôt).
Réserver une chambre dans cet hôtel est pratique et réduit les coûts de la réunion.

Réunions associées :
20 octobre – Groupe de travail sur la lutte biologique d'Agriculture et Agroalimentaire Canada
26 et 27 octobre – Forum de l'Ouest sur la lutte antiparasitaire http://www.westernforum.org/

Visitez SEC-SEM 2017 : http://home.cc.umanitoba.ca/ESM

Pour des renseignements généraux, contactez : Rhéal Lafrenière (président général), Rheal.Lafreniere@gov.mb.ca

Joint Meeting of the Entomological Societies of Canada and Manitoba

Fairmont Winnipeg Hotel
Winnipeg, Manitoba
22-25 October 2017

Small is Beautiful

On behalf of the Entomological Societies of Canada and Manitoba, we are pleased to invite you to the **ESC-ESM 2017 Joint Annual Meeting: Small is Beautiful.** Nestled in between two very large entomology meetings, ICE in Orlando 2016 and ESA-ESC in Vancouver 2018, the ESC-ESM JAM in Winnipeg will undoubtedly be a much smaller event but an excellent opportunity to showcase entomological research in Canada.

Keynote Speaker: **Angela Douglas**, Cornell University – "Interface between insects and bacteria"

Plenary Symposium Speakers:
- **Keith Summerville,** Drake University – **Forestry Symposium**
- **Dale Clayton**, University of Utah – **Ectoparasite Symposium**
- **Anthony Ives,** University of Wisconsin-Madison – **Population Dynamics Symposium**
- **Nigel Raine**, University of Guelph – **Pollination in a climate of change Symposium**

Additional Symposia:
- **Biological Survey of Canada**
- **Graduate Student Showcase:** Contact **Miles Zhang** or **Anne-Sophie Caron**

Organizing a member symposium or a workshop? Contact: **Paul Fields (Scientific Chair)**

***** Submitted paper deadline is 31 July 2017 *****

Registration: early registration deadline: 11 Sept. 2017. Online registration closes 15 Oct. 2017
- Regular members: early registration ($350), late or on-site registration ($450)
- Early professional members: early registration ($265), late or on-site registration ($365)
- Students: early registration ($175), late or on-site registration ($275)
- Non-members: early registration ($450), late or on-site registration ($585)
- Single day on-site registration ($200)

Register Early

Member Discount: Renew or become an ESC member - $26 for students and $105 for regular members

Accommodations: Fairmont Winnipeg Hotel, discount meeting rate - $169 + taxes (book early).
Staying at the conference hotel is convenient for you and lowers the meeting costs.

Associated Meetings:20 October 2017 - Agriculture & Agri-Food Canada Working Group on Biocontrol
26-27 October 2017 - Western Forum on Pest Management http://www.westernforum.org/

Visit ESC-ESM 2017: http://home.cc.umanitoba.ca/ESM

For general meeting inquiries contact: Rhéal Lafrenière (General Chair), Rheal.Lafreniere@gov.mb.ca

STEP Corner / Le coin de la relève

Anne-Sophie Caron and Miles Zhang

Call for Graduate Student Showcase (GSS) applications

Graduate students are invited to present their research at the 2017 Graduate Student Showcase (GSS). The GSS will be held on Sunday afternoon (22 October 2017) during the Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Manitoba in Winnipeg (22-25 October 2017) The purpose of the GSS is to provide a high profile opportunity for graduate students near the completion of their degrees to present a more in depth overview of their thesis research.

Applicants to the GSS must:
- have defended or plan to defend their thesis at a Canadian University within 1 year of the meeting
- be the principal investigator and principal author of the presented work
- be registered at the meeting

Eligible candidates who wish to be considered for the GSS must submit a complete application to gsscommittee@gmail.com, following the instructions below:
1) Submit a 250 word abstract describing the proposed presentation highlighting their work,
2) Submit a 1 page (single-spaced, 12 font) outline of their research, including rationale/significance, methodology, and results to date,

Appel de candidature pour la vitrine aux étudiants gradués

Les étudiants de deuxième et troisième cycle sont invités à présenter leur recherche à la vitrine aux étudiants gradués de 2017. La vitrine aura lieu le dimanche après-midi (22 octobre 2017) durant la réunion annuelle conjointe de la Société d'entomologie du Canada et de la Société d'entomologie du Manitoba à Winnipeg (du 22 au 25 octobre 2017). Le but de la vitrine est de permettre aux étudiants ayant presque complété leur diplôme de présenter de façon plus approfondie leur thèse de recherche et, ce, avec une grande visibilité.

Les candidats pour la vitrine doivent :
- avoir défendu ou prévoir défendre leur thèse dans une université canadienne dans l'année suivant la réunion
- être le chercheur principal et l'auteur principal du travail présenté
- être inscrit à la réunion

Les candidats éligibles qui souhaitent être considérés pour la vitrine doivent soumettre une application complète à gsscommittee@gmail.com, selon les instructions suivantes :
1) soumettre un résumé de 250 mots décrivant la présentation proposée, mettant en lumière leur travail
2) soumettre un aperçu (1 page, interligne simple, police taille 12) de leur recherche, incluant la problématique/l'importance du travail, la méthodologie et les résultats obtenus jusqu'à maintenant
3) le superviseur principal doit envoyer un courriel contenant une lettre de soutien confirmant la date réelle ou anticipée de graduation ainsi que des commentaires sur

3) Arrange to have the principal supervisor email a letter of support that confirms the anticipated or actual date of graduation and comments on the proposed presentation and the applicant's presentation and research abilities,
4) Include a CV that includes a list of previous conference presentations and other presentation experience.

All information must be submitted by 31 July 2017 as a single pdf document. All applicants will be notified of the status of their application. Unsuccessful applicants to the GSS will have their talks automatically moved to a President's Prize Oral session.
Differences between the GSS and the President's Prize (PP) Competition include:
- The GSS is a plenary session, with no concurrent talks and following the keynote speaker.
- Presenters in the GSS are given more time to speak about their research (30 minutes total, 25 for the presentation & 5 for questions) compared to the PP (15 minutes total)
- Abstracts for talks presented in the GSS are published in the ESC Bulletin, an open access publication.
- The selection process for the GSS is competitive (only selected students speak), compared to the PP where all students who enter speak but only one per category receives a prize.
- All presenters in the GSS receive an honorarium of $200.

We would like to encourage all eligible students of all backgrounds, genders and abilities to apply for the GSS. Supervisors, please encourage your students to apply and please help us to spread the word!
Any questions can be directed to Miles or Anne-Sophie, Co-chairs of the Graduate Student Showcase Committee (esc_students@gmail.com).

la présentation proposée et la présentation du candidat et ses aptitudes en recherche
4) inclure un CV qui contient une liste des présentations faites dans des conférences et toute autre expérience de présentation

Toutes les informations doivent être soumises au plus tard le **31 juillet 2017** dans un seul document pdf. Tous les candidats seront notifiés du statut de leur candidature. Les candidats n'étant pas sélectionnés pour la vitrine présenteront lors de la session du Prix du Président (PP).

Les différences entre la vitrine et le PP incluent :
- La vitrine est une session plénière : aucune autre présentation ne sera donc donnée en même temps et la vitrine suivra la présentation du conférencier d'honneur
- Les présentateurs de la vitrine ont plus de temps pour présenter leur recherche (30 minutes au total, 25 pour la présentation et 5 pour les questions) que ceux du PP (15 minutes au total)
- Les résumés pour les présentations de la vitrine seront publiés dans le bulletin de la SEC, une publication libre d'accès
- Le processus de sélection pour la vitrine est compétitif (seuls les étudiants sélectionnés présenteront), alors que tout étudiant peut présenter pour le PP, mais seulement un étudiant par catégorie gagne un prix
- Tous les présentateurs de la vitrine recevront un honoraire de 200$

Nous encourageons tous les étudiants éligibles de toutes les origines, genres et habilités à poser leur candidature pour la vitrine. Superviseurs, encouragez vos étudiants à appliquer et aidez-nous à passer le message!
Pour toutes questions, veuillez contacter Miles ou Anne-Sophie (esc_students@gmail.com), co-présidents du comité de la vitrine aux étudiants gradués.

Research Roundup

We continue to publicize graduate student publications to the wider entomological community through our Research Roundup initiative. Check out the ESC blog for the most recently featured articles. If you want your recently published article featured (or we missed yours), send us an email at entsoccan.students@ gmail.com. For regular updates on new Canadian entomological research, you can join the ESC Students Facebook page (Entomological Society of Canada Student Group) or follow us on Twitter (@esc_students).

We look forward to hearing from you,

Miles and Anne-Sophie

Aperçu de la recherche

Nous continuons à faire la publicité des publications des étudiants gradués auprès de la communauté entomologique via notre initiative Aperçu de la recherche. Consultez le blogue de la SEC pour les plus récents articles. Si vous voulez que votre plus récent article soit mis en vedette (ou si nous l'avons manqué le mois dernier!), envoyez-nous un courriel à entsoccan.students@ gmail.com. Pour des mises à jour régulières sur la recherche entomologique canadienne, adhérez à la page Facebook des étudiants de la SEC ou suivez-nous sur Twitter à @esc_students.

Au plaisir de vous parler!

Miles et Anne-Sophie

Thesis Roundup / Foisonnement de thèses

If you or a student you know has recently defended an entomology-related thesis at a Canadian University, and would like notice of this accomplishment published here and on the ESC website, please email students@esc-sec.ca with the relevant information (name, date, degree, thesis title, supervisor[s], and university).

Si vous, ou un étudiant que vous connaissez, avez récemment soutenu votre thèse dans un domaine lié à l'entomologie dans une université canadienne, et que vous voulez publier l'avis de cette réalisation ici et sur le site web de la SEC, merci d'envoyer les informations pertinentes (nom, date, diplôme, titre de la thèse, directeur[s] et université) à students@esc-sec.ca.

Fernández, Diana C. MSc, 2016. Ecological interactions between *Lygus* (Hemiptera: Miridae) and their nymphal parasitoids *Peristenus* (Hymenoptera: Braconidae) in southern Alberta. Supervisors: Robert A. Laird (University of Lethbridge) and Héctor Cárcamo (Agriculture and Agri-Food Canada). University of Lethbridge.

Seehausen, Lukas. PhD, 2016. Life-history traits and temperature-dependent performance of *Tranosema rostrale* (Hym.: Ichneumonidae), a parasitoid of low-density spruce budworm (Lep.: Tortricidae) populations. Supervisors: Sandy M. Smith (University of Toronto) and Jacques Régnière (Natural Resources Canada, Canadian Forest Service). University of Toronto.

Taking advantage of the available real-estate: Nest site plasticity in small and large carpenter bees

Jess Vickruck

Introduction

Critical habitat resources can be subdivided into two very broad main categories: food and shelter. For bees, food entails access to suitable floral resources with acceptable amounts of nectar and pollen to feed themselves and provision their offspring. Habitat destruction, habitat fragmentation and the introduction of invasive plant species can decrease available food resources and negatively impact bees (Jha & Kremen 2013). Equally important is the availability of suitable shelter, as represented by nesting resources within flying distance of appropriate flowers (Zurbuchen, Landert, et al. 2010). Bees are central place foragers, meaning that they collect resources and return them to the same focal nest. Not only does a female bee need to locate a suitable nest, but it must also be within flying distance of floral resources. Poor nest choice can lead to complete nest failure, reduced numbers of offspring provisioned, smaller offspring or higher levels of parasitism decreasing overall fitness (Zurbuchen, Cheesman, et al. 2010).

In order to lay eggs, each species of bee has different nesting requirements which vary based on species. Ground nesting species excavate tunnels in bare dirt, while cavity nesting species use pre-existing spaces found in the surrounding environment. Lastly are the carpenter bees, pith nesting species which must excavate their own tunnels in plant material. Carpenter bees use the inner portion of the stem (the pith) to create cell partitions for their developing offspring (Michener 2007). As such, it would serve to reason that habitat destruction could be particularly detrimental to pith nesting bees. If plants containing suitable pith for nesting are removed from the landscape, pith nesting species will no longer be able to nest in the area. In addition, even if an area is restored it may take several years for plants containing suitable nesting substrate to reach sizes large enough to support nesting bees.

Natural history of carpenter bees in Ontario

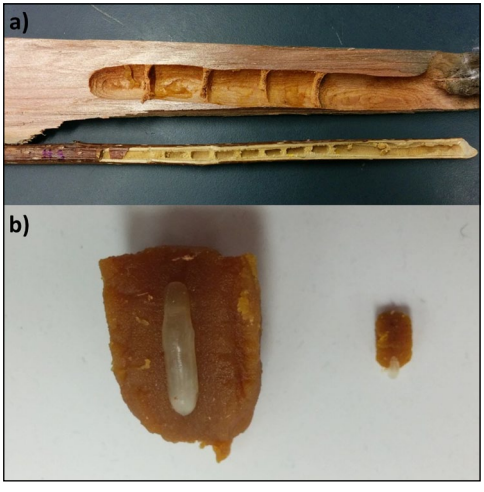
Pith nesting bees in Canada are represented by members of the subfamily Xylocopinae (Hymenoptera: Apidae). This subfamily contains four tribes: the Manuelini, Ceratinini, Xylocopini and Allodapini (Michener 2007). In Ontario where I have spent the vast majority of the time collecting and observing these bees, the genus *Xylocopa* is represented by a single species, *X. virginica.* Large and charismatic, *X. virginica* ranges as far north as Southern Ontario, south to Florida and west to the Prairies (Skandalis et al. 2011; Vickruck and Richards 2017; Fig. 1). Often mistaken for bumble bees, they sound like a small helicopter when they fly past! In the northern portion of

J. deHaan

Figure 1. An eastern carpenter bee female rests outside her nest after being measured and marked.

Jess Vickruck (jess.vickruck1@ucalgary.ca) is a postdoc with Paul Galpern at the University of Calgary. She completed her Masters and PhD degrees with Miriam Richards at Brock University studying behavioural ecology and social evolution in carpenter bees large and small. In 2016 she was one of three Canadian students invited to present her work in the International Graduate Student Showcase at the International Congress of Entomology in Orlando.

their range *X. virginica* females are univoltine, provisioning one brood per year. Gerling and Hermann (1978) suggest that there may be time for a second brood further south. Females and males typically overwinter as newly eclosed adults inside the nests in which they were laid. Initial spring activity is followed by a period of dispersal and nest joining where by most nests are comprised of small social groups of 2-7 females (Richards 2011). *Xylocopa virginica* females are mass provisioners, making several pollen trips to form one large pollen ball on which a large egg is laid (Fig. 2). Females then create a stunning spiral cell partition from the surrounding pith, providing each developing immature with its own room (Fig. 2). Immature bees must complete development and feed prior to overwintering. *Xylocopa virginica* nests are costly to excavate and are reused by subsequent generations for many years.



Andrea Cardama

Figure 2. a) Cross section of *Xylocopa* (top) and *Ceratina* nest (bottom). (The right half of the *Xylocopa* nest is not visible in this picture). b) Pollen ball and egg from *X. virginica* (left) and *C. calcarata* (right).

The genus *Ceratina* is represented by four species in north-eastern north America: *C. calcarata, C. dupla, C. miqmaqi* and the rare *C. strenua. Ceratina calcarata* and *C. miqmaki* are univoltine, while *C. dupla* appears to provision two broods per season (Vickruck et al. 2011). Like their larger cousins, *Ceratina* females excavate tunnels in wood; however, these small carpenter bees prefer the pithy stems of staghorn sumac (*Rhus*), raspberry (*Rubus*) and common teasel (*Dipsacus*). Females provision offspring in a very similar fashion to the large carpenter bees, albeit on a much smaller scale. Eggs laid in the summer eclose in between late July and late August and must feed before overwintering (Rehan and Richards 2010; Lewis & Richards 2017; Fig 3). Unlike those of *Xylocopa, Ceratina* nests are not reused in subsequent years, although they may be occupied by a number of species including other trap nesting bees, earwigs, various beetles and spiders in the years that follow. The natural history of all *Ceratina* species in Ontario indicates they are sub-social, with mothers (or even small daughters) providing food for newly eclosed individuals (Lewis and Richards 2017).

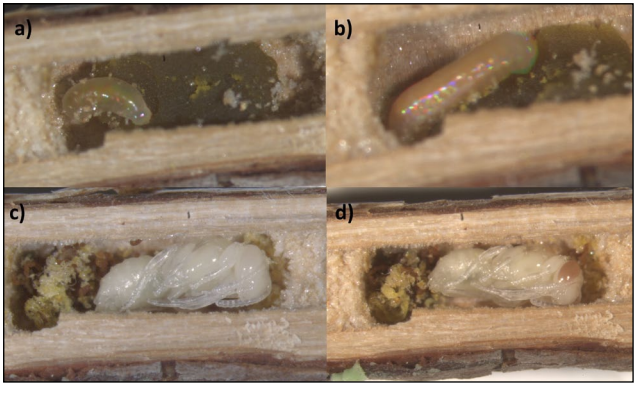


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Figure 3. *Ceratina* development. The egg hatches into a small larva (a-b) and eats the entirety of the pollen ball before pupating. c) White-eyed pupa just after pupation (notice the pile of frass on the far-left hand side. d) Pink-eyed pupa. Eyes darken from pink through brown and then black before the exoskeleton becomes pigmented prior to eclosion.

Nest site selection in carpenter bees

The nest is an important resource, and different substrate types and microclimates can lead to higher levels of parasitism and lower clutch sizes overall (Vickruck & Richards 2012). The removal and fragmentation of nesting habitat may have higher impacts on carpenter bees which have specific nesting requirements, typically in substrates which may take several years to grow. Despite this, or perhaps because of it, both *Ceratina* and *Xylocopa* appear to have the remarkable ability to adapt to newly available nesting substrates. Historically, *X. virginica* nested in windfall and appropriate horizontal tree branches of pine and cedar (Hurd 1961) however it now nests almost exclusively in milled lumber. Remarkably, population genetic analysis reveals that *X. virginica* populations across eastern North America maintain high levels of genetic diversity and generally low levels of inbreeding despite their link with disturbed areas (Vickruck & Richards 2017). In addition, it appears that *X. virginica* is expanding its range northward and potentially westward, indicating that the switch to nesting in milled lumber has not been overly detrimental to the species and may have helped facilitate range expansion where substrates were previously limiting.

In the small carpenter bees, another novel nest substrate story has emerged. Nest collections across the spring and summer revealed that *C. calcarata, C. dupla* and *C. mikmaqi* nest primarily in three different substrates: staghorn sumac (*Rhus typhina*), wild raspberry (*Rubus strigosus*) and common teasel (*Dipsacus fullonum;*Vickruck et al. 2011). Both sumac and raspberry are native to the region, but teasel is an invasive species, and a relatively recent introduction to Eastern North America. Plant species also occur in different microclimates, with sumac and raspberry common at shaded field margins and teasel common in full sun, grassy fields. Choice experiments demonstrate that all species prefer to nest in the sunny sites where teasel is common and that nesting in the shade (where the native nesting substrates were common) leads to higher levels of parasitism, smaller numbers of offspring provisioned and smaller offspring size overall (Vickruck and Richards 2012; Fig. 4).

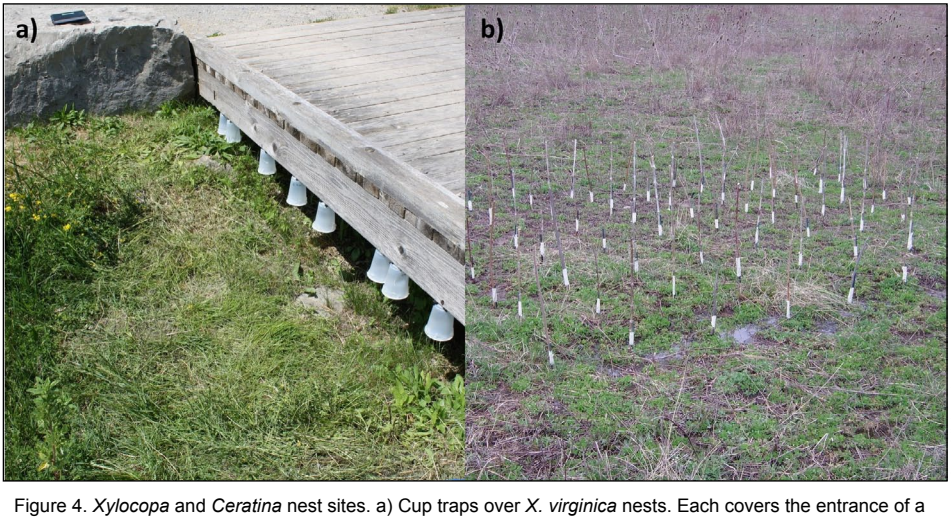

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Figure 4. *Xylocopa* and *Ceratina* nest sites. a) Cup traps over *X. virginica* nests. Each covers the entrance of a single nest and has a small hole cut out to allow the female to exit the nest. She gets trapped in the cup, where she is identified and then released. Cups are removed to allow females returning with pollen to enter the nest. b) *Ceratina* substrate choice experiment. Females could choose between all substrate types. This setup was replicated in different microclimates.

Studies of two different genera of carpenter bee revealed a similar pattern: both *Ceratina* and *Xylocopa* are able to capitalize on newly available nesting substrates in the environment. Not only were they able to adapt to nesting in novel substrates, this nesting substrate switch was advantageous for both groups. By nesting in milled lumber, *X. virginica* opened a new and broad nesting resource. Coupled with warming temperatures at the northern edge of its range, we propose that this nest substrate switch has actually facilitated range expansion in *X. virginica* (Vickruck & Richards 2017). For the small carpenter bees, nesting in an introduced plant species actually increased offspring size, the number of surviving offspring in the nest and reduced levels of parasitism.

Conclusions

In the wake of increased levels of anthropogenic disturbance leading to habitat loss and climate change, much of the focus of pollinator conservation has centered around floral availability and potential phenological mismatches between bees and flowers (Bartomeus et al. 2011). I think the lessons learned from carpenter bees are two-fold. First, nest site availability has great power in shaping bee distributions. Without a nest to rear offspring, it doesn't matter what flowers are there! Indeed, carpenter bee nesting patterns appear to be shaped by nest site availability in the surrounding environment. While nest site availability is inherently harder to quantify and observe than floral availability, it is a critical resource that no doubt influences bee distributions and health across the landscape. Second, is the remarkable adaptive ability of this group of bees. A priori, one may think that invasive plant species or nesting specifically *in* disturbed areas would have a negative impact on fitness overall, yet both the *Ceratina* and *Xylocopa* studied here appear able to adapt to changing nest site availability. My research consistently brings me back to the importance of the nest. Either I am inherently drawn to these questions, or nest site availability may be more important than it is often given credit for. I look forward to delving into these questions in the future.

References

Bartomeus, I., Ascher, J. S., Wagner, D., Danforth, B. N., Colla, S., Kornbluth, S., and Winfree, R. 2011. Climate-associated phenological advances in bee pollinators and bee-pollinated plants. Proceedings of the National Academy of Sciences, **108**: 20645–20649. https://doi.org/10.1073/pnas.1115559108

Gerling, D., and Hermann, H. R. 1978. Biology and mating behavior of *Xylocopa virginica* L. (Hymenoptera, Anthophoridae). Behavioral Ecology and Sociobiology, **3**: 99–111.

Hurd, P. D. 1961. A synopsis of the carpenter bees belonging to the subgenus *Xylocopoides* Michener (Hymenoptera: Apoidea). Transactions of the American Entomological Society, **87**: 247–257.

Jha, S., and Kremen, C. 2013. Urban land use limits regional bumble bee gene flow. Molecular Ecology, **22**: 2483–2495. https://doi.org/10.1111/mec.12275

Lewis, V., and Richards, M. H. 2017. Experimentally induced alloparental care in a solitary carpenter bee. Animal Behaviour, **123:** 229-238.

Michener, C. D. 2007. The Bees of the World (2nd ed.). Baltimore, Maryland: Johns Hopkins University Press.

Rehan, S. M. and Richards, M. H. 2010. Nesting and life cycle of *Ceratina calcarata* in southern Ontario (Hymenoptera: Apidae: Xylocopinae). The Canadian Entomologist, **142:** 65–74.

Richards, M. H. 2011. Colony social organisation and alternative social strategies in the eastern carpenter bee, *Xylocopa virginica*. Journal of Insect Behavior, **24**: 399–411. https://doi.org/10.1007/s10905-011-9265-9

Skandalis, D. A., Richards, M. H., Sformo, T. S., and Tattersall, G. J. 2011. Climate limitations on the distribution and phenology of a large carpenter bee, *Xylocopa virginica* (Hymenoptera: Apidae). Canadian Journal of Zoology, **89**: 785–795. https://doi.org/10.1139/z11-051

Vickruck, J. L., Rehan, S. M., Sheffield, C. S., and Richards, M. H. 2011. Nesting biology and DNA barcode analysis of *Ceratina dupla* and *C. mikmaqi*, and comparisons with *C. calcarata* (Hymenoptera: Apidae:

Xylocopinae). The Canadian Entomologist, **143**, 254–262. https://doi.org/10.4039/n11-006
Vickruck, J. L., and Richards, M. H. 2012. Niche partitioning based on nest site selection in the small carpenter bees *Ceratina mikmaqi* and *C. calcarata*. Animal Behaviour, **83**, 1083–1089.
Vickruck, J. L., and Richards, M. H. 2017. Nesting habits influence population genetic structure of a bee living in anthropogenic disturbance. Molecular Ecology, **26**, 2674–2686. https://doi.org/10.1111/mec.14064
Zurbuchen, A., Cheesman, S., Klaiber, J., Müller, A., Hein, S., and Dorn, S. 2010. Long foraging distances impose high costs on offspring production in solitary bees. Journal of Animal Ecology, **79**: 674–681. https://doi.org/10.1111/j.1365-2656.2010.01675.x
Zurbuchen, A., Landert, L., Klaiber, J., Müller, A., Hein, S., and Dorn, S. 2010. Maximum foraging ranges in solitary bees: only few individuals have the capability to cover long foraging distances. Biological Conservation, **143**, 669–676. https://doi.org/10.1016/j.biocon.2009.12.003

When things get hot: influence of temperature on a parasitoid-host relationship

M. Lukas Seehausen

The study system

The eastern spruce budworm, *Choristoneura fumiferana* (Clemens) (Lepidoptera: Tortricidae) (Fig. 1), is native to North America and is by far the most important defoliator of conifers in the northeastern region. Larvae feed on balsam fir *Abies balsamea* (L.) Miller (Pinaceae) and several species of spruce (Greenbank 1963). Archival data show that between 1968 and 1987 more than 50 million hectares of forests in Canada were severely defoliated (NFD 2017). Historical evidence suggests that outbreaks occur in a more or less periodic fashion, peaking every 30–40 years in the east (e.g., Royama 1984), and at shorter intervals in the west (Shore & Alfaro 1986; Burleigh et al. 2002). Currently, there is an outbreak developing in Québec, with more than 7 million hectares of forests defoliated in 2016 (MFFPQ 2016).

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Figure 1. Sixth-instar spruce budworm larva feeding on balsam fir foliage.

Many theories have been postulated to explain the drivers of spruce budworm population dynamics and they have enjoyed various degrees of acceptance and rejection (reviewed by Pureswaran et al. 2016). Certainly, natural enemies such as parasitoids play a critical role, especially during the collapse of outbreaks (Régnière & Nealis 2007) and at low population densities (Blais 1965; Miller & Renault 1976; Seehausen et al. 2014; J. Régnière, unpublished data). So far, 122 species of spruce budworm parasitoids have been identified (Fernández-Triana & Huber 2010) and, interestingly, the community composition of these parasitoids changes drastically with changes in spruce budworm population density (Eveleigh et al. 2007). At low population densities, parasitism rates by *Tranosema rostrale* (Brischke) (Hymenoptera: Ichneumonidae) (Fig. 2) exceed 90% in some sites in Québec (Cusson et al. 1998; Seehausen et al. 2013, 2014), and this is one of the factors that keeps spruce budworm populations low over long periods of time (J. Régnière, unpublished data).

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Figure 2. Adult *Tranosema rostrale* female grooming on balsam fir foliage

M. Lukas Seehausen (ml.seehausen@mail.utoronto.ca) is currently a postdoctoral fellow with Agriculture and Agri-Food Canada and the University of Toronto. He is interested in pest insects, natural enemies, biological control, and especially in parasitoids. This article is adapted from the presentation he made in the IGSS at ICE 2016 and provides an overview of his PhD thesis that he successfully defended at the University of Toronto in October 2016.

Tranosema rostrale is a larval koinobiont endoparasitoid with a Holarctic distribution and has been reared from 19 different lepidopteran host species, most of which belong to the family Tortricidae, originating from North America, Europe, and Asia (reviewed by Seehausen 2017). Some aspects of the parasitoid's life history in Canada have been described earlier by Cusson et al. (1998). This species has also been used as a model system to study gene expression (Béliveau et al. 2000, 2003; Rasoolizadeh et al. 2009a,b; Djoumad et al. 2013) as well as gene function (Cusson et al. 2000; Doucet et al. 2008; Djoumad et al. 2013) of its polydnavirus, an obligate symbiotic virus of the wasp, that helps to depress its host's immune reaction to parasitization.

Despite its importance as a natural enemy in low density spruce budworm populations, relatively little is known about the factors influencing the efficacy of *T. rostrale* in attacking and developing in this host. During my tenure as an MSc student at Laval University in Québec City, I found that partial cutting treatments can significantly reduce spruce budworm parasitism by *T. rostrale* (Seehausen et al. 2014). This sparked my interest in this species and I decided to further investigate the life history of this parasitoid as a PhD student at the University of Toronto. As my project took shape, I found that among other things temperature influenced the performance of *T. rostrale* and in this report, I would like to provide a general overview of my major findings.

First things first: filling knowledge gaps in *T. rostrale*'s life history

In order to understand the influence of temperature on the biology of a parasitoid, it is important to know details of its life history. Therefore, I started with filling knowledge gaps in the reproductive biology and behaviour of *T. rostrale* (Seehausen et al. 2016a). In a series of laboratory experiments, I identified life history traits related to the parasitoid's reproduction that contributed to its success when attacking low-density spruce budworm populations. These traits are: (1) its lack of a pre-mating or preoviposition period; (2) the relatively rapid maturity of its eggs soon after emergence, despite being synovigenic (matures eggs during its adult life); and (3) its efficacy in host searching and oviposition that appear to successfully circumvent basic behavioural defenses by spruce budworm larvae. Additionally, the study provided valuable information for rearing *T. rostrale* in the laboratory such as: (1) mating success increases with the number of males present in a cage, (2) adult parasitoids live longer when sucrose solution is provided, and (3) no pre-mating or preoviposition period is necessary, as mating and oviposition can take place immediately after emergence.

Next, I investigated factors that may drive *T. rostrale*'s seasonal pattern of spruce budworm parasitism in the field (Seehausen et al. 2016b). Results from sentinel larvae implantations in two sites in Québec over 5 years showed that parasitism of spruce budworm larvae by *T. rostrale* increased during third and fourth instars and then decreased during fifth to sixth instars. In a manipulative field choice experiment, it was determined that this pattern is not caused by a host instar preference, because *T. rostrale* readily attacks and successfully develops in all third to sixth larval instars without any significant impact on the parasitoid's overall performance. Additionally, the study showed that multiparasitism by *T. rostrale* and the ectoparasitoid *Elachertus cacoeciae* (Howard) (Hymenoptera: Eulophidae) occurred in spruce budworm larvae, and that their pattern of seasonal parasitism was negatively correlated. However, multiparasitism was rare, and thus unlikely to drive much of spruce budworm parasitism by *T. rostrale* during the season, which leads to the plausible hypothesis that seasonal changes in temperature might be responsible for the observed pattern.

Influence of temperature on development and reproduction of *T. rostrale*

Based on the findings from the two earlier studies on *T. rostrale*'s life history, the parasitoid was reared in climate chambers at 11 different constant temperatures ranging from 5-30°C to measure development time and survival of immature stages (eggs, larvae, and pupae), as well as longevity and fecundity of adult wasps (Seehausen et al. 2017a). Spruce budworm larvae were reared to the fifth instar, parasitized under controlled conditions, and then transferred to transparent plastic containers with screened windows for ventilation and a twig of balsam fir foliage inserted into a glass vial with water (Fig. 3). To rear adult parasitoids, the system was slightly altered by exchanging the glass vial at the bottom holding the balsam fir foliage with vials containing a sucrose solution. Maximum likelihood modeling approaches were used to estimate the thermal effects on development, survival, and longevity (Régnière et al. 2012). To determine the effect of temperature on fecundity of the parasitoid, a model was developed taking egg development and egg resorption into account.

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Figure 3. Transparent plastic containers with screened windows for ventilation and a twig of balsam fir foliage inserted into a glass vial with water to rear parasitized spruce budworm larvae at different temperatures.

Development rate of *T. rostrale* was fastest at 25°C, above which it rapidly decreased again, dropping to near-zero at about 35°C. Immature survival was highest at lower temperatures, sharply dropping with temperatures higher than 20°C and reaching zero probability of survival at temperatures between 31 and 34°C. Adult longevity decreased exponentially for males and females, with the maximum recorded longevity of almost 200 days for a female held at 5°C, and the shortest of about eight days average for males at 30°C. *Tranosema rostrale*'s potential fecundity (number of eggs in oviducts) increased linearly with female age at the lower temperatures and became more and more non-linear with increasing temperatures because egg-load decreased after an initial maximum. Highest potential and simulated realised fecundity (simulated number of eggs laid over a female's lifetime) were highest at 10°C with an average of 95 and 130 eggs, respectively. The results show that the overall fitness of *T. rostrale* is maximized at cooler temperatures but the rapid decrease in survival at temperatures above 20°C was a surprise and warrant further investigation. To explain these results, I proposed two hypotheses which I could test during my last year as a PhD student: (1) high temperature has a positive impact on spruce budworm's immune response to the intruding parasitoid, and (2) high temperature has a negative impact on *T. rostrale*'s polydnavirus, therefore interfering with the parasitoid's capacity to depress spruce budworm's immune reaction.

Using molecular techniques to understand the physiological effects

In order to test the two hypotheses, parasitized spruce budworm larvae were reared for 5 days at 30°C and dissected to examine the status of the parasitoid inside the host. The result was stunning: in most cases, parasitoid eggs or larvae were encapsulated and melanised (Fig. 4). Encapsulation (encasement by blood cells) and melanisation (sealing by melanin) are immune responses of insects to invasion of foreign bodies, such as parasitoid eggs (Lavine & Strand 2002). While these are also normal immunoreactions in spruce budworm larvae, melanisation has been found to be abrogated by *T. rostrale*'s polydnavirus (Doucet & Cusson 1996) and should therefore not occur in parasitized larvae. To find out what happened, I extracted RNA from parasitized larvae that were reared at different temperatures and quantified the RNA transcripts of several genes from both, the spruce budworm and the polydnavirus. The results showed that transcription of spruce budworm genes related to its melanisation reaction (PPO1 and PPO2) increased rapidly at the highest temperature (30°C). However, the transcription of several polydnavirus genes was lower at 30°C, when compared to 20°C. Thus, the results support both hypotheses we set out to test and the increase of encapsulation response at high temperature appears to be due to the combined effects of reduced expression of polydnavirus genes and enhanced expression of spruce budworm immune genes (Seehausen et al. 2017b).

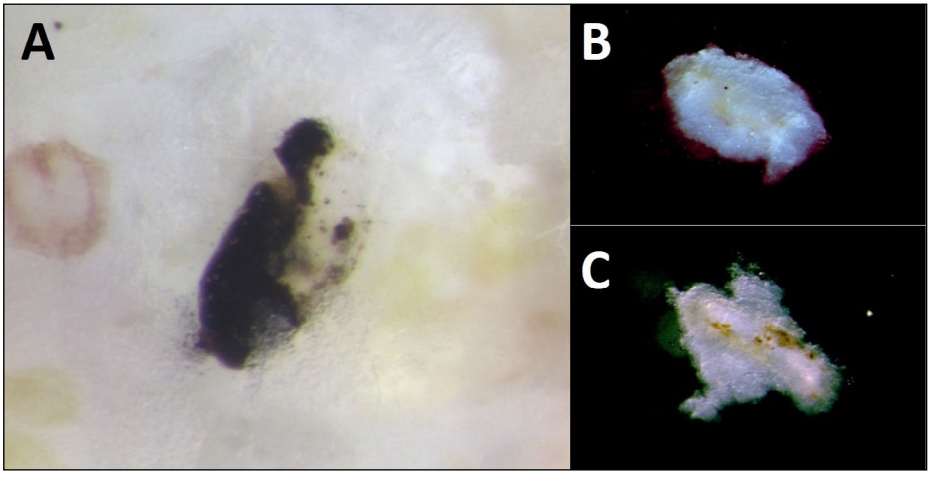


Figure 4. *Tranosema rostrale* eggs in dissected spruce budworm larvae that were reared for 5 days at 30°C; (A) the egg is partially encapsulated by hemocytes and melanised (dark-brown coloration); (B) the egg is encapsulated by a thick layer of hemocytes and (C) melanisation becomes apparent (brown patches) when part of the encapsulation is removed.

Using modeling approaches to understand the spatiotemporal biology

Despite filling certain knowledge gaps about the parasitoid's biology, questions regarding the seasonal and spatial pattern of spruce budworm parasitism by *T. rostrale* remain unanswered. Also, the parasitoid's voltinism (number of generations per year) and overwintering strategy remain a mystery. Ecological modeling approaches can help to solve these mysteries, especially if there is one factor dominating an organism's life history, such as temperature. Therefore, an individual-based model was developed that takes *T. rostrale*'s developmental, survival, and reproductive responses to temperature into account to gain insight into its spatiotemporal biology across northern North America (Seehausen et al., in preparation). Simulations of the model showed that indeed, the parasitoid's observed phenology and seasonal pattern of spruce budworm

parasitism by the first generation can be accurately explained by temperature. Furthermore, the model predicts one to four generations of the parasitoid across northern North America and accurately predicts an observed pattern of parasitism of the second generation, that has been measured through a manipulative experiment using implantations of spruce budworm larvae. The model also offers two hypotheses about *T. rostrale*'s overwintering strategy. Simulations of temperature-based development suggest that the parasitoid either overwinters as a pupa under the snow, or as a first-instar larva in a host that is exposed to air temperature.

Conclusions and implications of the results

The results of my dissertation show that *T. rostrale*'s key life history traits are highly dependent on ambient temperature. The parasitoid seems to be well adapted to cooler environments, and temperatures above 20°C drastically reduce its overall performance and ability to successfully develop in spruce budworm larvae. Spruce budworm, on the other hand, has been shown to be more tolerant to high temperatures, with optimum temperature for development around 30°C (Régnière 1987) and survival as high as 95% between 15 and 32°C (Weber et al. 1999; Régnière et al. 2012). Thus, high temperatures in exceptionally hot years or under conditions of changing climate can be expected to have a negative influence on the parasitoid's efficacy as a mortality factor in spruce budworm populations. Because *T. rostrale* is one of the factors keeping spruce budworm populations low over long periods of time, this may play an important role for the transition from low spruce budworm populations to outbreak levels. To gain more insights into the implication of the findings, the *T. rostrale* model may be combined with the existing Spruce Budworm Seasonality Model (Régnière et al. 2012) to identify where and when low-density spruce budworm populations are likely to escape from high natural mortality through parasitism due to changes in temperature. In the years to come, the *T. rostrale* model may become a part of a management tool to identify situations where human intervention will be necessary to prevent forest stand damage by the spruce budworm. It may even help to coordinate early interventions aimed at keeping spruce budworm population levels low enough to permit natural control by enemies such as *T. rostrale*.

In general, organisms of higher trophic levels, such as parasitoids, are more sensitive to changes in the environment than those at lower trophic levels, because they depend on the adaptation of the lower trophic levels to the change (e.g., Harvey et al. 2015). Especially in the context of climate change, it is therefore important to study the response of pest insects and their natural enemies to be able to predict changes in population dynamics and resulting implications for natural resources, such as forests (Logan et al. 2003). However, besides studying the influence of temperature on development, mortality, and reproduction, it is imperative to understand the mechanisms behind the responses to temperature in order to draw more general conclusions. For example, there are many other parasitoids that are associated with polydnaviruses and temperature may have a similar effect on them. Thus, findings on the negative impact of high temperature on *T. rostrale*'s polydnavirus add to the understanding about mechanisms that reduce parasitoid performance under increasing temperature, and this will help predict the impact of climate change on natural enemies in other pest insect systems.

My dissertation constitutes a comprehensive study of the spruce budworm parasitoid *T. rostrale*, including aspects of its basic behaviour, ecology, physiology, and molecular biology. Such a comprehensive study is necessary to be able to (a) develop an efficient laboratory rearing protocol, (b) use this information to study the parasitoid's response to temperature, (c) understand this response, and (d) develop tools that provide information for spruce budworm management.

Acknowledgements

I am grateful to my supervisors S.M. Smith (University of Toronto), J. Régnière, and V. Martel (Natural Resources Canada, Canadian Forest Service) for their support during my PhD studies. Many thanks also to my co-authors of the papers published out of my thesis, as well as to my committee members, lab mates, and all the summer students that helped me with my research. Thank you A. Retnakaran for reviewing an earlier version of this paper. I thank the Laurentian Forestry Centre in Québec City for providing me with the facilities for conducting my research and all the help provided by the researchers. I am grateful for the financial support granted through SERG International funding partners (Ontario, Quebec., Newfoundland, Nova Scotia, Saskatchewan, and Société de protection des forêts contre les insectes et maladies [SOPFIM]), the Atlantic Canada Opportunities Agency, and Natural Resources Canada (Canadian Forest Service), as well as through an NSERC Discovery Grant to S.M. Smith, and an Ontario Trillium Scholarship to me.

Literature cited

Béliveau, C., Laforge, M., Cusson, M., and Bellemare, G. 2000. Expression of a *Tranosema rostrale* polydnavirus gene in the spruce budworm, *Choristoneura fumiferana*. Journal of General Virology, **81**: 1871–1880.

Béliveau, C., Levasseur, A., Stoltz, D., and Cusson, M. 2003. Three related *TrIV* genes: Comparative sequence analysis and expression in host larvae and Cf-124T cells. Journal of Insect Physiology, **49**: 501–511.

Blais, J.R. 1965. Parasite studies in two residual spruce budworm (*Choristoneura fumiferana* (Clem.)) outbreaks in Quebec. The Canadian Entomologist, **97**: 129–135.

Burleigh, J.S., Alfaro, R.I., Borden, J.H., and Taylor, S. 2002. Historical and spatial characteristics of spruce budworm *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae) outbreaks in northeastern British Columbia. Forest Ecology and Management, **168**: 301–309.

Cusson, M., Barron, J.R., Goulet, H., Régnière, J., and Doucet, D. 1998. Biology and status of *Tranosema rostrale rostrale* (Hymenoptera: Ichneumonidae), a parasitoid of the eastern spruce budworm (Lepidoptera: Tortricidae). Annals of the Entomological Society of America, **91**: 87–93.

Cusson, M., Laforge, M., Miller, D., Cloutier, C., and Stoltz, D. 2000. Functional significance of parasitism-induced suppression of juvenile hormone esterase activity in developmentally delayed *Choristoneura fumiferana* larvae. General and Comparative Endocrinology, **117**: 343–54.

Djoumad, A., Dallaire, F., Lucarotti, C.J., and Cusson, M. 2013. Characterization of the polydnaviral "*T. rostrale* virus" (TrV) gene family: *TrV1* expression inhibits in vitro cell proliferation. Journal of General Virology, **94**: 1134–1144.

Doucet, D., Béliveau, C., Dowling, A., Simard, J., Feng, Q., Krell, P.J., and Cusson, M. 2008. Prophenoloxidases 1 and 2 from the spruce budworm, *Choristoneura fumiferana*: Molecular cloning and assessment of transcriptional regulation by a polydnavirus. Archives of Insect Biochemistry and Physiology, **67**: 188–201.

Eveleigh, E. S., McCann, K. S., McCarthy, P. C., Pollock, S. J., Lucarotti, C. J., Morin, B., McDougall, G.A., Strongman, D.B., Huber, J.T., Umbanhowar, J., and Faria, L.D.B. 2007. Fluctuations in density of an outbreak species drive diversity cascades in food webs. Proceedings of the National Academy of Sciences USA, **104**: 16976–81.

Fernández-Triana, J.L., and Huber, J.T. 2010. Braconid parasitoids (Hymenoptera: Braconidae) of Nearctic *Choristoneura* species (Lepidoptera: Tortricidae), with a summary of other parasitoid families attacking *Choristoneura*. The Canadian Entomologist, **142**: 295–343.

Greenbank, D.O. 1963. Host species and the spruce budworm. Memoirs of the Entomological Society of Canada, **95**: 219-223.

Harvey, J.A. 2015. Conserving host–parasitoid interactions in a warming world. Current Opinion in Insect Science, **12**: 79-85.

Lavine, M.D., and Strand, M.R. 2002. Insect hemocytes and their role in immunity. Insect Biochemistry and Molecular Biology, **32**: 1295-1309.

Logan, J.A., Regniere, J., and Powell, J.A. 2003. Assessing the impacts of global warming on forest pest dynamics. Frontiers in Ecology and the Environment, **1**: 130-137.

Miller, C.A., and Renault, T.R. 1976. Incidence of parasitoids attacking endemic spruce budworm (Lepidoptera: Tortricidae) populations in New Brunswick. The Canadian Entomologist, **108**: 1045–1052.

Ministère des Forêts, de la Faune et des Parcs (MFFPQ) 2016. Aires infestées par la tordeuse des bourgeons de l'épinette au Québec en 2016 − Version 1.0, Québec, gouvernement du Québec, Direction de la protection des forêts, 16 p.

National Forestry Database (NFD) 2017. Area within which moderate to severe defoliation occurs including area of beetle-killed trees by insects and province/territory, 1975-2016 [online]. Available from http://nfdp.ccfm.org/data/compendium/html/comp_41e.html#bookMark_Aa [accessed 24 April 2017].

Pureswaran, D.S., Johns, R., Heard, S.B., and Quiring, D. 2016. Paradigms in eastern spruce budworm (Lepidoptera: Tortricidae) population ecology: A century of debate. Environmental Entomology, **45**: 1333-1342.

Rasoolizadeh, A., Dallaire, F., Stewart, D., Beliveau, C., Lapointe, R., and Cusson, M. 2009a. Global transcriptional profile of *Tranosema rostrale* ichnovirus genes in infected lepidopteran hosts and wasp ovaries. Virologica Sinica, **24**: 478–492.

Rasoolizadeh, A., Béliveau, C., Stewart, D., Cloutier, C., and Cusson, M. 2009b. *Tranosema rostrale* ichnovirus repeat element genes display distinct transcriptional patterns in caterpillar and wasp hosts. Journal of General Virology, **90**: 1505–1514.

Régnière, J. 1987. Temperature-dependent development of eggs and larvae of *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae) and simulation of its seasonal history. The Canadian Entomologist, **119**: 717-728.

Régnière, J., and Nealis, V.G. 2007. Ecological mechanisms of population change during outbreaks of the spruce budworm. Ecological Entomology, **32**: 461–477.

Régnière, J., Powell, J., Bentz, B., and Nealis, V.G. 2012a. Effects of temperature on development, survival and reproduction of insects: Experimental design, data analysis and modeling. Journal of Insect Physiology, **58**: 634–647.

Régnière, J., St-Amant, R., and Duval, P. 2012b. Predicting insect distributions under climate change from physiological responses: Spruce budworm as an example. Biological Invasions, **14**: 1571–1586.

Royama, T. 1984. Population dynamics of the spruce budworm *Choristoneura fumiferana*. Ecological Monographs, **54**: 429–462.

Seehausen, M.L. 2017. Life-history traits and temperature-dependent performance of *Tranosema rostrale* (Hym.: Ichneumonidae), a parasitoid of low-density spruce budworm (Lep.: Tortricidae) populations. PhD thesis. University of Toronto, Toronto, Ontario, Canada.

Seehausen, M.L., Régnière, J., and Bauce, É. 2013. Does spruce budworm (Lepidoptera: Tortricidae) rearing diet influence larval parasitism? The Canadian Entomologist, **145**: 539–542.

Seehausen, M.L., Bauce, É., Régnière, J., and Berthiaume, R. 2014. Influence of partial cutting on parasitism of endemic spruce budworm (Lepidoptera: Tortricidae) populations. Environmental Entomology, **43**: 626–631.

Seehausen, M.L., Labrecque, M., Martel, V., Régnière, J., Mansour, A., and Smith, S.M. 2016. Reproductive biology and behavior of *Tranosema rostrale* (Hymenoptera: Ichneumonidae), a parasitoid of low-density spruce budworm (Lepidoptera: Tortricidae) populations. Journal of Insect Behavior, **29**: 500-514.

Seehausen, M.L., Régnière, J., Martel, V., and Smith, S.M. 2016. Seasonal parasitism and host instar preference by the spruce budworm (Lepidoptera: Tortricidae) larval parasitoid *Tranosema rostrale* (Hymenoptera: Ichneumonidae). Environmental Entomology, **45**: 1123-1130.

Seehausen, M.L., Régnière, J., Martel, V., and Smith, S.M. 2017. Developmental and reproductive responses of the spruce budworm (Lepidoptera: Tortricidae) parasitoid *Tranosema rostrale* (Hymenoptera: Ichneumonidae) to temperature. Journal of Insect Physiology, **98**: 38-46.

Seehausen, M.L., Cusson, M., Régnière, J., Bory, M., Stewart, D., Djoumad, A., S.M. Smith, and Martel, V. 2017. High temperature induces downregulation of polydnavirus gene transcription in lepidopteran host and enhances accumulation of host immunity gene transcripts. Journal of Insect Physiology, **98**: 126-133.

Shore, T.L., and Alfaro, R.I. 1986. The spruce budworm, *Choristoneura fumiferana* (Lepidoptera: Tortricidae), in British Columbia. Journal of the Entomological Society of British Columbia, **83**: 31–38.

Weber, J.D., Volney, W.J.A., and Spence, J.R. 1999. Intrinsic development rate of spruce budworm (Lepidoptera: Tortricidae) across a gradient of latitude. Environmental Entomology, **28**: 224-232.

James Stewart Kelleher
6 November 1924
– 24 November 2016

The entomological community lost one of its long-time members on 24 November 2016, with the death of Jim S. Kelleher at the age of 91. Jim was born in Saskatchewan and grew up in Brandon, Manitoba. He served in the Royal Canadian Navy during World War II aboard HMCS Kirkland Lake and, upon his return to Canada, completed a BSc in Biology at Brandon University, later obtaining an MSc (University of Iowa) and PhD (University of Minnesota). With increasing staff in the Canada Department of Agriculture after the war, Jim was hired as a research scientist at the Brandon Lab in 1946. There he worked with Ralph Bird on sweet clover weevil and he began his own research into the biological control of Colorado potato beetle and *Hylemya* (now *Delia*) *planipalpis*, the latter a member of a complex of crucifer root maggots. His experience in Brandon led to his transfer to the Institute for Biological Control in Belleville, Ontario, in 1959, where he was appointed as the Importation Officer, responsible for obtaining, providing and processing the biological control material required by the Canada Departments of Agriculture and Forestry. He was in charge of the National Quarantine Facility at Belleville until 1972 when the Institute closed and continued in this capacity at the Central Experimental Farm in Ottawa until his retirement.

Jim was friendly, out-going and always helpful. TDG first met him in the summer of 1970 when, as an aspiring young entomologist, he walked into the Belleville Lab and approached the receptionist to announce he was a student at the University of Guelph and interested in talking to an entomologist. The receptionist was taken aback, but she disappeared, soon to return with Jim. He greeted his guest with a big smile, a handshake, and most important, as a colleague, even though the latter had completed only 1 year of an undergraduate degree. He took Terry on a tour of the lab, and introduced him to several entomologists who would later end up in Winnipeg, just down the street from where he eventually worked at the University of Manitoba. Had the Director been in his office that day, Jim would surely have introduced Terry to him, too. After the tour, he took him to coffee with Conrad Loan, where they talked about entomology in general, and especially about careers in entomology. That meeting had a tremendous impact on Terry at the time, and is always remembered for the encouragement he received from Jim.

When the Belleville Institute closed in 1972, Jim moved to Ottawa where he continued his work on regulation and importation of natural enemies for biological control of insects. During his time in Ottawa, Jim maintained his contact with Manitoba, where he returned often to visit family and to act in a professional capacity. He was part of the working group that obtained the initial funding for the pilot study for the Canada Biting Fly Centre in Winnipeg, and then served as a member of and secretary for the National Advisory Committee for the Centre – for 10 years. In his role as secretary of the Expert Committee on Insect Pests of Animals, Jim met another young entomologist, PGM, the newly hired black fly entomologist in Saskatoon. Jim's calm and welcoming personality influenced, among other things, the former's understanding on how to filter relevant information from sometimes lengthy meetings. As serendipity happens, PGM moved to Ottawa and incorporated the work on regulation and importation of natural enemies, which continues today, as part of a new biological control research program. Each time we encountered one another Jim would ask how the biological control program was doing.

Jim retired on 12 October 1990, after 43 years of service. He and his second wife, Murielle, lived in Dorval for a time. Later, Jim enjoyed wintering on the shores of Lago de Chapala, Mexico's largest freshwater lake where he ran into his old grad school mate and BRI Ottawa co-worker Larry L'Arrivée and wife Cathy of Lethbridge, Alberta. For several years, Jim spent time teaching English to mixed classes of young and old alike.

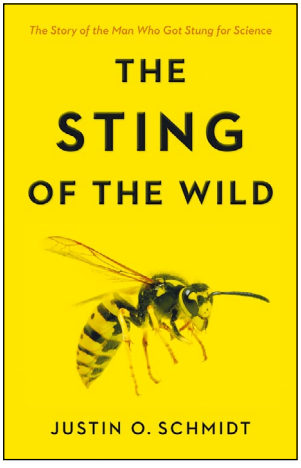
Jim returned to Manitoba, with one more job to do in the province. While in Brandon, Ralph Bird had given Jim a desk made by the pioneer entomologist, Norman Criddle, a desk Norman had used at the Entomology Lab in Aweme. Jim transported this desk with him to Belleville, then to Ottawa, but in 1998, decided it needed a new home. He dismantled it and drove it to Manitoba to be placed in a museum there, but the current whereabouts of the desk are unknown.

For the last 5 years of his life, Jim enjoyed the activities, facilities and kind staff at the Perley Rideau Veterans' Health Care Facility in Ottawa. In his last year, a returning Afghan Veteran donated a collection of spiders and insects mounted in acrylic to the facility, and it was kept by the nurses in Jim's ward and presented to him periodically for comment. Even with failing eyesight and diminishing cognitive skills, he would take about 10 seconds to size up "the bug board". Invariably, he would take a deep breath, sigh, and patiently, calmly begin his lecture with "to begin with, they are not all bugs".

Jim was one of the friendliest and most helpful individuals you could ever want to meet, someone genuinely interested in other people, and always willing to lend an encouraging word. He will be sorely missed.

Terry D. Galloway (Winnipeg), Peter G. Mason (Ottawa) and Mary Jane Kelleher (Ottawa) (with help from Peter Belton, Reiny Brust, Mary Galloway, Neil Holliday and Manfred Mackauer)

The Sting of the Wild. Schmidt, J.O. 2016, John Hopkins University Press, Baltimore, U.S.A. 257 pp., 8 colour plates. ISBN 978-1-4214-1928-2, CAN$26.37, hardcover.



My relationship with aculeate Hymenoptera has been that of hapless victim. I have never intentionally molested them, yet *Bombus*, *Eciton*, *Pseudomyrmex*, *Rhytidoponera*, *Ropalidia*, *Vespula*, and others have found cause to sting me. Yes, some of these instances were due to my foolishness or naïveté (one learns not to lean against trees in rainforests after a few such encounters), and some were due to the insects defending their nests or themselves, but others seemed induced sheerly by malice. For me, the results of such interactions are highly variable, from short-lived terror and flailing about (*Ropalidia* sting to the jugular) to days of swollen limbs and weeping blisters (*Rhytidoponera* sting to the calf). What they all produce is a desire to tell others about the events, and a long-lasting recollection of the finest details. Stings are memorable. In this highly readable book, Justin Schmidt, creator of the renowned Schmidt Pain Index, relates in vivid prose the many experiences – some accidental, others deliberate – he has had with stinging Hymenoptera. He argues that detailed recollection of the pain and fear associated with ant, bee and wasp stings is something that has been naturally selected for on both sides: in mammals as a warning to not do that again, and in stinging insects to maximize respect. Schmidt has broken his book into two thematic arrays of chapters. The first five deal with theory and general biology of the aculeate Hymenoptera, and the last six with particular taxa, roughly but not consistently arranged by how painful their individual stings are. Each of these latter chapters covers life-history, ecology and behaviour of the taxa as well as chemical and pharmacological aspects of their venom. Following the tradition of eating your study organism, Schmidt sometimes also describes how these animals taste (e.g., drones are more palatable than worker honey bees). After the chapters comes a list of 83 species and their associated Pain Index values, which range from 1 to 4 with 4 being most excruciating, plus descriptions of what the stings felt like to Schmidt. Many of these descriptions are amusingly written in the style of the wine snob, for example, for *Polistes canadensis*, “Caustic and burning, with a distinctly bitter aftertaste. Like spilling a beaker of hydrochloric acid on a paper cut.” I was a little disappointed to find that none of the species that have stung me so far rank higher than 2.0! The book also includes references cited (plus suggested readings) for each chapter, an index and a set of eight colour plates illustrating a small subset of the taxa discussed.

Although I usually find the story-telling approach taken by some science writers to be condescendingly folksy, Schmidt’s story-rich prose is both entertaining and packed with information of interest to hard-core arthropodologists. I seldom went for more than a couple of pages without reading a natural history detail I hadn’t known before. Learning about Schmidt’s academic (chemistry and entomology) and personal background augmented rather than distracted from the scientific content, and made his fascination with personally experiencing stinging insects seem almost logical (if not a tempting alternative career). The writing is tight and has an excellent balance of accessible prose and scientific detail. It reminds me of one of the equally readable books that opened my eyes to the wonders of terrestrial arthropods, *Life on A Little Known Planet* (1968) by H.E. Evans. My quibbles with *The Sting of the Wild* are minor: some stories and analogies are repeated between and within chapters, the index was rather haphazard (you can find one but not all mentions of a topic by using it), and more photographs illustrating the full range of

taxa would have been nice. There is no concluding chapter with a prospectus for future research but rather the book ends abruptly with the honey bee chapter. In addition, some of Schmidt's evolutionary hypotheses would have benefited from stronger literature support; however, minimizing citations may have been the decision of the editor rather than of the author.

The potential audience for this fascinating and sometimes terrifying book is enormous. Who doesn't have an opinion about ants, wasps or bees? Even if you don't like them, you will have a better understanding of their biology and how their venoms act after reading it. I strongly recommend it to lay people and scientists alike.

Heather Proctor
Department of Biological Sciences
University of Alberta

Books available for review / Livres disponibles pour critique

The ESC frequently receives unsolicited books for review. A list of these books is available online (http://www.esc-sec.ca/bulletinbooks.php) and is updated as new books are received.

If you wish to review one of these books, please send an email to the Chair of the Publications Committee (Maya Evenden, mevenden@ualberta.ca).

You should briefly indicate your qualifications to review the topic of the book, and be able to complete your review within 8 weeks.

Preference will be given to ESC members.

Guidelines

Book reviews should be approximately 800-1200 words in length. They should clearly identify the topic of the book and how well the book meets its stated objective. Weaknesses and strengths of the book should be described.

Formatting of the review should follow that of reviews in recent issues of the Bulletin. A scan of the book cover (jpeg or tiff format, about 500 kb) should be submitted with the review.

La SEC reçoit fréquemment des livres non demandés pour des critiques. Une liste de ces livres est disponible en ligne (http://www.esc-sec.ca/f-bulletinbooks.php) et est mise à jour lorsque de nouveaux livres sont reçus.

Si vous souhaitez critiquer un de ces livres, veuillez envoyer un message au président du comité des publications (Maya Evenden, mevenden@ualberta.ca).

Vous devez brièvement indiquer vos qualifications pour critiquer le sujet du livre, et être en mesure de terminer votre critique en 8 semaines.

La préférence est donnée aux membres de la SEC.

Lignes directrices

Les critiques de livre doivent compter entre 800 et 1200 mots. Elles doivent clairement identifier le sujet du livre et si le livre rencontre bien les objectifs énoncés. Les forces et faiblesses du livre devraient être décrites.

Le format des textes doit suivre celui des critiques des récents numéros du Bulletin. Une version numérisée de la couverture du livre (en format jpeg ou tiff, environ 500 kb) devra être soumise avec la critique.

Books Available for Review

Pryke, L.M. 2016. Scorpion. 221 pgs, colour plates, photos. The University of Chicago Press. ISBN: 9781780235929 [soft cover]

Dodd, A. 2016. Beetle. 192 pgs, colour plates, photos, The University of Chicago Press. ISBN: 9781780234885 [soft cover]

Gandy, M. 2016. Moth. 238 pgs, colour plates, photos. The University of Chicago Press. ISBN: 9781780235851 [soft cover]

Appel, E. & S.N. Gorb. 2015. Comparative Functional Morphology of Vein Joints in Odonata. Zoologica Vol. 159; 104 pages, 53 figures, 1 table; E. Schweizerbart'sche Verlagsbuchhandlung. ISBN-978-3-510-55046-3. [paperback]

Cárcamo, H.A, & D.J. Giberson [Eds.]. 2014. Arthropods of Canadian Grasslands. Vol. 3: Biodiversity and Systematics, Part 1. 413 pp.; photos, maps, checklists. Biological Survey of Canada. ISBN 9780968932162 [soft cover]

Giberson, D.J., & H.A. Cárcamo [Eds.]. 2014. Arthropods of Canadian Grasslands. Vol. 4: Biodiversity and Systematics, Part 2. 479 pp.; photos, maps, checklists. Biological Survey of Canada. ISBN 9780968932179 [soft cover]

D.Giberson

How many entomologists does it take to set up a Malaise Trap to sample beside a northern tundra river? More than one, when there are no trees or bushes to tie it to! (Note the use of canoe paddles as poles, as well as the 'duct' tape to tape paddles together to get some extra height). Horton River, NWT, August 2000.

67th Annual Meeting of Members and Board of Directors Meetings Meeting / 67e assemblée annuelle et réunions du conseil d'administration

The Annual Business Meeting of Members of the Entomological Society of Canada will be held at the Fairmont Winnipeg, 2 Lombard Place, Winnipeg, Manitoba, on Tuesday, 24 October 2017, from 12:00 to 13:30, in the Midway Ballroom. Lunch will be provided.

The Board of Directors Meeting will be held at the same location on Sunday, 22 October 2017, from 08:00 to 12:45, in the Cambridge Room. The incoming Board of Directors will meet on Tuesday, 24 October 2017, from 17:00 to 17:30, in the Cambridge Room.

Matters for consideration at any of the above meetings should be sent to Aynsley Thielman, Secretary of the ESC (see inside back cover for contact details).

L'assemblée annuelle des membres de la société d'entomologie du Canada se tiendra à l'hôtel Fairmont Winnipeg, 2 Lombard Place, Winnipeg, Manitoba, le mardi 24 octobre 2017, de 12h00 à 13h30, dans la salle Midway Ballroom. Le diner sera fourni.

La réunion du conseil d'administration se tiendra au même endroit, le dimanche 22 octobre 2017 de 08h00 à 12h45. Le nouveau conseil d'administration se réunira mardi le 24 octobre 2017, de 17h00 à 17h30, dans la salle Cambridge.

Les sujets à aborder pour n'importe laquelle de ces réunions doivent être envoyés à Aynsley Thielman, secrétaire de la SEC (voir le troisième de couverture pour les coordonnées détaillées).

Entomological Society of Canada Member Plebiscite

Under the Canada Not-for-profit Corporations Act, ESC conducts a member plebiscite to identify those who will be recommended for election as Directors, with the formal election taking place at the Annual Business Meeting. Normally, the two positions to be filled are Societal Director/Second Vice-President, and Director-at-Large. Information on candidates for these two positions is provided below. The plebiscite for Candidates for Director-at-Large is unchanged, but there is a change in the plebiscite for Candidates for Societal Director.

In May 2017, our current Second Vice-President, Fiona Hunter, resigned from her position. Fiona would have become First Vice-President at the Annual Business Meeting in October 2017. Our standing rules indicate that, when the position of First Vice-President becomes vacant, the Second Vice-President fills that vacancy. Thus, the plebiscite for Societal Director will produce a recommendation of a candidate, who, if elected at the Annual Business Meeting, will immediately become First Vice-President, leaving the position of Second Vice-President vacant. Accordingly, the current member plebiscite for Societal Director will be for **Societal Director/ First Vice-President**. The two candidates, Kevin Floate and Sherah VanLaerhoven, whose profiles are published below, have agreed to stand as candidates for the position of Societal Director/First Vice-President, and the Board is grateful for their agreement.

The ESC Nominating Committee is now seeking candidates for a second member plebiscite, for the position of Societal Director/Second Vice-President. This plebiscite is envisaged to be open in August with a deadline in September 2017.

Please vote in the first plebiscite, for Societal Director/First Vice-President and for Director-at-Large. The plebiscite is open now, with voting closing on 15 July 2017. To vote, please go to https://goo.gl/forms/oU0emcU7Z5ph2XSY2.

Plébiscite des membres de la Société d'entomologie du Canada

En vertu de la Loi canadienne sur les organisations à but non lucratif, la SEC conduit un plébiscite pour identifier ceux qui seront recommandés pour l'élection comme directeurs(trices), l'élection formelle prenant place à l'assemblée annuelle des membres. Normalement, les deux postes à combler sont ceux de directeur(trice) sociétal(e)/second(e) vice-président(e) et conseiller(ère). L'information sur les candidats pour ces deux postes est fournie ci-dessous. Le plébiscite pour les candidats pour le poste de conseiller(ère) demeure le même, mais il y a un changement pour le plébiscite pour les candidats pour le poste de directeur(trice) sociétal(e).

En mai 2017, notre seconde vice-présidente actuelle, Fiona Hunter, a démissionné de son poste. Fiona serait devenue première vice-présidente à l'assemblée annuelle des membres en octobre 2017. Nos règles permanentes indiquent que, lorsque le poste de premier(ère) vice-président(e) devient vacant, le (la) second(e) vice-président(e) comble ce poste. Ainsi, le plébiscite pour le poste de directeur(trice) sociétal(e) produira une recommandation pour un(e) candidat(e) qui, si élu(e) à l'assemblée annuelle des membres, deviendra immédiatement premier(ère) vice-président(e), laissant le poste de second(e) vice-président(e) vacant. Le plébiscite actuel pour le poste de directeur(trice) sociétal(e) est donc pour le poste de directeur(trice) sociétal(e) / premier(ère) vice-président(e). Les deux candidats, Kevin Floate et Sherah VanLaerhoven, dont les profils sont publiés ci-dessous, ont accepté de se présenter comme candidats pour le poste de directeur(trice) sociétal(e) / premier(ère) vice-président(e), et le CA leur en est reconnaissant.

Le comité des nominations de la SEC recherche maintenant des candidats pour un second plébiscite pour le poste de directeur(trice) sociétal(e)/second(e) vice-président(e). Ce plébiscite devrait ouvrir en août avec une date limite en septembre 2017.

Merci de voter pour le premier plébiscite, pour les postes de directeur(trice) sociétal(e) / premier(ère) vice-président(e) et conseiller(ère). Le plébiscite est maintenant ouvert, et les votes se termineront le 15 juillet 2017. Pour voter, veuillez visiter le https://goo.gl/forms/oU0emcU7Z5ph2XSY2.

Candidates for Societal Director / First Vice-President
Candidat(e)s pour le poste de
directeur(trice) sociétal(e) / premiere (ère) vice-président(e)

Kevin Floate
(AAFC, Lethbridge)
(left / gauche)

and / et

Sherah VanLaerhoven
(University of Windsor)
(right / droite).

Candidates for Director-at-Large / Candidates pour le poste de conseillère

Deepa Pureswaran
(Laurentian Forest Centre,
CFS, Quebec City)
(left / gauche),

and / et

Chandra Moffatt
(AAFC, Fredericton)
(right / droite).

Treizième concours annuel de photographie

Le treizième concours annuel de photographie visant à sélectionner des images pour les couvertures de *The Canadian Entomologist* et du *Bulletin de la Société d'entomologie du Canada* pour 2018 est en cours. Les images sur la couverture doivent représenter l'étendue entomologique couverte par les publications de la Société. Des photos représentant des insectes ou autres arthropodes forestiers, urbains ou agricoles, des paysages, du travail de terrain ou de laboratoire, des gros plans, ainsi que montrant des activités associées à la physiologie, au comportement, à la taxonomie ou à la lutte intégrée seraient souhaitées. Deux « insectes vedettes » (pour le dos et sous le titre) sont également recherchés. Si elle est sélectionnée, votre photo ornera la couverture des deux publications pour l'année entière. De plus, vos photos gagnantes et une sélection de photos soumises seront montrées sur le site Internet de la SEC.

Règlements du concours :

Les photos d'insectes et autres arthropodes à n'importe quel stade, effectuant n'importe quelle activité et dans n'importe quel habitat sont acceptées. Afin de représenter les sujets de la recherche entomologique, nous encourageons également les photos de parcelles de terrain, expériences de laboratoire, impacts des insectes, activités de recherche, équipement d'échantillonnage, etc. Les photos doivent, cependant, avoir un intérêt entomologique clair.

Les images numériques doivent être soumises sans bordure, en format JPG de haute qualité, avec le plus grand côté (largeur ou hauteur) d'un minimum de 1500 pixels.

Chaque participant peut soumettre jusqu'à cinq photographies. Une légende doit être fournie pour chaque photo soumise : les photos sans légendes ne seront pas acceptées. La légende doit inclure la localisation, l'identification du sujet le plus précisément possible, la description de l'activité si le sujet n'est pas un insecte, et toute information intéressante ou pertinente. Les légendes doivent avoir une longueur maximale de 40 mots.

Les participants doivent être membres en bonne et due forme de la Société d'entomologie du Canada. Les photos doivent avoir été prises par le participant, et le participant doit en posséder les droits d'auteur.

Le participant conserve les droits d'auteur de la photo, mais l'utilisation libre de droits doit être accordée à la SEC afin de l'inclure sur la couverture d'un volume (6 numéros) de *The Canadian Entomologist*, un volume (4 numéros) du *Bulletin*, et sur le site Internet de la SEC.

Le comité d'évaluation sera choisi par le président du comité des publications de la SEC et inclura un membre du comité du contenu du site Internet.

Les gagnants du concours de photographie seront annoncés sur le site Internet de la SEC et pourront être annoncés à la réunion annuelle de la SEC ou dans le *Bulletin*. Il n'y a pas de prix en argent pour les gagnants, mais les photographes seront remerciés dans chaque numéro où les photos seront imprimées.

La date limite de soumission est le **15 août 2017**. Les soumissions doivent être faites en pièces jointes d'un courrier électronique. L'objet du message doit débuter par « Soumission pour le concours de photographie de la SEC ».
Envoyez vos courriels à : photocontest@esc-sec.ca.

Thirteenth Annual Photo Contest

The Thirteenth Annual Photo Contest to select images for the 2018 covers of *The Canadian Entomologist* and the *Bulletin of the Entomological Society of Canada* is underway. The cover images are intended to represent the breadth of entomology covered by the Society's publications. Insects and non-insects in forestry, urban or agriculture; landscapes, field, laboratory or close-ups; or activities associated with physiology, behaviour, taxonomy or IPM are all desirable. A couple of 'Featured Insects' (for the spine and under the title) are also needed. If selected, your photo will grace the cover of both publications for the entire year. In addition, winning photos and a selection of all submitted photos will be shown on the ESC website.

Contest rules:

Photos of insects and other arthropods in all stages, activities, and habitats are accepted. To represent the scope of entomological research, we also encourage photos of field plots, laboratory experiments, insect impacts, research activities, sampling equipment, etc. Photos should, however, have a clear entomological focus.

Digital images must be submitted in unbordered, high-quality JPG format, with the long side (width or height) a minimum of 1500 pixels.

Entrants may submit up to five photographs. A caption must be provided with each photo submitted; photos without captions will not be accepted. Captions should include the locality, subject identification as closely as is known, description of activity if the main subject is other than an insect, and any interesting or relevant information. Captions should be a maximum of 40 words.

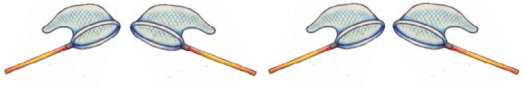
The entrant must be a member in good standing of the Entomological Society of Canada. Photos must be taken by the entrant, and the entrant must own the copyright.

The copyright of the photo remains with the entrant, but royalty-free use must be granted to the ESC for inclusion on the cover of one volume (6 issues) of *The Canadian Entomologist*, one volume (4 issues) of the *Bulletin*, and on the ESC website.

The judging committee will be chosen by the Chair of the Publications Committee of the ESC and will include a member of the Web Content Committee.

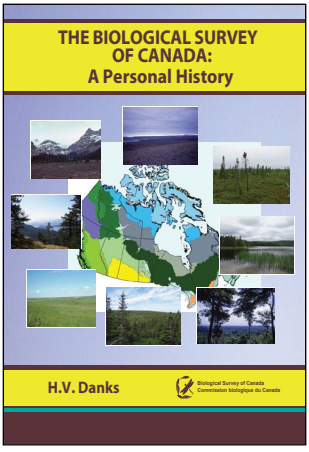
The Photo Contest winners will be announced on the ESC website, and may be announced at the Annual Meeting of the ESC or in the *Bulletin*. There is no cash award for the winners, but photographers will be acknowledged in each issue in which the photos are printed.

Submission deadline is **15 August 2017**. Entries should be submitted as an attachment to an email message; the subject line should start with "ESC Photo Contest Submission".
Send the email message to: photocontest@esc-sec.ca.



New Book: The Biological Survey of Canada: A Personal History, by H.V. Danks

ISBN: 978-0-9689321-9-3 doi:10.3752/9780968932193



In 2017, the Biological Survey of Canada (BSC) celebrates its 40th anniversary. The history of the BSC is a long and proud one. In this book about the history of the BSC, Hugh Danks combines his ability for impeccably correct reporting about Survey activities with a range of anecdotes and the inside story of the Survey's development. His account shows how the BSC came into being, how it operated, and why it was successful. The many products of the Survey are listed for reference in detailed appendices. This readable and organized analysis not only documents the Survey as a significant chapter in the history of entomology in Canada, but also provides wider lessons about the remarkable cooperation of the Canadian scientific community and the value of collaborative efforts.

Hugh Danks was head of the Biological Survey of Canada from its inception in 1977 until he retired in 2007. In that role he helped to coordinate studies of the arthropod fauna of Canada. He also carried out research on the composition of the Canadian fauna, including emphasis on its characteristic northern aspects. He studied the nature of faunas in the arctic and elsewhere, and key ecological themes such as insect adaptations to freezing and other seasonal events. He was an active participant in the Entomological Society of Canada, and a recipient of the Society's Gold Medal for outstanding achievement in entomology.

This book is available for free download from the the Biological Survey of Canada website, at http://biologicalsurvey.ca/public/Bsc/Controller/Page/Danks2016_BSCHistory.pdf

Biological Survey of Canada / Commission biologique du Canada

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Worldwide Dragonfly Association Grants

The Worldwide Dragonfly Association (WDA) announces that applications are now being accepted for Conservation and Research Grants for 2017. The applicant must be a member of the WDA and the value of each grant is usually capped at 1000 Euros. For full details on how to apply for the grant, go to our website (http://worlddragonfly.org/?page_id=15).
For details on how to become a member of the WDA (with an option to subscribe to the International Journal of Odonatology, and special rates for students), please see our website (http://worlddragonfly.org/?page_id=141) or write to us via the WDA Secretary at: wda.secretary@gmail.com. Sponsored memberships are also available.

List of Contents: CPS / Table des matières : SCP

Content of newsletters published by the Canadian Phytopathological Society
Contenu des bulletins publiés par la Société canadienne de phytopathologie

THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

LA SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE

CPS.SCP News
Vol 61 (1)March 2017
http://phytopath.ca/wp-content/uploads/2017/04/CPS-SCP-News-61-1-March-2017.pdf

Table of Contents:

List of Contents: CWSS / Table des matières : SCM

Content of newsletters published by the Canadian Weed Science Society
Contenu des bulletins publiés par la Société canadienne de malherbologie

Canadian Weed Science Society
Société canadienne de malherbologie

Contents of the Summer 2016 Newsletter / Contenu du bulletin du été 2016

This issue may be viewed online at / Ce numéro peut être visionné en ligne sur : http://weedscience.ca/wp-content/uploads/2016/09/CWSS-SCM-Newsletter-summer-2016.pdf

Canadian Weed Science Society
Société canadienne de malherbologie

CWSS-SCM Newsletter Spring 2017 / Contenu du bulletin du printemps 2017

This issue may be viewed online at / Ce numéro peut être visionné en ligne sur : http://weedscience.ca/wp-content/uploads/2017/03/CWSS-SCM-Newsletter-Spring-2017.pdf

Meeting announcements / Réunions futures

The International Congress of Odonatology (ICO 2017): *Dragonfly vision and flight*
Cambridge, United Kingdom, 16-20 July 2017
http://www.ico2017.org/

Society for Invertebrate Pathology, 50th Anniversary Meeting
San Diego, California, 13-17 August 2017
http://sipweb.org/meetings.html

26th International Conference of the World Association for the Advancement of Veterinary Parasitology, WAAVP 2017
Kuala Lumpur, Malaysia 4-8 September 2017
http://www.waavp2017kl.org/index.php

Entomological Society of Canada Joint Annual Meeting 2017
Winnipeg, 22-25 October 2017
The meeting will be held in conjunction with the Entomological Society of Manitoba
http://www.esc-sec.ca/annmeet.php

Entomological Society of America Annual Meeting 2017: *Ignite, Inspire, Innovate*
Denver, Colorado, 5-8 November 2017
http://www.entsoc.org/events/annual-meeting

The XV International Conference on Ephemeroptera and XIX International Symposium on Plecoptera
Aracruz, Brazil, 4-8 June, 2018
http://ephemeroptera.com.br/jointmeeting/

Ninth International IPM Symposium: *Improving Health, Environment and Global Sustainability*
Baltimore, Maryland, 19-22 March 2018
https://ipmsymposium.org/2018/

Readers are invited to send the Editor notices of entomological meetings of international, national or Canadian regional interest for inclusion in this list.

Les lecteurs sont invités à envoyer au rédacteur en chef des annonces de réunions entomologiques internationales, nationales ou régionales intéressantes afin de les inclure dans cette liste.

Bulletin of the Entomological Society of Canada

Editor: Cedric Gillott
Assistant Editor: Donna Giberson

The *Bulletin of the Entomological Society of Canada*, published since 1969, presents quarterly entomological news, opportunities and information, details of Society business, matters of wider scientific importance and book reviews.

Published by the
Entomological Society of Canada
386 Broadway, Suite 503
Winnipeg, Manitoba R3C 3R6
E-mail: info@esc-sec.ca
www.esc-sec.ca/

The Entomological Society of Canada was founded in 1863 primarily to study, advance and promote entomology. It supports entomology through publications, meetings, advocacy and other activities.

Send correspondence to:
Cedric Gillott
Bulletin Editor
Department of Biology
University of Saskatchewan
112 Science Place, SK S7N 5E2
Telephone: (306) 966-4401
Fax: (306) 966-4461
E-mail: cedric.gillott@usask.ca

ISSN: 0071-0741

Submission deadline for the next issue: 31 July 2017

Bulletin de la Société d'entomologie du Canada

Rédacteur: Cedric Gillott
Rédactrice adjointe: Donna Giberson

Le *Bulletin de la Société d'entomologie du Canada*, publié depuis 1969, présente trimestriellement des informations entomologiques, des occasions, des renseignements sur les opérations de la Société, des dossiers scientifiques d'importance et des analyses d'ouvrages.

Publié par la
Société d'entomologie du Canada
386 Broadway, Suite 503
Winnipeg, Manitoba R3C 3R6
E-mail: info@esc-sec.ca
www.esc-sec.ca/

La Société d'entomologie du Canada a été établie en 1863 principalement pour promouvoir l'étude et l'avancement de l'entomologie. Elle soutient l'entomologie par l'entremise de publications, de réunions et d'autres activités.

Envoyer vos soumissions à:
Cedric Gillott
Rédacteur du *Bulletin*
Department of Biology
University of Saskatchewan
112 Science Place, SK S7N 5E2
Telephone: (306) 966-4401
Fax: (306) 966-4461
courriel : cedric.gillott@usask.ca

ISSN: 0071-0741

Date de tombée pour le prochain numéro: 31 juillet 2017

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Dirigeants des Sociétés associées, 2016-2017

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1767 Angus Campbell Road, A
Abbotsford, BC, V3G 2M3
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E-mail: Tracy.Hueppelsheuser@gov.bc.ca
secretary@entsocbc.ca
http://entsocbc.ca

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Tel: (403) 556-8261
E-mail: esalberta@gmail.com
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Tel: (306) 933-7474
Email: iain.phillips@swa.ca
http://www.entsocsask.ca

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http://home.cc.umanitoba.ca/esm/

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E-mail: entsocont.membership@gmail.com
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430, boul. Gouin
Saint-Jean-sur-Richelieu (Québec) J3B 3E6
Tél : (579)224-3063
Email : secretariat@seq.qc.ca
thibodeaudanielle@hotmail.com

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P.O. Box 4000, 1350 Regent Street South
Fredericton, NB, E3B 5P7
Tel: (506) 260-6176
E-mail: treasurer@acadianes.ca
http://www.acadianes.ca

Editor's note: *Society Directors and Officers are reminded to check these lists, and submit corrections, including the names and positions of new officers.*

The last word / Le dernier mot

Cedric Gillott, Editor / Rédacteur and Donna Giberson, Rédactrice adjointe

An impressive record!

With Canada's 150th birthday fast approaching, we thought it appropriate to wave our entomological flag a little as part of the celebration. Of course, compared to the Entomological Society of Canada, founded in 1863, Canada as a nation is simply 'the kid sister'. We celebrated our 150th at the splendid Joint Annual Meeting in Guelph almost 4 years ago. (And Cedric still wears the T-shirt bearing the logo 'Predating the Nation' when playing tennis!). *The Canadian Entomologist* (*TCE*) has been published continuously since 1868 and will celebrate its sesquicentennial with a special issue in 2018 devoted to historical aspects of entomological research in Canada.

Not far behind the national society is the Entomological Society of Ontario, a name first used in 1871 when the Ontario Government required that the word 'Canada' in the Society's name be replaced by 'Ontario' in return for providing a grant to the Society (Baker 1939). Despite the name change, this body initially continued to represent and include entomologists from across Canada, as well as maintaining publication of *TCE*. Though, as might be expected, almost all of the ESO's annual meetings were held in province, the Society did occasionally venture farther afield, meeting twice in Montreal (1882 and 1898) before the turn of the century.

Three other regional societies are also centenarians. The Société d'entomologie

Une fiche impressionnante!

Avec le 150e anniversaire du Canada qui approche rapidement, nous avons pensé qu'il serait approprié d'agiter notre drapeau entomologique dans le cadre de ces célébrations. Évidemment, comparé à la Société d'entomologie du Canada, fondée en 1863, le Canada en tant que nation n'est qu'une « petite sœur ». Nous avons célébré notre 150e à la splendide réunion annuelle conjointe de Guelph il y a presque 4 ans. (Et Cedric porte encore le chandail avec le logo « Predating the nation[1] » en jouant au tennis!). *The Canadian Entomologist* (*TCE*) est publié continuellement depuis 1868 et célèbrera son sesquicentenaire avec un numéro spécial en 2018 dédié aux aspects historiques de la recherche entomologique au Canada.

Pas très loin derrière la société nationale se trouve la Société d'entomologie de l'Ontario, un nom utilisé pour la première fois en 1871 quand le gouvernement de l'Ontario a demandé que le mot 'Canada' dans le nom de la Société soit remplacé par 'Ontario' en échange d'une subvention à la Société (Baker 1939). Malgré le changement de nom, cette organisation a au départ continué de représenter et d'inclure des entomologistes de tout le Canada, en plus de maintenir la publication de *TCE*. Tel qu'attendu, bien que presque toutes les réunions de la SEO se tenaient dans la province, la Société s'aventurait parfois plus loin, se réunissant deux fois à Montréal (1882 et 1898) avant la fin du siècle.

Trois autres sociétés régionales sont aussi centenaires. La Société d'entomologie du Québec a été formé en 1873. La Société d'entomologie de Colombie-Britannique a été fondée en 1902, alors que sur la côte Est, la Société d'entomologie acadienne a débutée en 1915.

[1] « Antérieure à la nation »

du Québec was formed in 1873. The Entomological Society of British Columbia was founded in 1902, while on Canada's eastern shores, the Acadian Entomological Society began in 1915.

Formation of Canada's three other regional entomological societies occurred significantly later, awaiting the spread of settlement and 'turning the sod' in western Canada, hence the increased need for entomological expertise in the prairies. The first formed, in 1945, was the Entomological Society of Manitoba. The founding of the two remaining societies was a closely fought affair, with (Cedric is delighted to note!) the Entomological Society of Saskatchewan winning by a head (formed in May 1952) over the Entomological Society of Alberta (organized in November 1952, but only 'officially' founded in February 1953).

Finally, we would be remiss if we did not note the foundation of the Biological Survey of Canada which is 40 this year, and which will also celebrate its anniversary with a special issue in *The Canadian Entomologist*, the publication of a History of the BSC by Hugh Danks (Danks 2016), and a special symposium at the upcoming JAM. And, of course, this *Bulletin*, which began publication in 1969, is fast approaching its own special anniversary.

Without question, this is an impressive record outlining Canada's long history of entomological expertise. But let's not forget, none of us would be here and reading this today if it weren't for the over 94 000 species of insects and their relatives that are estimated to occur in this fantastic country (Hebert et al. 2016)!

La formation des trois autres sociétés entomologiques régionales du Canada s'est produite beaucoup plus tard, attendant la dispersion des établissements et les premières pelletées de terre dans l'Ouest du Canada, et ainsi la hausse du besoin pour une expertise entomologique dans les prairies. La première à être formée, en 1945, a été la Société d'entomologie du Manitoba. La fondation des deux autres sociétés a été une lutte très serrée, avec (Cedric est ravi de le noter!) la Société d'entomologie de Saskatchewan gagnant par un cheveu (formée en mai 1952) contre la Société d'entomologie de l'Alberta (organisée en novembre 1952, mais fondée « officiellement » en février 1953).

Finalement, nous serions négligents de ne pas noter la fondation de la Commission biologique du Canada qui a 40 ans cette année, et nous célébrerons également son anniversaire avec un numéro spécial dans *The Canadian Entomologist*, la publication de l'histoire de la CBC par Hugh Danks (Danks 2016) et un symposium spécial à la prochaine réunion annuelle conjointe. Et, évidemment, ce Bulletin, qui a débuté sa publication en 1969, et qui approche son propre anniversaire spécial.

Il s'agit hors de tout doute d'une fiche impressionnante soulignant la longue histoire de l'expertise entomologique au Canada. Mais n'oublions pas, aucun de nous ne serait ici et ne lirait ce texte aujourd'hui sans les plus de 94 000 espèces d'insectes et leurs parents qui sont estimés présents dans ce pays fantastique (Hebert et al. 2016)!

References / Références

Baker, A.W. 1939. A short history of the Entomological Society of Ontario. The Canadian Entomologist, **71**: 14-20.

Danks, H.V. 2016. The Biological Survey of Canada: A Personal History. Biological Survey of Canada Monograph Series No. 8. Biological Survey of Canada, Ottawa. 180 pp. Available from: http://biologicalsurvey.ca/monographs/read/19

Hebert, P.D., Ratnasingham, S., Zakharov, E.V., Telfer, A.C., Levesque-Beaudin, V., Milton, M.A., Pedersen, S., Jannetta, P., and DeWaard, J.R. 2016. Counting animal species with DNA barcodes: Canadian insects. Phil. Trans. R. Soc. B, **371**(1702):.20150333. doi: 10.1098/rstb.2015.0333 Available from: http://rstb.royalsocietypublishing.org/content/371/1702/20150333.full

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Société d'entomologie du Canada, 2016-2017

Executive Council / Conseil exécutif

President / Président
Neil Holliday
Department of Entomology
University of Manitoba
Winnipeg, MB, R3T 2N2
Tel: (204) 474-8365 Fax: (204) 474-7628
E-mail: Neil_Holliday@UManitoba.CA

First Vice-President / Premier vice-président
Patrice Bouchard
Canadian National Collection of Insects, Arachnids and Nematodes
Agriculture and Agri-Food Canada
Ottawa, ON, K1A 0C6
Tel: (613) 759-7510, Fax: (613) 759-1701
E-mail: patrice.bouchard@agr.gc.ca

Second Vice-President / Second vice-présidente
Fiona F. Hunter
Department of Biological Sciences
Brock University
1812 Sir Isaac Brock Way
St. Catharines, ON L2S 3A1
Tel: (Office) (905) 688-5550 ext. 3394,
(Lab) (905) 688-5550 ext. 3408
E-mail: fhunter@brocku.ca

Past President / Président sortant
Terry Wheeler
Department of Natural Resource Sciences
McGill University
Ste-Anne-de-Bellevue, QC, H9X 3V9
Tel: (514) 398-7937
Fax: (514) 398-7990
E-mail: terry.wheeler@mcgill.ca

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Miles Zhang, University of Central Florida
E-mail: yuanmeng.zhang@gmail.com

Officers / Dirigeants

Treasurer / Trésorier
Christopher P. Dufault
461 Tweedsmuir Ave.
Ottawa, Ontario, K1Z 5P1
Tel: (613) 261-1314
E-mail: christopher.p.dufault(at)gmail.com

Secretary / Secrétaire
Aynsley Thielman
Natural Resource and Environmental Studies Institute (NRESi)
University of Northern British Columbia
3333 University Way
Prince George, BC Canada V2N 4Z9
Fax: (250) 960-6533
E-mail: aynsley.thielman@unbc.ca

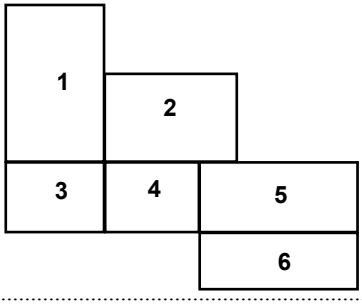
Bulletin Editor / Rédacteur du *Bulletin*
Cedric Gillott
Dept. of Biology, University of Saskatchewan
112 Science Place, Saskatoon, SK S7N 5E2
Tel: (306) 966-4401 Fax: (306) 966-4461
E-mail: cedric.gillott@usask.ca

Asst. *Bulletin* Editor / Rédactrice adj. du *Bulletin*
Donna Giberson
Dept. of Biology, U. Prince Edward Island
Charlottetown, PE, C1A 4P3
E-mail: giberson@upei.ca

Webmaster / Webmestre
Jordan Bannerman
University of Manitoba
email: jordan.bannerman@umanitoba.ca

The Canadian Entomologist Editor-in-Chief / Rédacteur en chef
Kevin Floate
Lethbridge Research and Development Centre
Agriculture and Agri-Food Canada
Lethbridge, AB T1J 4B1
Tel: (403) 317-2242
E-mail: kevin.floate@agr.gc.ca

Head Office / Siège social
Entomological Society of Canada
386 Broadway, Suite 503
Winnipeg, Manitoba, R3C 3R6 Canada
Tel: 1-888.821.8387; +1-204.282.9823
Fax: +1-204.947.9767
E-mail: info@esc-sec.ca www.esc-sec.ca



Front cover/Plate supérieur:

1 Mayflies: *Hexagenia* (Ephemeroptera: Ephemeridae) in tandem from Spanish [north shore of Georgian Bay, Ontario, Canada]
Mayflies: Hexagenia (Ephemeroptera: Ephemeridae) en tandem à Spanish [rive nord de la baie Georgienne, Ontario, Canada]
[Photo: Rosemarie De Clerck-Floate]

2 Specialist Subcommittee of the Committee on the Status of Endangered Wildlife in Canada doing an insect survey in a bog [Corner Brook, Newfoundland, Canada]
Les membres du sous-comité de spécialistes des arthropodes sur le comité sur la situation des espèces en péril du Canada faisant un inventaire d'insectes dans une tourbière [Corner Brook, Terre-Neuve, Canada]
[Photo: Greg Pohl]

3 Face to face with the death's-head hawkmoth, *Acherontia atropos* (Lepidoptera: Sphingidae) [Delémont, Switzerland]
Face à face avec le sphynx tête de mort, *Acherontia atropos* (Lepidoptera: Sphingidae) [Delémont, Suisse]
[Photo: Tim Haye]

4 A male *Chionea alexandriana* (Diptera: Limoniidae), a wingless fly, on snow in the sub-alpine forest [Mount Seymour, British Columbia, Canada]
Un mâle *Chionea alexandriana* (Diptera: Limoniidae), une mouche aptère, sur la neige dans la forêt subalpine [le mont Seymour, Colombie-Britannique, Canada]
[Photo: Chris Ratzlaf]

5 A milkweed bug, *Oncopeltus fasciatus* (Hemiptera: Lygaeidae), moulting on milkweed Centreville, Ontario, Canada]
Une punaise de l'asclépiade, *Oncopeltus fasciatus* (Hemiptera: Lygaeidae), muant sur ne asclépiade [Centreville, Ontario, Canada]
[Photo: Andrea Brauner]

6 Wolf spider (Araneae: Lycosidae) carrying her young on her abdomen collected from the field [Agassiz, British Columbia, Canada]
Une araignée lycosidée (Araneae: Lycosidae) portant ses petits sur son abdomen, attrapée dans un champ [Agassiz, Colombie-Britannique, Canada]
[Photo: Jesse MacDonald]

Back cover/Plate inférieur:

Male orchid bee, *Euglossa dilemma* (Hymenoptera: Apidae) [Everglades City, Florida, United States of America]
Un mâle de l'abeille *Euglossa dilemma* (Hymenoptera: Apidae) [Everglades City, Florida, États-Unis d'Amérique]
[Photo: Matthias Buck]

www.esc-sec.ca

Entomological Society of Canada
Société d'entomologie du Canada
386 Broadway
Suite 503
Winnipeg, Manitoba
R3C 3R6
E-mail: info@esc-sec.ca

Date of issue: June 2017 /
juin 2017

ISSN: 0071-0741