Bulletin

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

Halyomorpha halys (Hemiptera: Pentatomidae) is an emerging pest of fruit across North America. This is an individual from London (Ontario, Canada), where the overwintering biology is being studied.

Halyomorpha halys (Hemiptera : Pentatomidae) est un nouveau ravageur des fruits en Amérique du Nord. Ici un individu de London (Ontario, Canada), où la biologie hivernale est étudiée.

[Photo: Brent Sinclair]

Kevin Floate, President of ESC / Président de la SEC

JAM insights

We are roughly midway between JAM 2018 and JAM 2019 (18-21 August, Fredericton, New Brunswick). It seems like a good time to share some insights from our recent JAM survey.

If you attended JAM 2018, you were part of history. There were exactly 3800 registrants – the largest number of attendees to an entomological meeting in North America with the exception of the International Congress of Entomology in 2016 in Orlando, Florida. In early December, ESC members received emails from the Society asking them to complete a short survey. Answers to survey questions are used to improve the experience of attendees at future JAMs. Answers also provide important general information on the demography of attendees and what they value. So let me share some of the information we received for the 2018 JAM survey.

Of the 150 responses received, 29% respondents self-identified as Researcher, 17% as Professor, 25% as Graduate Student (MSc or PhD), 5% as PDF and 11% as Retired. The remainder self-identified as Government Employee, Extension, Unemployed or another category. Ranked

Perspectives sur la réunion annuelle

Nous sommes environ à mi-chemin entre les réunions annuelles conjointes 2018 et 2019 (18-21 août, Fredericton, N.-B.). Cela me semble un bon moment pour partager quelques perspectives de notre récent sondage sur la réunion annuelle conjointe.

Si vous avez assisté à la réunion annuelle conjointe 2018, vous avez fait partie de l'histoire. Il y avait exactement 3800 inscrits – le plus grands nombre de participants à une réunion entomologique en Amérique du Nord, à l'exception du Congrès international d'entomologie en 2016 à Orlando, Floride. Au début décembre, les membres de la SEC ont reçu des courriels de la Société leur demandant de compléter un court sondage. Les réponses à ces questions sont utilisées pour améliorer l'expérience des participant aux futures réunions annuelle conjointes. Les réponses fournissent également des informations générales importantes sur la démographie des participants et ce qu'ils jugent important. Alors laissez-moi partager certaines des informations que nous avons reçues pour le sondage sur la réunion annuelle conjointe 2018.

Des 150 réponses reçues, 29% des répondants se sont identifiés comme chercheurs, 17% comme professeurs, 25% comme étudiants des cycles supérieurs (MSc ou PhD), 5% comme chercheurs postdoctoraux et 11% comme retraités. Les autres se sont identifiés comme employés du gouvernement, en transfert de connaissance, sans emploi ou d'une autre catégorie. En ordre décroissant, les principaux sujets d'études identifiés par les répondants étaient Écologie > Gestion des ravageurs ≈ Agriculture > Lutte biologique > Évolution ≈ Foresterie >

in descending order, the main topics of study identified by respondents were Ecology > Pest Management ≈ Agriculture > Biological Control > Evolution ≈ Forestry > Conservation > Behaviour > Taxonomy ≈ Pollinators. Many respondents were also members of regional provincial societies. Students comprised 30% of our membership in 2018 and provided 25% of survey responses. So, it's fair to say that the respondents represent a pretty good cross-section of the ESC membership.

Among the respondents, 81% attended the JAM. The main reasons for attendance were what you might expect, that is, networking, meeting with colleagues, learning about new research advances, and presenting one's own research results. Overall impressions of social events, scientific content, and registration/organization were predominantly 'Very Positive' (35%) or 'Positive' (55%). Compared to costs to attend other meetings in Canada in the previous 12 months, respondents (n = 115 responses) indicated that the cost of attending JAM 2018 was 'Much higher than average' (15%), 'Higher than average' (53%), or 'Average' (31%); 69% of respondents indicated that they had ≥ 75% of their costs paid by their employer or from a grant. The high cost was the number one reason given by respondents who did not attend the JAM.

The survey included a comment section for which there were 41 respondents. All of these comments have been forwarded to the ESC's Annual Meeting Committee for use in planning future JAMs. The comments were generally positive to somewhat negative. By co-hosting with the Entomological Society of America, some attendees found the conference was too large. Other attendees really enjoyed the larger number of presentations and the greater opportunity to interact with colleagues from other countries. Among the comments, one in particular caught my eye; that is, *Did the ESC make a profit? If so, are they considering the ethics involved in making a profit*

Conservation > Comportement > Taxonomie ≈ Pollinisateurs. Plusieurs répondants étaient aussi membres de sociétés régionales provinciales. Les étudiants constituaient 30% de nos membres en 2019 et ont fourni 25% des réponses au sondage. Il est donc juste de dire que les répondants étaient une plutôt bonne représentation des membres de la SEC.

Parmi les répondants, 8% ont participé à la réunion annuelle. Les principales raisons pour y participer étaient ce que vous pouvez attendre, c'est-à-dire le réseautage, les rencontres avec des collègues, en apprendre sur les nouvelles avancées en recherche, et présenter ses propres résultats de recherche. Les impressions globales des évènements sociaux, du contenu scientifique et de l'inscription/organisation étaient de façon prédominante « Très positive » (35%) ou « Positive » (55%). Les répondants (n = 115 réponses) ont indiqué que les coûts pour assister à la réunion annuelle conjointe 2018, comparés aux autres réunions au Canada dans les 12 derniers mois, était « Beaucoup plus chers que la moyenne » (15%), « Plus cher que la moyenne » (53%) ou « Comparables à la moyenne » (31%); 69% des répondants ont indiqués que ≥ 75% des coûts étaient couverts par leur employeur ou une subvention. Le coût élevé était la principale raison donnée par les répondants qui n'ont pas assisté à la réunion annuelle. Le sondage incluait une section de commentaires pour laquelle il y a eu 41 répondants. Tous ces commentaires ont été transférés au comité de la réunion annuelle de la SEC pour utilisation dans la planification des prochaines réunions. Les commentaires étaient de généralement positifs à quelque peu négatifs. En co-organisant la réunion avec la Société d'entomologie d'Amérique, quelques participants ont trouvé que la conférence était trop grosse. D'autres participants ont beaucoup apprécié le grand nombre de présentations et les opportunités plus grandes d'interagir avec des collègues d'autres pays. Parmi les commentaires, un en particulier a attiré mon attention; « *Est-ce que la SEC a fait un profit? Si oui, est-ce qu'ils considèrent l'éthique impliquée à faire un profit pour leur société sur les profits de la réunion payée par les payeurs de taxes? Les participants* *for their society off meeting profits paid for by taxpayers? The attendees are supposed to be paying for a meeting, not for the ESC….*" These are reasonable questions and provide me with the opportunity to share some insights on societal operations.

Did the ESC make a profit? As I write this (in mid-January), I'm told that the ESC will receive a sizable surplus from JAM 2018. How much? I don't yet know, but it is good news for the ESC and the Entomological Society of British Columbia. JAMs are structured to provide a flush of revenue into the coffers of the host regional society on the roughly 7-yr cycle that they host the meeting. This surplus can be used by the regional society to subsidize the cost of their regional meetings and promote regional entomological activities. JAMs are also structured to protect the regional society should the JAM run a deficit. Without this arrangement, regional societies with limited funds would not be able to host a JAM. The ESC advances up to $5000 to help the regional society with arrangements for the venue and scientific program, plus up to an additional $3000 to help bring in conference speakers. If the JAM recovers a surplus, the funds advanced by the ESC are repaid in full and the remainder is evenly split between the regional society and the ESC. If the surplus does not cover the amount advanced by the ESC, the ESC takes a loss – ***but not the regional society***. If the JAM runs a deficit, the ESC forgives the advance and covers ≥ 50% of the loss. In 2016, the ESC held their annual meeting jointly with the Entomological Society of America and the International Congress of Entomology. Neither the ESC nor a regional Canadian society received a financial benefit to boost their societal coffers. Following JAM 2017 (Winnipeg), the Entomological Society of Manitoba and the ESC each received $6000. The substantial surplus from JAM 2018 reflects the large number of attendees, sponsorships and exhibitors.

sont supposés payer pour une réunion, pas pour la SEC… »[1]. Ces questions sont raisonnables et m'ont fourni l'occasion de partager certaines perspectives sur les opérations de la société.

Est-ce que la SEC a fait un profit? Alors que j'écris ces lignes (à la mi-janvier), on m'a dit que la SEC recevra un surplus appréciable de la réunion annuelle 2018. Combien? Je ne sais pas encore, mais ce sont de bonnes nouvelles pour la SEC et la Société d'entomologie de Colombie-Britannique. Les réunions annuelles sont construites pour produire un revenu dans les coffres de la société régionale hôte sur les cycles d'environ 7 ans où elles accueillent la réunion conjointe. Ce surplus peut être utilisé par la société régionale pour couvrir les coûts de leur réunions régionales et promouvoir les activités entomologiques régionales. Les réunions annuelles sont également construites pour protéger la société régionale si la réunion avait un déficit. Sans cet arrangement, les sociétés régionales ayant des fonds limités ne serait pas capables de recevoir la réunion annuelle conjointe. La SEC avance jusqu'à 5000$ pour aider la société régionale avec les arrangements pour les salles de la réunion et le programme scientifique, en plus d'un montant additionnel allant jusqu'à 3000$ pour aider à amener les conférenciers. Si la réunion fait un surplus, les fonds avancés par la SEC sont remboursés en totalité, et le restant est séparé également entre la société régionale et la SEC. Si le surplus ne couvre pas l'avance de la SEC, la SEC assume les pertes – *mais pas la société régionale*. Si la réunion est déficitaire, la SEC renonce à son avance et couvre ≥ 50% des pertes. En 2016, la SEC a tenu sa réunion annuelle conjointement avec la Société d'entomologie d'Amérique et le Congrès international d'entomologie (ICE). Ni la SEC, ni une société régionale canadienne n'ont obtenu de bénéfices financiers afin de renflouer ses coffres. Après la réunion annuelle 2017 (Winnipeg), la Société d'entomologie du Manitoba et la SEC ont chacune reçu 6000$. Le surplus substantiel de la réunion annuelle 2018 reflète le grand nombre de participants, de

[1] Traduction libre de l'anglais

If so, are they considering the ethics involved in making a profit for their society off meeting profits paid for by taxpayers? This question has several layers and some implicit assumptions. Based on respondents to the JAM survey, about 70% of attendees had ≥ 75% of their meeting expenses paid by a grant or employer. If their experience was like mine, their travel costs were identified and approved by the funding agency or employer up to a year in advance. So the money used to travel to the meeting was approved for this purpose by the 'taxpayer'. The question implies that when JAMs do generate a surplus, all of the surplus derives from registration fees. It may not. Some of this surplus may derive from corporate sponsorships. Towards this end, the ESC is developing a national fund-raising strategy. Sponsorships are used to enrich the overall conference experience for attendees (e.g., evening mixers, coffee breaks, keynote speakers) while keeping registration fees to a reasonable amount. Depending on the level of sponsorship and number of registrants, more or less money may be spent than anticipated. There is also the assumption that it is somehow wrong to recover a surplus. Meeting organizers ***want*** to recover a surplus to offset deficits at future JAMs, to finance societal operations, and to promote and advance the study of entomology. Indeed, members of the ESC and regional societies cumulatively donate hundreds of volunteer hours each year to help ensure that JAMs return a surplus. With this in mind, let me rephrase the original question – *Is it ethical to set high registration fees at JAMs to make excessive profits?* I think we can agree the answer is 'no'. I would only add that all surpluses recovered at JAMs are returned back to the entomological community in various forms, for example, affordable dues for regular members, subsidized dues for student and early career professional members, support for future JAMs, travel and public education grants, and the financial sustainability of regional

partenaires financiers et d'exposants.

Si oui, est-ce qu'ils considèrent l'éthique impliquée à faire un profit pour leur société sur les profits de la réunion payée par les payeurs de taxes? Cette question a plusieurs volets et quelques suppositions implicites. Selon les répondants au sondage sur la réunion annuelle, environ 70% des participants avaient plus de 75% de leurs dépenses pour la réunion payées par une subvention ou un employeur. Si leur expérience est comme la mienne, leurs coûts de déplacement étaient identifiés et approuvés par l'agence de financement ou l'employeur jusqu'à un an d'avance. L'argent utilisé pour voyager à la réunion était donc approuvé pour cet usage par le « payeur de taxes ». La question implique que quand les réunions génèrent un surplus, tout le surplus provient des frais d'inscription. Ce n'est pas nécessairement le cas. Une partie de ce surplus provient des partenariats corporatifs. À cet effet, la SEC développe une stratégie de financement nationale. Les partenariats financiers sont utilisés pour enrichir l'expérience de conférence des participants (p. ex. réception en soirée, pauses-café, conférenciers invités) tout en gardant des frais d'inscription à un montant raisonnable. Selon le niveau du partenariat et le nombre d'inscrits, plus ou moins d'argent que prévu peut être dépensé. Il y a aussi une supposition qu'il est mal de faire un surplus. Les organisateurs des réunions veulent faire un surplus afin de compenser les déficits de prochaines réunions, pour financer les opérations sociétales, et pour promouvoir et faire avancer l'étude de l'entomologie. Évidemment, les membres de la SEC et des sociétés régionales donnent cumulativement des centaines d'heures de bénévolat chaque année afin d'assurer que les réunions produisent un surplus. En gardant cela en tête, laissez-moi reformuler la question originale – *Est-il éthique de fixer des coûts d'inscription élevés aux réunions pur faire des profits excessifs?* Je pense que nous pouvons nous mettre d'accord que la réponse est « non ». Je voudrais seulement ajouter que tous les surplus produits par les réunions annuelles sont retournés à la communauté entomologique sous différentes formes, par exemple en ayant des societies and the ESC.

I think it helps to understand how registration fees are set. JAM organizers consider a number of factors to strike a balance between reasonable registration fees, attendee expectations, likely levels of corporate sponsorship, and not running a deficit. And don't forget that the registration fees for regular members are set to subsidize the registration fees for students and early career professionals. There are negotiations with available venues to minimize expenses for hotel rooms, meeting rooms, catering (e.g., banquet, evening mixers, coffee breaks), and audio-visual equipment rental. There are costs for the set up and operation of a website for online registration, credit card processing fees, payment of federal and provincial taxes, meeting liability insurance, and numerous other items. Some of these expenses aren't known until after the JAM. For example, hotels typically provide meeting rooms at a discount if attendees book a minimum number of 'guest room nights'; that is, 2 people in 1 room = 1 room night. If the quota of 'room nights' is not met, the JAM may need to pay an unanticipated penalty fee to the hotel. (This is why JAM attendees are encouraged to stay at the conference hotel.) A number of attendees to JAM 2018 remarked on the higher than typical registration fees. But think about the cost of hosting any event in Vancouver, plus the limited number of venues able to accommodate 3800 attendees. And also think about the much greater opportunities offered at JAM 2018 to share your research and interact with a large and diverse group of your fellow entomologists.

There is much more I could say about societal operations, but I fear I may be exhausting my readers. So let me finish with the final three points. First, if you are concerned that JAM registration fees may be unreasonable… consider the points I've made here. Second, if you want to see how the ESC spends those registration fees, the

frais d'adhésion abordables pour les membres réguliers, des frais réduits pour les membres étudiants et jeunes professionnels, du soutien pour les prochaines réunions annuelles, des subventions de voyage et d'éducation publique, et une durabilité financière des sociétés régionales et la SEC.

Je pense que ça aide de savoir comment les frais d'inscription sont fixés. Les organisateurs des réunions considèrent un nombre de facteurs afin d'avoir un équilibre entre des frais d'inscription raisonnables, les attentes des participants, le niveau probable de partenariats financiers et le but de ne pas faire de déficit. Et n'oubliez pas que les frais d'inscription pour les membres réguliers sont fixés pour pouvoir réduire les frais d'inscription des membres étudiants et jeunes professionnels. Il y a des négociations avec les lieux de réunions disponibles pour minimiser les dépenses pour les chambres d'hôtel, salles de réunions, traiteurs (p. ex. le banquet, les réceptions en soirées, les pauses-café) et la location de l'équipement audio-visuel. Il y a des coûts pour monter et maintenir le site web pour les inscriptions en ligne, les frais de traitement des cartes de crédit, le paiement des taxes fédérales et provinciales, les assurances responsabilité et plusieurs autres items. Certaines de ces dépenses ne sont pas connues jusqu'après la fin de la réunion. Par exemple, les hôtels fournissent typiquement des salles de réunion à un prix réduit si les participants réservent un minimum de nuitées : c'est-à-dire que 2 personnes dans une chambre = 1nuitée. Si le quota de nuitées n'est pas rencontré, la réunion annuelle peut devoir payer une pénalité à l'hôtel. (Cela explique pourquoi les participants aux réunions annuelles sont encouragés à dormir à l'hôtel de la conférence.) Certains participants à la réunion annuelle conjointe 2018 ont fait des remarques sur les frais d'inscription plus élevés que d'habitude. Mais pensez au coût d'organiser n'importe quel évènement à Vancouver, en plus du nombre limité d'installations capables de recevoir 3800 participants. Et pensez également au plus grand nombre d'opportunités offertes à la réunion annuelle 2018 pour partager votre recherche et interagir avec un large groupe

Society posts its audited financial statements in the Member's area of the ESC's website. Third, if you attended JAM 2018, you almost certainly opted to reduce your registration fee by becoming a member of the ESC. And as a member, remember that your benefits don't stop the day after the JAM. They extend throughout the year and have much to offer. We are a dynamic society, supported by dedicated volunteers and are heavily invested in the future of our student members. Be informed, get involved, and help make the ESC even better!

diversifié de collègues entomologistes.

Il y en aurait tellement plus à dire concernant les opérations sociétales, mais je crains que j'épuiserais mes lecteurs. Alors laissez-moi terminer avec les trois derniers points. D'abord, si vous êtes inquiets que les coûts d'inscription aux réunions annuelles ne soient pas raisonnables… considérez les points que j'ai apportés ici. Ensuite, si vous voulez voir comment la SEC dépense ces frais d'inscriptions, la Société affiche ses états financiers vérifiés dans la section des membres du site web de la SEC. Finalement, si vous avez assisté à la réunion annuelle 2018, vous avez certainement opté pour réduire vos couts en devenant membre de la SEC. Et en tant que membre, rappelez-vous que vos avantages ne s'arrêtent pas le jour suivant la réunion. Ils se poursuivent tout au long de l'année et ont beaucoup à vous offrir. Nous sommes une société dynamique, soutenue par des bénévoles dévoués qui sont fortement investis dans le futur de nos membres étudiants. Soyez informé, impliquez-vous, et aidez à rendre la SEC encore meilleure!

C. Sheffield

Chrysolina quadrigemina *(Coleoptera: Chrysomelidae)* on St. Johns Wort (*Hypericum perforatum*) on the Magdalen Islands (Îles de la Madeleine).

Announcing the 2019 JAM

18–21 August
Fredericton, NB

In August 2019, the **Entomological Society of Canada** will meet jointly with the **Acadian Entomological Society** and the **Canadian Society for Ecology and Evolution**. Join us on the banks of the beautiful St. John River as we bring these three sister societies together for their first-ever joint meeting! **Registration will open on 5 April 2019 (early-bird and oral presentation deadlines 5 June 2019)**

- Link ecological principles and theory to applied entomology
- Learn new tools and approaches relevant to your work
- Celebrate how insects fit into broader ecological studies
- Meet new colleagues and gain new perspectives

Follow the meeting on Twitter (*@CSEE_Meetings*) or find more details on the web: www.csee-esc2019.ca

Annonce pour la réunion annuelle conjointe 2019

18-21 août
Fredericton, NB

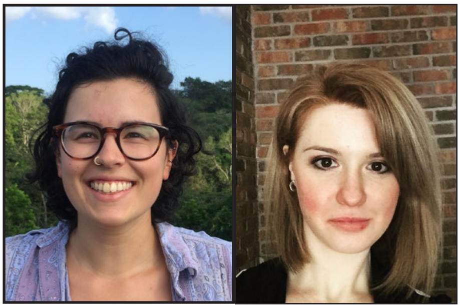
En août 2019, la **Société d'entomologie du Canada** se réunira conjointement avec la **Société d'entomologie acadienne** et la **Société canadienne d'écologie et d'évolution**. Joignez-vous à nous sur les rives du magnifique fleuve Saint-Jean alors que nous réunirons pour la première fois ces trois sociétés sœurs!
Les inscriptions débuteront le 5 avril 2019 (la date limite pour les inscriptions hâtives et les présentations est le 5 juin 2019)

- Liez les principes écologiques et la théorie à l'entomologie appliquée
- Découvrez de nouveaux outils et de nouvelles approches pertinents à vos travaux
- Célébrez la façon dont les insectes cadrent dans les études écologiques plus vastes
- Rencontrez de nouveau collègues et acquérez de nouvelles perspectives

Suivez la réunion sur Twitter (*@CSEE_Meetings*) ou trouvez plus d'informations sur le site web : www.csee-esc2019.ca.

STEP Corner / Le coin de la relève

Anne-Sophie Caron and Rachel Rix



2019 Eco-Evo-Ento meeting

The next JAM will take place in Fredericton, New Brunswick from 18 to 21 August and will include the Canadian Society for Ecology & Evolution, the Entomological Society of Canada, and the Acadian Entomological Society. Don't hesitate to contact us to get involved! For more information, go to http://csee-esc2019.ca/index.html

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 most recent featured articles. If you want your recently published article featured (or we missed yours last month!), send us an email at students@esc-sec.ca. For regular updates on new Canadian entomological research, you can join the ESC Students Facebook page or follow us on Twitter @ esc_students.

Getting involved with the ESC

The Student and Early Professional Affairs Committee (SEPAC) is looking for new members (especially Early Professionals). Volunteering for the SEPAC is a great way to get involved with the Society and promote entomology to students across Canada. If you are interested in joining or just have suggestions for new initiatives in the coming year, email us at students@esc-sec.ca, or

La réunion Éco-Évo-Ento 2019

La prochaine réunion annuelle, qui aura lieu à Fredericton, Nouveau-Brunswick du 18 au 21 août, est organisée par la Société canadienne d'écologie et d'évolution, la Société d'entomologie du Canada, et la Société d'entomologie acadienne. Si vous souhaitez vous impliquez, contactez-nous! Pour plus d'informations, rendez-vous à l'adresse suivante http://csee-esc2019.ca/index.html

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 students@esc-sec.ca. 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.

S'impliquer au sein de la SEC

Le comité des affaires étudiantes et des jeunes professionnels cherche de nouveaux membres (particulièrement des jeunes professionnels). S'impliquer bénévolement pour le comité est une excellente façon de s'impliquer avec la Société et promouvoir l'entomologie auprès des étudiants au Canada. Si vous êtes intéressés à joindre le comité, ou si vous avez des suggestions pour de nouvelles initiatives pour la prochaine année, écrivez-nous à students@esc-sec.ca. Vous pouvez aussi nous contacter personnellement à annesophie.

contact us personally at annesophie.caron.p@gmail.com or Rachel.Rix@dal.ca We look forward to hearing from you,

Anne-Sophie and Rachel.

caron.p@gmail.com ou Rachel.Rix@dal.ca. Au plaisir d'avoir de vos nouvelles,

Anne-Sophie et Rachel.

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.

(paid advertisement/ publicité payée)

Entomological Society of British Columbia

This year at the Annual General Meeting of the Entomological Society of British Columbia, Dr Robert (Robb) Bennett, PhD, FESC, was inducted as an Honorary Member of the ESBC in recognition of his outstanding contributions to the advancement of entomology in British Columbia. In addition to a career as a seed orchard entomologist with the British Columbia Ministry of Forests and a second, parallel career as an arachnologist, Robb has been an invaluable member of the provincial society. He served as a Director, an editor of Boreus, and also as Secretary/Treasurer for 12 years. For a more complete, and amusing, account of his adventures in entomology (with photos!), you are directed to the December 2018 issue of the Society's newsletter (http://entsocbc.ca/wp-content/uploads/2019/02/Boreus-Final-Dec-2018.pdf).

Entomological Society of Saskatchewan

Annual General Meeting

The Society held its Annual General Meeting on 21 December 2019 with a business session, preceded by five student presentations:

Karolina Pusz-Bochensika discussed "LAMP- a rapid and easy molecular test of aster yellows detection in a single leafhopper."

Dan Malmura presented "Integrated management approaches for controlling lesser clover leaf weevils and its effects on pollinator communities in red clover seed production."

Zach Balzer talked about "Morphology of the first instar larva of *Stylops advarians* (Strepsiptera) and the discovery of the elusive adult male."

Stefanie de Heij spoke on "Searching for the carabids' role in weed ecology."

Kiara Calladine discussed "Distribution and abundance of Gibson's big sand tiger beetle (*Cicindela formosa* gibsoni) in the Douglas provincial park sand hills."

All the talks were very interesting, with undergraduate Kiara Calladine receiving the Student Presentation Award. Other student awards were made to Zach Balzer (A.R. Brooks Prize) and Stefanie de Heij and Charlie Bailey (Travel Awards).

News of interest

ESS members have been busy with various outreach activities including several talks at provincial parks, and elementary schools. In late-September, Dr Tyler Wist gave a very entertaining presentation on the entomological science behind one of the most famous sci-fi movies franchise: Alien (Alien 1,2,3,4,5 and Alien versus Predators) as part of the kick-off to Ag West Bio's Global Biotech week and the first talk in the Café Scientifique speaker series in Saskatoon.

More recently, members taught an insect order identification “class” to Grade 9 students who visited the Agriculture and Agri-Food Canada’s Saskatoon Research and Development Centre during “Take Your Kids to Work Day”.

Additionally, members displayed the ESS collection and answered entomology/science related career questions at the Oskayak High School Career Fair.

Two Society members were recently recognized for their outstanding work. Dr Dwayne Hegedus (AAFC-Saskatoon) received Agriculture and Agri-Food Canada’s “Prize for Outstanding Achievement in Science” as part of a team that developed the InsectSelect™ Gene Expression System. Dr Boyd Mori (AAFC-Saskatoon) received the “Early Career Research and Leadership Award” from the International Branch of the Entomological Society of America during the ESC-ESBC-ESA meeting in November.

The Spring Meeting of the ESS is tentatively scheduled for the first week of April.

Student presenters at the ESS AGM: (from left) Zach Balzer, Dan Malmura, Stefanie de Heij, Kiara Calladine, and Karolina Pusz-Bochensika. Zach Balzer also received the A.R. Brooks Prize and Stefanie de Heij received a Travel Award.

Boyd Mori is presented with the Early Career Research and Leadership Award from the International Branch of the Entomological Society of America at JAM 2018. Boyd received his award from the Chair of the IBESA (and his PhD Supervisor) Maya Evenden.

Entomological Society of Manitoba

Ace Burpee is the host of the morning show on 103.1FM (Virgin Radio) in Winnipeg. He comes up with a list of the top 100 Most Fascinating Manitobans each year. The list was released in late 2018, and there’s an entomologist on it! Dr. Jason Gibbs was listed among the top 100 most interesting Manitobans, in part due to his discovery of *Epeolus gibbsi,* which we reported on in the September 2018 *Bulletin*.

Société d'entomologie du Québec

Lors d'un Gala tenu à Montréal au Planétarium Rio Tinto le 30 novembre 2018 pour fêter les 50 ans du Réseau Technoscience, les noms de trois entomologistes de la Société d'entomologie du Québec ont été mentionnés pour avoir donné bénévolement aux enfants des cours sur les insectes dans le cadre du programme «Innovateurs à l'école». Il s'agit de Jean-Pierre Bourassa (groupe de 25 ans et plus d'engagement - **Photo A,** quatrième de droite), de Charles Vincent (groupe de 20-25 ans d'engagement - **Photo B,** quatrième de droite) et de Julien Saguez (groupe de 0 à10 ans d'engagement- absent).

At the Gala held in Montreal at the Rio Tinto Planetarium on 30 November 2018 to celebrate the 50th anniversary of the Technoscience Network, the names of three entomologists from the Entomological Society of Quebec were mentioned for having volunteered to give entomology courses to students as part of the "Innovators at School" program. The three entomologist volunteers are Jean-Pierre Bourassa (group of 25 years or more of involvement – **Photo A**, fourth from right), Charles Vincent (group of 20-25 years of involvement - **Photo B**, fourth from right) and Julien Saguez (group of 0-10 years of involvement – absent).

A

B

Judith H. Myers

Roy King/Entomological Society of America

Fundamental ecological insights as a legacy of spruce budworm research in Canada

The study of forest insect ecology in Canada experienced a heyday of research following the Second World War. This was influenced by several important factors. First, men returning from the military were going to university and some trained in entomology and ecology. Planes were also increasingly available for monitoring the defoliation caused by forest insects and for aerial spraying. In addition, knowledge and techniques for monitoring weather patterns and conditions were improving. Finally, with the increasing availability of computers, a new era of more complex data synthesis and biologically realistic models became possible.

As these developments in the potential for ecological studies occurred in the early 1940s, a periodic outbreak of eastern spruce budworm (SBW) (*Choristoneura fumiferana*) began (Figure 1). The univoltine SBW occurs in the Boreal Forest from the west to the east coasts of Canada and northern USA (Nealis 2016). Balsam fir, *Abies balsamea*, is the primary host tree of SBW, but white spruce, *Picea glauca*, black spruce, *P. mariana*, and red spruce, *P. rubens*,

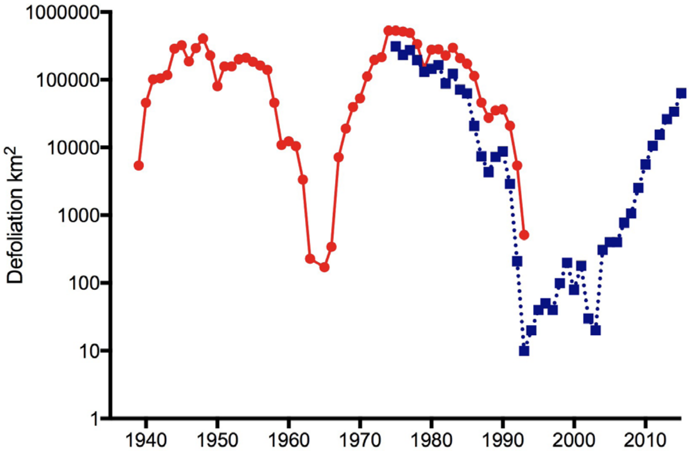


Figure 1. Defoliation predominantly by SBW in Quebec. Data provided by Barry Cooke (1940-1992) circles and from Canadian Forest Service and National Forestry Database (1975-2014) (http://nfdp.ccfm.org/en/data/insects.php) squares.

Judy Myers (myers@zoology.ubc.ca) is a professor emerita in the Department of Zoology and the Biodiversity Research Centre, University of British Columbia. Her Heritage Lecture was presented at the Joint Annual meeting of the Entomological Societies of Canada, British Columbia, and America, in Vancouver, November 2018.

Table 1. Major contributions to ecology from studies of Canadian forest insects arising particularly from studies on eastern spruce budworm. Citations based on Google (January 11, 2019).

Contribution	Early Authors	Status
Climatic release – warm dry conditions initiate population outbreak	Wellington et al. 1950 (69 citations)	Still being discussed but not supported as causing outbreaks. Dry conditions promote cone growth that provides good larval food.
Life tables and key factor analysis	Morris and Miller 1954 (333 citations)	Replaced by general linearized models and information theoretic approaches. Criticised by Royama (1996). Royama (2001) recommends using marginal mortality rather than the nominal mortality.
Functional responses to describe predation and parasitism	Holling 1959*a*, 1959*b* (3762 & 2873 citations)	Difficult to measure in the field with multiple predators and prey but used in models of population dynamics and widely discussed
Mathematical models for insect control	Watt 1961 (118 citations)	Further development on models of Thompson 1930, Nicholson 1933
Regression models of eruptive populations	Morris 1963 (570 citations)	Mathematics criticized by Royama (1971)
Stability, resilience and multiple stable states	Holling 1973 (12,335 citations)	Based on ideas about population eruptions that are not supported by cyclic population dynamics that show continuous change
Analytical models of eruptive population dynamics	Ludwig et al. 1978 (841 citations)	Output not realistic and depends on tree death that does not always occur
Second-order, density dependent, cyclic models – Oscillatory Hypothesis	Royama 1984 (441 citations)	Supported but improved by the addition of foliage quality and quantity and dispersal by Régnière and Nealis 2007
Innovative quantification of moth dispersal	Greenbank et al. 1980 (234 citations)	Dispersal still considered an important factor, but how it relates to synchronization of populations from "hotspots" and synchronizes populations remains under discussion
Development and application of ecologically based models to decision making in pest management	Baskerville 1975 (203 citations), Régnière and You 1991 (31 citations)	Still work in progress – "early intervention" programs to protect forests are now attempted.
Consideration of tree and insect quality, fecundity and mating success contribute to more realistic models of insect populations	Royama 1984 (441 citations) Régnière and Nealis, 2007 (56 citations)	Process driven models provide testable predictions as compared to earlier analytical models

are also acceptable host trees (Morris 1963). SBW became the focus for a unique and massive ecological study of the factors influencing population dynamics and resulted in numerous valuable contributions to insect ecology in general. Here I highlight some of the ecological advances that were made over the outbreak of SBW from the 1950s through 1970s and evaluate how these developments have held up over time as work has progressed (Table 1).

Weather and insect outbreaks

One of the first contributions from the study of SBW was the testing of the influence of weather on population dynamics. W.G. Wellington spent the war years as a meteorologist with the Canadian Air Force in Sault Ste. Marie, Ontario, which was also the location of the Forest Insect Laboratory founded in 1940. His combined interests in weather and insects culminated in his work on the influence of temperature and moisture on the behaviour of SBW larvae (Wellington 1949*a*, 1949*b*) and the association between June rainfall and SBW population increase (Wellington et al. 1950). This led to the "climatic release" hypothesis that proposed that warm and dry conditions are beneficial to larval survival and allow populations to escape the endemic period between population outbreaks. The potential association of weather and insect outbreaks continued to be an element in future work on SBW, but the generality of the association proposed by Wellington was later criticized as having been based on a small geographical region and a single outbreak (Royama 1984).

Further detailed analyses of weather and population growth and larval survival (Royama 1984) concluded that temperature and population dynamics of SBW were not related. Much later, Bouchard and Auger (2014) found that forest composition and average degree-days were not important to the initial development of SBW outbreaks, but did influence insect defoliation patterns within and between areas later in the outbreak process. In particular, dry weather in the previous summer which promotes the development of pollen cones, particularly in balsam fir, provides high quality larval food (Bouchard et al. 2018). Warm May temperatures are also related to larval survival and both low precipitation in the previous year and May temperatures were related to synchrony among SBW populations in Quebec.

Recently, interest in the influence of climate change on forest insects has stimulated a number of studies using data available on SBW to ask if the characteristics of the population cycles will change in the future. The results of these models have been contradictory, with some predicting increased duration of the outbreaks (Fleming and Volney 1995, Volney and Fleming 2000, Gray 2008), shorter duration of outbreaks (Gray 2013, Boulanger et al. 2016), or no change (Candau and Fleming 2011). Thus, climate change models don't predict how cyclic dynamics of SBW might change in the future. A current summary of SBW population dynamics on the NRCAN Website 2018 (https://www.nrcan.gc.ca/forests/fire-insects-disturbances/top-insects/13383) states that: "Although weather is often cited as an important factor, there is no consensus as to how weather may influence the beginning or end of outbreaks."

Life tables

In 1944 the Green River Project was established in northwestern New Brunswick for the long-term study of SBW as related to forest management (Morris 1951). This project ran until 1960, at which time SBW had declined to low density (Figure 1). One approach used in this project was to study the relationship between population increase and mortality factors through the development of life tables (Deevey 1947) for each generation of moths in different forest stands. Morris (1955) discussed the history of life tables and, although life tables had been used for studies of humans, they had not been used for insects (Morris and Miller 1954). Life tables are a way to organize data by selecting appropriate age intervals such as larval instars, recording the number alive at the beginning of the age interval, the number dying over the age interval, the proportion dying, the cause of death and the life expectation of individuals. If the population variation from generation to generation is determined by only one factor, the log of the density in the next generation should be determined by the log of the rate of increase plus the log of the initial population plus the proportion surviving (Morris and Miller 1954). Morris distinguished mortality factors that varied little from year to year from those that appeared to be responsible for the changes in the population density and showed that the factor causing the highest mortality was not necessarily that related to population density change.

The data collected in the Green River Project at different sites and over time became the basis of a key factor analysis of SBW reported in "The dynamics of epidemic spruce budworm populations" edited by Morris (1963). Parasitism was not a key factor for epidemic populations of SBW, but this study only included data from the outbreak phase of the populations and thus potential relationships for declining and low-density populations remained unknown.

More recent studies by Bouchard et al. (2018) of low-density populations using experimentally introduced sentinel larvae found that parasitism was compensatory between parasite species, varied among years and locations, and was higher in warmer areas; also temporal variation in parasitism was not related to temporal variation in SBW.. An Allee effect related to reduced mate finding could also have an influence on reproductive success in low density populations (Régnière et al. 2013).

While key factor analysis has been widely used, Bellows et al. (1992) pointed out that the identification of a key factor does not necessarily identify the factor or factors that regulate population densities. A recent review of population studies of Canadian forest insects (Johns et al. 2016) found that 12 life table studies have been done on 7 species that involved key factor analysis. They concluded, however, that the approach has been largely abandoned after Royama (1996) showed statistical and logical issues with the technique.

Functional responses and endemic populations

In the same general time that Wellington was investigating the relationships between weather and SBW population dynamics, and Morris was developing the key factor analysis, C.S. Holling was describing the relationships between insect prey and vertebrate predators (Holling 1959*a*, 1959*b*), and insect hosts and parasitoids. Three basic patterns between prey capture and prey density were described both graphically (Type I, II, and III) (insert, Figure 2) and numerically. While these patterns are presented as being distinct, they represent a continuum (Denny 2014). Both Type I and Type II responses are described by equations that are special cases of the Type III expression. If predators followed the sigmoidal Type III functional response of Holling, the relationship between the number of larvae in N_t and N_{t+1}, the recruitment curve of Ricker (1954) (Figure 2), would indicate the possibility of a stable equilibrium at lower density associated with predation, a "predator pit". A lower unstable equilibrium "release" point related to the effects of low parasitism, good weather or available host trees would be the point at which the outbreak begins, and a high density "stable" equilibrium related to defoliation of the food supply would occur if the trees responded to reduced larval density (Berryman 1987). If tree mortality reduces food availability, the larval population could fall back into the predator pit.

How well SBW dynamics fit this scenario is unclear. Although the impact of parasitoids could increase with host density following a Type 2 response, parasitism was not a key factor in the increasing phase of SBW dynamics described by Morris (1963). Royama (1984) recognized that what appears to be a sudden eruption of a population following a period of low density looks quite different if plotted appropriately on a log scale rather than an arithmetic scale (see Figure 1 for log scale). Thus, a long period of low density that might be predicted if a predator pit were operating does not seem to occur.

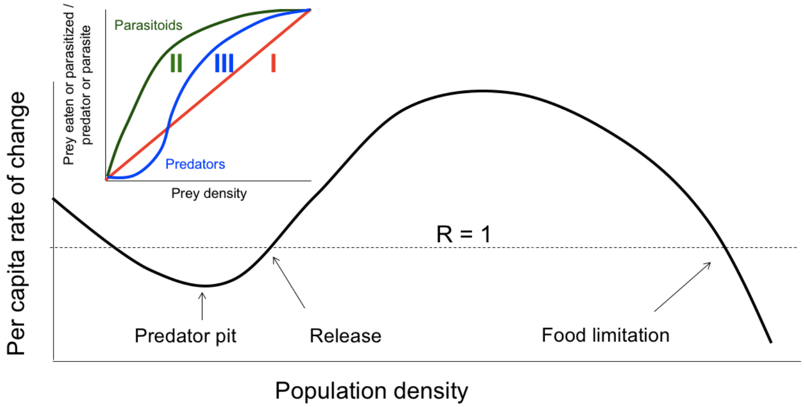


Figure 2. Recruitment curve after Berryman (1987) with the insert showing the functional responses described by Holling (1959*a*, 1959*b*).

Stability and resilience

The concepts of equilibrium theory and stability arose out of the field of forest insect ecology. The SBW dynamics described above clearly contributed to Holling's treatise on stability and resilience (Holling 1973). Holling proposed that SBW is highly unstable as indicated by its outbreak dynamics, but also the system is resilient because SBW defoliation prevents the forest from being dominated by balsam fir. Although fir suffers greater mortality from SBW attack than spruce, it also regenerates more rapidly than spruce and birch that are non-favoured host trees (Baskerville 1975). Even though SBW comes and goes, the forest composition is maintained over the long run.

While the details of budworm oscillations may not have been totally clear in 1973, the dramatic pattern of outbreaks of this defoliating insect certainly demonstrates that a simple equilibrium view of the world does not hold. But it is debatable as to whether regular population oscillations themselves equate to a form of ecosystem stability (Bouchard et al. 2006).

Models of population dynamics

The development of mathematical ecology and modelling of population dynamics was greatly advanced by forest insect ecologists. During the 1920s and 1930s deterministic models were developed for some insect systems (e.g., Thompson 1930, Nicholson 1933), but these were not realistic. With the availability of computers more realistic models of the interactions of predators, parasitoids, insects and host trees were feasible.

K.E.F. Watt, who was with the Statistical Research Service of the Canadian Department of Forestry, was a pioneer in developing models for insect pest control. His first mathematical model was published in 1959 (Watt 1959) and in the following years (Watt 1961, Watt 1962) he wrote about the use of mathematics in population ecology (but see Royama [1971] for a critique of this work). In the Memoir edited by Morris (Morris 1963), Watt developed a multiple regression model that showed that larval parasitism was not related to the level of larval survival during the epidemic phase of population growth.

Later computer models were designed to test the influences of various measures for SBW control. Watt (1964) predicted that applying control measures as moth populations were increasing would be more effective than when populations were at peak density. This is the basis for the early intervention program now in place in New Brunswick (Rob Johns, personal communication, and Pureswaran et al. 2016).

Recently (Sturtevant et al. 2015), reviewed 15 models of SBW population dynamics. The early models, inspired largely by Morris and Watt (Morris 1963) and later Jones (1977) (cited by Sturtevant et al. 2015). These considered the population dynamics to be eruptive with multiple equilibria, for example, long periods of low density followed by SBW population outbreak, defoliation, tree death, and moth decline. One of the most highly cited models (Ludwig et al. 1978) had three main components: larval density, foliage density, and (mature) tree density. Larval density increased rapidly and tree recovery was slow. The population dynamics produced by this simulation model were cyclic but not realistic as the duration of the period of moth outbreak was very short as compared to the longer periods of outbreak in field data (Figure 1 and also Myers [1988]). The decline in larval survival in the model was attributed to tree death even though tree mortality is not a consistent characteristic of declining moth populations (Royama 1984). Ludwig et al. (1978) concluded that "the analytic model is likely to extend our understanding of the phenomena (SBW population dynamics), since the full armory of mathematical techniques is available". No testable predictions were given to aid the understanding or predictability of SBW outbreaks although it would seem that if the model were correct, protecting forests with spray programs would prolong the outbreaks. History shows that this view is over simplified and other insect mortality factors during the decline must be considered (Pureswaran et al. 2016).

By 1984 Royama realized that the eruptive paradigm of SBW population dynamics was inaccurate and developed a second-order, density-dependent model that he proposed was a better description of SBW dynamics (Royama 1984). This model focused on mortality of the third to sixth instar larvae, with parasitoids, disease and an unknown mortality factor being the driving variables. Predation, weather, food shortage and larval dispersal are density-independent factors. This has been described as the "Oscillatory hypothesis" (Pureswaran et al. 2016).

In conclusion, without integrating defoliation and forest composition, as well as density related mortality as factors influencing SBW dynamics, models will be incomplete. Régnière and Nealis (2007) analyzed 15 years of sampling data from Ontario and Quebec and showed that defoliation influenced both moth fecundity and larval survival. Creating cyclic dynamics with mathematical models such as with the Ludwig et al. (1978) model is "not a predictive tool, nor could the assumptions be subjected to statistical tests" (Ludwig personal communication). Whether it promoted ecological understanding I think is debatable but the model is widely cited (Table 1). The process-oriented simulation of SBW feeding on white spruce and balsam fir by Régnière and You (1991) is a step in the right direction as it can be used to predict defoliation from SBW density. Thus, even to this day, more and more complex modelling of forest insect systems continues to attempt to explain the observed population dynamics.

Dispersal

The most difficult process to quantify in a population study is dispersal, yet it is key to understanding the dynamics of cyclic populations. Observations of the mass dispersal of SBW moths extend back to the 1912 outbreak in which additional street cleaners were required to sweep up dead moths in New Brunswick (Morris and Mott 1963). Dispersal of SBW can occur by adults, first instar larvae after emergence from the eggs, and by second instar larvae when they emerge from their hibernacula. Early studies showed dispersal of moths away from trees when defoliation was high (Morris and Mott 1963), little impact of dispersal of large larvae, but more more significant dispersal, related to egg density, of small larvae among plots. Greenbank (1963) also recorded unexpected increases and declines in the number of egg batches in plots that could only be explained by immigration or emigration of moths. This phenomenon continues to be recognized as being important to the population dynamics (Régnière and Nealis 2007).

As technologies developed, studies of moth dispersal became more elaborate. Between 1970 and 1973 observations of moth flights were made from platforms, helicopters and fixed-wing aircraft (Greenbank 1973). This led to a much more extensive study using radar systems, a night-viewing telescope for observing moths taking off after dark, Doppler-equipped aircraft for the exploration of wind patterns, and aircraft with specially designed insect collecting nets to sample airborne moths (Greenbank et al. 1980). This work showed that moths emigrate from the forest canopy in vast numbers with dispersal flights at altitudes of 100-300 m and lasting for several hours between 7 and 10 PM. Moths were often concentrated by convergent wind fields and travelled from tens to hundreds of kilometers, depending on wind conditions. Landing sites tended to be localized and to change temporally. This expensive and unique project showed that dispersal varied temporally and, surprisingly, was greater on nights of widespread and heavy rain (Dickison et al. 1986).

The observed redistribution of moths may be an important factor in synchronizing outbreaks of SBW among areas, but Royama et al. (2005) concluded that because moth dispersal is not a diffusion process, as proposed by Williams and Liebhold (2000), a weather-driven Moran effect is required to synchronize populations. Based on pheromone trapping of male moths over 28 years, such weather associations have been shown to be related to the synchrony in variation among SBW populations in Quebec (Bouchard et al. 2018). Recent work reports genetic similarity among outbreak populations of SBW, indicating high gene flow (James et al. 2015).

In conclusion, moth movement, influenced by wind, temperature and forest conditions, is important for maintaining genetic homogeneity and potentially synchronizing population densities among sites with different forest characteristics (Candau et al. 1998, Nealis 2016). Models of dispersal of SBW are continuing to be developed (Sturtevant et al. 2013). Similarly, high dispersal and genetic homogeneity appear to be characteristics of all cyclic species that have been analyzed (Myers 2018).

Contribution of ecology to the control of spruce budworm

The focus on SBW as a study species stemmed from the need to develop management strategies for this outbreak species. Early work focused on the population ecology of SBW with the underlying idea that if the factors that influenced the density of populations could be understood, some clue to controlling populations might be revealed. The SBW system is an example of adaptations between forests and insects, and management aimed at disrupting the stability of this system is unlikely to be sustainable and thus "ecologic resilience does not imply economic stability" (Baskerville 1975).

The distribution of SBW in North America extends across the Boreal Forest from the west coast to the east coast. Thus, the areas attacked by SBW are heterogeneous in their histories and bioclimatic conditions. This is reflected in the spatial patterns of SBW outbreaks that show considerable geographic variation in their length and severity (Candau and Fleming 2005, Zhao et al. 2014). Heterogeneity among sites and the difficulties with scaling up models based on smaller spatial scales (Fleming et al. 2002) create a mismatch between results of detailed ecological studies and large scale projections of SBW dynamics. The dispersal of SBW moths that has been observed is a major factor in determining population dynamics but it remains unpredictable in when and where it will occur.

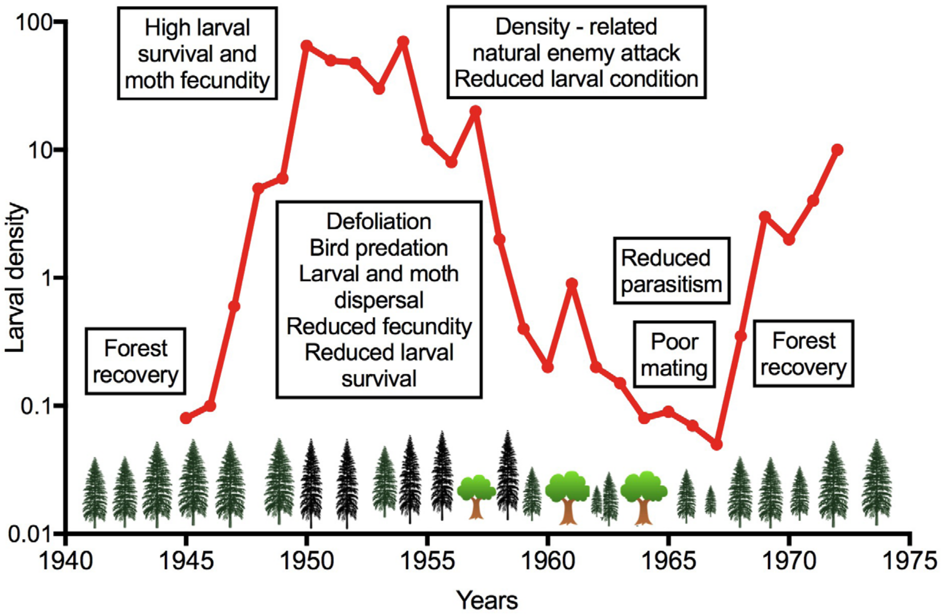


Figure 3. Summary of processes influencing SBW (Régnière and Nealis 2007; Royama et al. 2005) are outlined on a SBW population trend from Royama (1984).

Conclusion

For over 90 years the eastern spruce budworm has been the focus of ecological study in North America. The interactions between SBW, their myriad natural enemies (Eveleigh et al. 2007), and trophic interactions with their host trees (review in Nealis 2016) are well studied. While much is known about the details of SBW dynamics (Figure 3), the ecological principles developed from the extensive and innovative research have contributed to population ecology in general and to the study of cyclic forest Lepidoptera in particular. Table 1 outlines some of these advances and indicates through citations the relevance of particular work to further research on this species and others. Some of the ecological advances such as key factor analysis have not stood the test of time. Other advances such as functional responses and ideas about stability and resilience have continued to be developed and applied to many systems. There is no question that Canada has a proud heritage of insect ecology that has been particularly developed from the challenges of SBW outbreaks.

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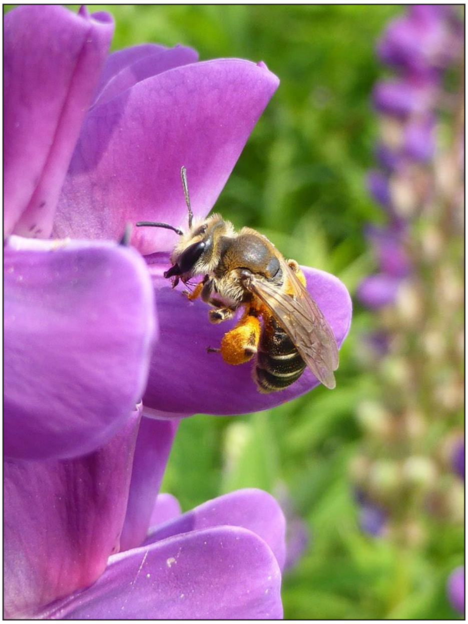


C. Sheffield

Andrena wilkella (Hymenoptera, Andrenidae) on Lupine (*Lupinus*), PEI

Special features / Articles spéciaux

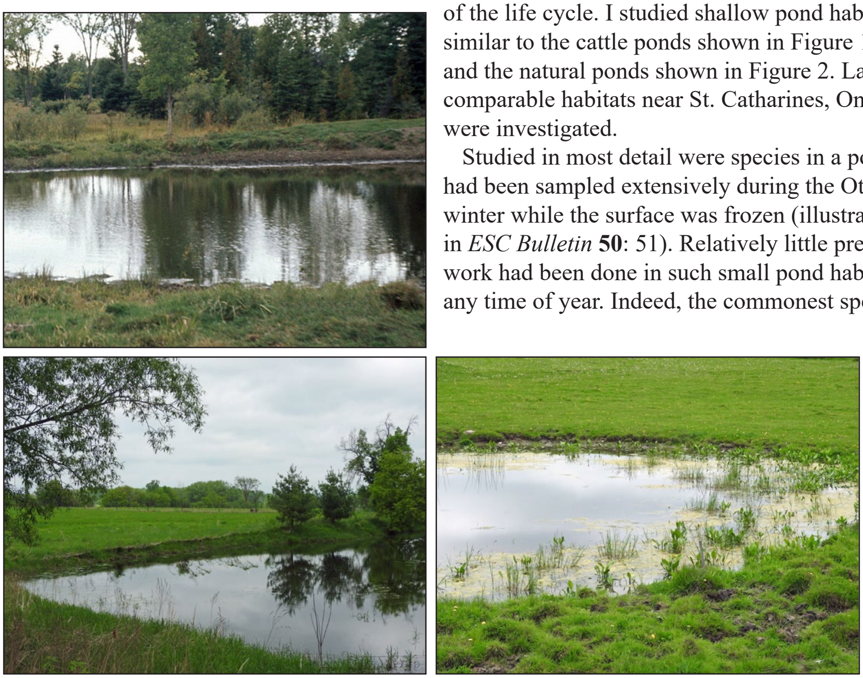
Wider aspects of a career in entomology. 5. Spring to fall research in Canada

Hugh V. Danks

This series of articles outlines some ancillary aspects of my entomological career, for the potential amusement of readers. It reports the sometimes unexpected challenges of working in new places and in the real world, an approach that serves also to expose some conclusions about research activities and some information about insects and their environments.

My work at the Entomology Research Institute in Ottawa on the cold-hardiness of larvae of chironomid midges (introduced by the winter and arctic themes of previous articles in this series [ESC *Bulletin* **50**: 25, 50, 115, 173]) was extended into warmer seasons by exploring other parts of the life cycle. I studied shallow pond habitats, similar to the cattle ponds shown in Figure 1 and the natural ponds shown in Figure 2. Later, comparable habitats near St. Catharines, Ontario, were investigated.

Studied in most detail were species in a pond that had been sampled extensively during the Ottawa winter while the surface was frozen (illustrated in *ESC Bulletin* **50**: 51). Relatively little previous work had been done in such small pond habitats at any time of year. Indeed, the commonest species



H. Danks

H. Danks

H. Danks

Figure 1. Shallow cattle ponds near Ottawa, representative of habitats sampled during the research noted here.

Hugh Danks (hughdanks@yahoo.ca) retired in 2007 after many years as head of the Biological Survey of Canada. In that role, he helped to coordinate work on the composition and characteristics of the arthropod fauna of the country, and to summarize the results. In addition, his research studied cold-hardiness, diapause, and other adaptations to seasonality in northern regions.

H. Danks

H. Danks

H. Danks

Figure 2. Natural ponds near Ottawa, similar to those sampled during research.

there, which was my main focus, even required taxonomic description so that the ecological and other work could be referenced. This finding emphasizes the fact, visible more widely, that many components of the Canadian fauna are not well known.

The substrate of the pond was composed of very fine muck, making it difficult to sort. Therefore, an initial challenge was how to separate chironomid larvae from the millions of tiny substrate particles. This sorting was done by flotation with sugar solution: concentrated solutions of sugar are so dense that they cause insect larvae to float to the surface. I was anxious to learn what the habitat would yield, because it had been chosen in the hope that larvae were abundant. I stirred the first sample into the solution and waited briefly as the mixture swirled. Suddenly, dozens of larvae burst to the surface and lashed about, confirming the abundance of material in the pond.

During summer, some of the smallest particles were first removed by sieving each sample through a net of very fine mesh. It was not practicable to process an adequate number of samples without this step, although many first-instar and some second-instar larvae were also removed. Many research decisions require compromises of this sort: in this instance, a comprehensive assessment of spatial and temporal variation in larger larvae was more important than retaining every small larva.

Substantial amounts of sugar are needed for flotation (cf. Figure 3). Granulated sugar is a relatively harmless laboratory substance, but the strong solution used for sorting sometimes proved troublesome. For example, an unnoticed spill that had not been cleaned promptly off the floor turned into something resembling a huge sticky-trap, entangling the feet of unsuspecting pedestrians, including me, on more than one occasion. Once, I failed

H. Danks

Figure 3. Granulated sugar measured out into a dish to make a solution for sorting chironomid larvae from a substrate sample by flotation (about 2 cups [475 ml]). An effective solution is obtained by adding about twice this volume of water, for a specific gravity of 1.12.

to notice that some solution had spilled on to my pants. Those particular pants could not be washed because they were made of wool, and so in due course were dry cleaned. When I went to pick them up, the dry cleaner took great pride in regaling me with the story of how he had fought valiantly to get the garment spotlessly clean, trying multiple techniques to remove one especially stubborn stain. Finally, he had succeeded—using hot water. I thought it politic to congratulate him on his expert work without mentioning my use of sugar solution.

The pond bottom was sampled with a brass corer. A soft rubber cap was applied before the corer was withdrawn, sealing the top end to limit disturbance of the substrate. The lower end was sealed with a styrofoam plug before the corer was lifted from the water. This procedure not only prevented loss of any of the sample, but also allowed each core to be pushed out in sections, so that larvae in the surface layers could be distinguished from those located more deeply. In the winter, when the pond was covered by ice, the corer had been carefully applied to the substrate by hand to ensure that samples were undisturbed and accurately confined to layers that might be inhabited. In summer, extensive growth of the alga *Chara* in the pond made similar precise sampling very difficult and time-consuming, but this extra effort was necessary to capitalize on the winter work. It is always essential to concentrate during research to ensure that procedures are optimized and followed closely—avoiding any lapse into a robotic state induced by repetitive chores.

Emergence traps were deployed to monitor adults (Figure 4). I also visited the pond at dusk during the period of adult activity to observe oviposition and to catch some females, which readily laid egg-batches in the laboratory. There is no substitute for observations of living insects in the field to understand the species under study. Field observations are therapeutic too, because the excitement of watching insects in nature helps to compensate for the heavy burden of chores required in research. In fact, because worthwhile data depend on these chores, researchers use their full knowledge and training only a small fraction of the time.

H. Danks

Figure 4. Floating emergence traps on the main study pond in Ottawa, 1970.

A useful technique for associating the larvae and pupae of chironomids with their adult stages (favouring identification) is to place individual larvae that have finished feeding into vials with a little water. These larvae can be recognized because the thorax is slightly swollen prior to pupation. Daily checks reveal if any adults have emerged. Larvae in that stage were so easy to find in the spring that I was tempted into setting up too many vials, adding another seemingly endless commitment of daily checking to the burden of research-related chores.

The reward for these labours became apparent later, however. Studying several species in the same pond showed that each one had its own characteristic seasonality, preferred water depth, and other features. Studying many components of the life cycle of a single species revealed interesting patterns and linkages in seasonal timing, larval distribution, population size, and other elements, few of them fully documented for any species.

That particular species had only one generation per year, and adult emergence was strikingly synchronized in spring. Females could produce more than one egg mass. More larvae occupied central than peripheral areas, although there was some movement in response to seasonal changes in depth. Larvae penetrated into deeper substrate layers and curtailed development not only during the cold winter but also in late summer. Many winter larvae made special sealed winter cocoons that were very different from the summer cases. Apparently, these cocoons protected larvae from mechanical injury by surrounding ice, and were not made until the water temperature fell close to the freezing point.

From this pond, which occupied only 800 square metres at the spring maximum (and much less after the summer), at least 145,000 adults of this species emerged during a period of only one week, although more than 9 million larvae inhabited it in the third instar. However, there were substantial year-to-year differences in the population levels and in the instars reached before winter, although development continued into November after the late summer lull.

These findings reinforce the lesson that a great deal of detailed information is required to understand the natural history even of a single species. The need for proper detail is underappreciated, in entomology as in other fields. Emphasis has often been placed instead on deriving some kind of index to interpret the world with minimal effort, and without any need for comprehensive knowledge. Most of these shortcuts have misled scientists for years until proven to be of limited application, or even worthless. By the same token, the potential for differences from year to year, and from one habitat or subhabitat to another, is not always recognized.

As summer turned to fall, I continued to monitor the larvae in the study pond after the seasonal emergence of every species had ended. On one typical day, fieldwork was scheduled to begin in the morning, leaving enough time to sort the samples in the laboratory the same day. However, as I drew close to the pond the road was suddenly lined with a large number of burly gentlemen, standing near well-used pickup trucks, wearing camouflage vests, and carrying rifles. The deer-hunting season had begun[1]. Some hunters identify their quarry with insufficient care before shooting, making simultaneous occupation of hunting areas hazardous. I decided that sampling was not so urgent after all! Several hours later, the hunters had gone and it was possible to complete the sampling.

Typical study ponds had shallow basins, but one habitat in St. Catharines was larger and deeper than the rest. Therefore, an old canoe was left beside it to use during sampling. The pond was on private property and out of sight of the road, but even so someone took a ride in the canoe, and in addition amused themselves by sinking the emergence traps after removing the floats. Fortunately, because the water was only a few metres deep, an Ekman dredge could be used as a grab to recover the traps, though not the sampled adults. Many of my research projects over the

[1] Hunter orange was not required in Ontario until 1997.

years have suffered disruptions, usually much more significant than this one, delivering the message that it is unwise to promise results too early in a project.

That pond in St. Catharines was unusually exposed, and so the traps were difficult to empty when it was raining hard. The heaviest rain often seemed to start just as sampling was scheduled—one component of Murphy's Law of Fieldwork! The impact of the rain was doubled when the wind was strong, and windy conditions also made it difficult to control the canoe single-handed whilst emptying emergence traps or taking bottom samples.

Fortunately, I had gained a good deal of paddling practice during a previous summer as part of a project to sample a number of large lakes near Ottawa. On those occasions, my small car transported a heavy fibreglass freight canoe, which was large enough to carry the two summer students who accompanied me. One evening, as I drove back towards Ottawa, three deer leapt out of the woods just in front of us. At that time, it was not unusual to see a mattress, a sheet of plywood, or a piece of siding hand-held on to the roof of a car, from which a gust of wind or a sudden manoeuvre might launch the item from its platform to sail away into adjacent traffic like a giant Frisbee. However, the canoe was properly secured and did not move during our abrupt emergency stop, serving as a reminder that safe procedures are important throughout research work, not just during the sampling itself (including the life-jackets that were mandatory in this project).

Cattle ponds, such as those shown in Figure 1, provided water to the stock. In turn, nutrient-rich deposits contributed by the animals made the ponds highly eutrophic, supporting substantial populations of chironomids. Cattle were sometimes present during sampling (cf. Figure 5). I was not always convinced that they were only curious, or that they were friendly; now and again, young bulls would make mock charges. Subsequently, I heard about an Australian stockman who, when told that this behaviour merely showed that the animals wanted to play, replied that he would play with them all right—with a crowbar!

H. Ryan (USFWS)

Figure 5. Cattle looking at a visitor to their pasture.

At one site, a calf had died after being trapped in mud exposed at the edge of the pond as the water receded during summer. I avoided further sampling from that especially muddy shore lest I meet the same fate! The dead calf was already starting to bloat, and I alerted the owners (who initially had given permission to access the property, of course). Apparently, they were not the most engaged herdsmen. "Oh yes," one of them said, "I remember we heard the cow bellowing the other day." The body was not removed until several days later.

Samples in addition to substrate cores were sometimes taken to obtain larvae for rearing and experiments. Usually I worked alone, but a technician from the Entomology Research Institute once helped me to collect qualitative samples from a pond that was well used by the local cattle. The technician seemed to wear an unusual grin as he handed me one of the many samples for labelling; and on the journey back to the laboratory he made particular reference to "Sample 4". I concluded during sorting that the sample had been drawn entirely from a submerged, recently deposited, cow pat—a subhabitat unlikely to contain insect larvae...

The abundance of larval chironomids in typical samples from ponds of this sort permitted experiments with large numbers of larvae and appropriate numbers of replicates. At St. Catharines, laboratory experiments on larval development and life-cycle control were conducted in four environmental cabinets. Inside the cabinets, sets of larvae were relatively easy to rear using a shallow depth of water in petri dishes and a diet based on dry dog treats. Each cabinet was labelled with the respective conditions of temperature and photoperiod to which the larvae were exposed, such as 25°C/16L:8D.

I shared that laboratory with another faculty member. In his area at the other end of the room he had several constant-temperature cabinets too, but he had labelled the doors with human forenames, including "Percy" (for the manufacturer Percival) and others far too clever for me to remember now. Almost every time we met, he asked me when I was going to label my own units. Eventually, I mentioned to him while we were in another part of the building that individual designations had indeed been applied to my cabinets. He rushed away to see them: the labels read A, B, C, and D.

Recently, I revisited some of my sites near Ottawa that were examined about 50 years ago. All of the ponds that had received more than preliminary study were now modified beyond recognition or destroyed by housing and other developments, as the population of the city and its surroundings grew from about 580,000 people to nearly 1.4 million.

Many other changes took place in Ottawa over the same period. Several of them have links to entomology. For example, nearly all of the city's large elm trees succumbed to bark-beetle-transmitted Dutch elm disease in the 1970s and 1980s, including more than 100,000 on public property. In particular, a striking tree tunnel of magnificent elms along the National Capital Commission driveway through the Central Experimental Farm was gradually destroyed, and the replacement trees are still much smaller than the original graceful giants.

The aspect of many suburban roads lined by mature trees has also been markedly impoverished over the past few years because numerous tall ash trees killed by the emerald ash borer had to be removed, a task lasting several years because about 140,000 publicly owned trees were affected in these and other locations. This tally included ash trees that had been planted to replace some of the missing elms.

Finally, my more recent appearance differs somewhat from the way I looked during my early projects in the city (Figure 6)!

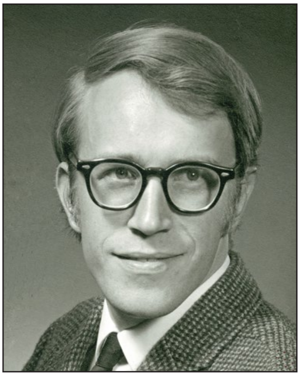


Figure 6. Author Hugh Danks in Ottawa during 1971.

Feeding mycotoxin-contaminated wheat to insect larvae (*Tenebrio molitor*) as a strategy to use *Fusarium*-damaged grain and generate a safe protein replacement for animal feed.

Carlos Ochoa-Sanabria

Introduction

For the Food and Agriculture Organization (FAO), feeding the increasing world population is paramount, ensuring both food security and safety (FAO 2009). With rapid population growth, there is the need to increase worldwide food supplies, particularly animal derived products such as meat. To achieve this goal, livestock producers need to increase animal production, guaranteeing access to healthy and yet affordable food. It sounds simple, but the reality is quite different. Often, farmers are challenged with many obstacles that impede optimal production of livestock, thus negatively affecting the efficiency of the production system. These challenges include animal sickness, sporadic outbreaks of disease, and fluctuations in the price of ingredients for animal feed. Notably, the latter has become a major concern as feed represents an important portion of the total cost of livestock production. Meat supplies have increased, but so have the prices of conventional sources of protein such as fish meal and soybean meal (Asche et al. 2013). Consequently, the scarcity of these ingredients further increases their cost, and leads to the overuse of natural resources such as land and ocean reserves (Sánchez-Muros et al. 2016). For these reasons, novel, inexpensive and more sustainable sources of protein are required to support the high demand for animal feed and aid in increasing global food production (Grau et al. 2017).

The use of edible insects as a protein replacement for human and animal diets has been reported (Siemianowska et al. 2013, Sánchez-Muros et al. 2016, Smetana et al. 2016, Grau et al. 2017). Insects contain high-quality protein (~50%) and are a rich source of fatty acids (~35%), making edible species the perfect candidate to replace the scare and costly protein ingredients for livestock (Gasco et al. 2016). However, the insects' nutritional content is not the only advantage of including them in animal diets. Bovera et al. (2015) and Sánchez-Muros et al. (2016) demonstrated that the inclusion of *Tenebrio molitor* (yellow mealworm) in poultry and fish diets has also improved both performance and health. The chitin contained in the larval exoskeleton also enhanced the immune system of broiler chicks infected with *Escherischia coli* and *Salmonella* spp. (Islam and Yang 2017). Additionally, rearing edible insects may offer a more environmentally sustainable option compared to conventional protein production (Smetana et al. 2016). According to Grau et al. (2017), to produce 1 kg of edible mealworm meal requires 75% less land and 3.5 times less water than to produce 1 kg of beef or poultry.

One of the most appealing facts about farming edible insects is their resilience to grow under poor nutritional conditions and yet succeed and reproduce (Oonincx et al. 2015, Van Broekhoven et al. 2015). This ability makes it possible for insects to convert materials that are unusable by livestock/humans into edible protein. For example, research has shown that yellow mealworm larvae can tolerate ingesting wheat infected with *Fusarium* fungi (Guo et al. 2014, Van

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Broekhoven et al. 2017). Some *Fusarium* species produce fungal metabolites called mycotoxins that cause toxicity if consumed by livestock or humans. When yellow mealworms were fed mycotoxin-contaminated grain, there was minimal to no effect on larval performance and survival. In fact, under these circumstances larvae increased body weight and had low to undetectable concentrations of deoxynivalenol (DON), one of the most prevalent *Fusarium* mycotoxins in grains (Guo et al. 2014, Van Broekhoven et al. 2017, Ochoa-Sanabria 2018).

High levels of DON-contamination in grains has become a major concern regarding food safety and animal health. As the worldwide incidence of this mycotoxin has increased, grain producers receive lower prices or nothing for *Fusarium*-infected and/or mycotoxin-contaminated grain. Unusable or salvage grain needs to be disposed of, which traditionally involves burning or burying it, affecting the environment negatively. We aimed to determine if salvage (no monetary value) grain contaminated with DON could be used as feed for mealworm farming. Additionally, we wanted to evaluate whether or not mealworms reared on this wheat could be a safe, inexpensive, and sustainable alternative of protein for animal feed.

Experimental set up

The main objectives of this research were to determine the effect of different concentrations of DON on yellow mealworm larvae production traits and nutritional value, and whether they could convert the mycotoxin-contaminated wheat into a safe source of protein. To achieve this, two sources of wheat were obtained and tested for mycotoxin content. The first source had 200 µg/kg of naturally occurring DON and was used as the control diet as this is very low. The second wheat source contained 8,000 µg/kg of DON and was sorted into six fractions using a BoMill® grain sorter. Thereafter, these fractions were mixed to obtain the three levels of DON-contaminated grain: low (2,000 µg/kg), medium (10,000 µg/kg) and high (12,000 µg/kg). The four dietary treatments were fed to larvae (7-9th instar, Park et al. 2014) in both feeding and breeding trials. Additionally, a preference trial was performed to determine avoidance or attraction behaviour from mealworm larvae to any of the four treatments.

The feeding trial: Six thousand larvae were allocated in groups of 300 into plastic drawers (25 x 15 x 5 cm). There were five replicates per diet. Productions traits such as survival, larval weight at the end of the experiment, average daily gain (ADG), feed conversion ratio (FCR), efficiency of conversion of ingested food (ECI), and protein efficiency ratio (PER) were measured. ADG is the rate of weight gain per day, and FCR the amount of food that larvae required to increase a unit of weight (mg). The ECI determined how much of the food ingested was converted into insect mass, whereas PER determined how much of the dietary protein was transformed into body weight. The endpoint was determined when the first two pupae were observed in a replicate.

The breeding trial: This trial was conducted concurrently with the feeding trial. Here, a total of 4000 larvae, in groups of 200, were placed into each plastic drawer (25 x 15 x 5 cm). There were five replicates per diet. In this trial we evaluated survival and final weight (at the end of the experiment) of larvae, pupae, and beetles as well as the weight of 200 larvae, 50 pupae and 100 beetles from a second generation of mealworms. The experiment was ended when the first two pupae were observed in a replicate.

The preference trial: In this trial, 30 naïve larvae (never exposed to DON-contaminated wheat) were exposed to the experimental diets. Three petri dishes, the replicates, were each divided into four quadrants containing 20 g of the respective diet. Then, 10 larvae were placed in the centre of the dish and left in a dark quiet environment for 30 minutes. After this time, larvae remaining in each quadrant were counted, and the whole process was repeated 20 times.

When each trial was completed, the larvae in the trial were starved for 24 hours and the frass was collected to determine if DON was being excreted. Thereafter, larvae were frozen, freeze-dried, and ground up, enabling analysis of mycotoxins and nutritional content to be performed. The samples of frass were also analysed for mycotoxins. The toxicological analysis included 14 common mycotoxins regularly tested for in Canadian grain, while the nutritional chemical analysis measured crude protein, crude fat, ash, fiber, chitin content, essential amino acids and fatty acids.

Results and Discussion

Only two mycotoxins were detected in the grain, larvae and frass; these were DON, and an acetylated form of DON known as 3-acetyldeoxynivalenol (3-ADON). The concentration of DON in larvae fed wheat containing the highest level (12,000 µg/kg) was 131.0±23.6 µg/kg. DON excretion (in frass) increased with concentration of ingested DON, suggesting that DON is partially eliminated through faeces. There was no difference in concentration of DON detected in the larvae fed the four DON-containing diets. Higher concentrations of 3-ADON were detected in frass than in the larvae, indicating that DON may be partially metabolized into the acetylated form 3-ADON and other unknown compounds.

A nutritional analysis of the mealworm meal was performed per diet using pooled samples of replicates, therefore no statistical analysis could be performed. There was minor variation in these parameters among the four diets. Thus, feeding contaminated wheat with up to 12,000 µg/kg DON had minimal effect on the nutritional profile of the mealworms. In this study, the larval crude protein value was 50%, crude fat 35%, ash (inorganic constituents such as minerals) 3.4%, fiber 5.4% and chitin content 2.7%. These values were similar to those previously reported in mealworms fed grain crumbs, ethanol residues or bakery by-products (Ghaly and Alkoaik 2009, Ravzanaadii et al. 2012, Van Broekhoven et al. 2015).

In the feeding trial, the lowest survival was 96.4±2.5% with no significant differences observed among the treatments. Similarly, there was no differences among treatments in terms of ADG where mealworms gained 2.02±0.11 mg/day. Conversely, FCR, ECI and PER showed significant differences between control and low, control with low and medium, and control and low with medium and high, respectively. The differences detected in FCR, ECI, and PER may be due to the differences between the two sources of wheat. In practical terms, these results may not affect mealworm production parameters, and therefore mycotoxin-contaminated grain could be considered in the farming of this insect. In the breeding trial, pupal survival was the only trait that showed a difference, but that being said the lowest survival rate was 96.9±0.9%. This is unlikely to be much of a concern for farming yellow mealworms. Mortality at any stage of life could be caused by other factors such as cannibalism, food competition or physiological responses to the diets (Weaver et al. 1989). Second generation beetles fed the control diet weighed more than those exposed to the low, medium and high diets. This could be a consequence of the nutritional differences between the two sources of wheat, and their assimilation by the mealworm midgut microbiota (Pimentel et al. 2017). When we compared larvae from the first-generation with those from the second-generation, individuals from the latter weighed more. This variation might be due to the longer exposure time that second-generation larvae had to the treatments (egg to adult) compared with the first generation. Another reason may be the effect that a higher population density has on larvae from second-generation. Weaver and McFarlane (1990) reported higher weights when larvae were exposed to higher (optimal), but not crowded densities. No attraction or avoidance behaviour was observed from the naïve larvae to any of the diets in our preference trial.

In conclusion, wheat contaminated with DON with concentrations up to 12,000 µg/kg may offer a source of food for insect farming. Due to the low accumulation of DON in larvae, and the minimal to no effects observed on productivity or nutritional composition, larvae reared under these conditions may be considered as a safe, inexpensive, and sustainable source of protein for animal feed.

Future Directions

The modern world has renewed its interest in the ancient practice of eating insects. This practice, also known as entomophagy, has been used by humans since the Palaeolithic era (2.6 million years ago), as insects offered nutritional satisfaction and were readily available (Van Huis 2017). However, views on insects changed over time from offering dietary benefits to be characterized as 'dirt crawlers'. As farming practices evolved for crops and livestock production, the search for food resources became less onerous. Subsequently, insects were no longer included as food sources despite their nutritional value. Notwithstanding, human beings progressed and proclaimed themselves as the most dominant of the species on earth. However, they did not take into consideration that this dominance came with consequences such as overpopulation.

The world's population is expected to increase up to 34% by 2050, and thus current sources of protein will no longer be enough to satisfy this demand. The use of insects, reared on waste or low value crops, will help to provide a sustainable source of protein for humans and/or animals. However, there are safety concerns with this practice as well. We have shown that minimal accumulation of DON occurred in larvae fed for 30 days on contaminated grain and therefore it should be possible to use mealworm meal as a replacement protein source for animal feed. However, unknown compounds could have been formed and sequestered in larvae as part of the metabolism of DON, and their effects on consumer health are unknown. Consequently, further research is needed to evaluate the dynamic of these elements and their impact on animals. Currently, our research group is evaluating the effect on health and performance of poultry fed mealworms reared on DON-contaminated wheat. Additionally, other co-contaminants found in grains, such as other mycotoxins, fertilizer residues or heavy metals, should be considered as they could negatively affect animal health and performance.

Before yellow mealworm meal can be used as a feed ingredient, it needs regulatory approval from the CFIA to guarantee its safety. The levels of DON detected in our yellow mealworm larvae are much lower than the CFIA regulatory limit allowed for poultry feed. As of today, the use of insect protein from species such as the black soldier fly (*Hermetia illucens*) has been accepted for chicken and fish diets in North America (Leung 2017). However, research is needed to support the approval of other insects such as yellow mealworms in poultry and fish diets, as well as to expand its use to other animal species. With our research, we hope to provide more information that regulatory agencies need to gain approval for the use of yellow mealworm meal. We also hope that mealworms reared on DON-contaminated wheat can be considered as a novel and clean ingredient for animal feed. By feeding mealworms contaminated grain, we are also providing a safer way to dispose of DON-contaminated feed and reduce the environmental footprint from conventional protein production.

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A remarkable emergence of the long-horned beetle *Meriellum proteus* (Kirby 1837) (Coleoptera, Cerambycidae) and presence of diverse Hymenoptera on white spruce logs

Robert E. Wrigley

Introduction

On a warm afternoon on 24 May 2018, I was sitting on my patio in Winnipeg with family members when a long-horned beetle landed on the table. Well aware of my interest in insects, my son quickly captured the beetle under his empty glass until I could secure it. The next day, my wife brought me two additional specimens cupped in her hands. Although I had collected numerous North American cerambycids, I was unfamiliar with this species — *Meriellum proteus* (Kirby 1837), Family Cerambycidae, Subfamily Cerambycinae. Haldeman (1847) used the name *Callidium proteus*, Blatchley (1910) the genus *Merium*, and Linsley (1957: 287) *Meriellum*.

The only species in the genus, this attractively coloured insect has an iridescent dark-purple head and pronotum (with two rounded glabrous spots), and dark-brown elytra highlighted by two interrupted, elevated, yellow costae running along each elytrum (diminishing distally) (Figure 1). Most specimens are a brilliant violet-purple on the posterior two-thirds of the elytra, which tends to fade after death, presumably due to deterioration of pigments. The legs

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Figure 1. *Meriellum proteus.*

A retired ecologist, Robert Wrigley (robertwrigley@mymts.net) obtained his BSc (zoology 1965) and MSc degrees (mammalogy 1967) from McGill University, and a PhD degree (systematics and biology of the woodland jumping mouse, Napaeozapus insignis, 1970) at the University of Illinois, Urbana-Champaign. He held the positions of Curator of Birds and Mammals, and later Museum Director, at the Manitoba Museum of Man and Nature (Winnipeg), Director of the Oak Hammock Marsh Interpretive Centre (Stonewall, Manitoba), and Curator of the Assiniboine Park Zoo (Winnipeg). He has been an amateur entomologist for 24 years and has gathered a personal collection of over 10,000 species of Coleoptera, including 786 species of Cerambycidae. He has donated many thousands of specimens to a number of Canadian institutions, and enjoys publishing the results of his field activities. In 2009 he received the Norman Criddle Award for his contributions as an amateur entomologist.

are delicately formed, with orange-red, moderately clavate femora. A detailed description was provided by Linsley (1964). This species was first illustrated by Kirby (1837) and a drawing by Knull (1946) was used subsequently by Linsley (1963), Hatch (1971), and Arnett (1985). Yanega (1996), Evans (2014), and Bousquet et al. (2017) included photographs and brief descriptions of this uncommon species. The website (http://inaturalist.nz) has several close-up photos that demonstrate the species' colour variation. Syntypes collected by W. Kirby are contained in the Natural History Museum, London. (Synonyms are provided in http://www.catalogueoflife.org/content/tools and citations are listed in http://madbif.mg/titan/sel_genann1.php?numero=4761). With three specimens appearing suddenly, I suspected the species must be emerging nearby, so I examined the 30 pieces of white spruce (*Picea glauca*) firewood (averaging 25 cm in diameter and 38 cm long) stacked next to the north outside wall of my garage, where they had been protected from the sun and rain by a roof overhang. I was astonished to see over a dozen of these beetles, running in start-stop fashion over the bark and cut ends of the logs. Then I noticed multiple sites of chewed bark, piles of freshly deposited frass, and hundreds of holes in the bark where the adult beetles had emerged. Several individuals were still sitting in their burrows with just their head and pronotum exposed, and two others were stuck and immobile all day between the bark and sapwood, until I finally released them. The emergence holes and beetle activity were concentrated in the top two layers (16 pieces) of the four layers of firewood. There were only 11 exit holes on the front cut ends, distributed from 1–7 cm in from the bark, which had required the beetles to mine long distances through the sapwood.

Gardiner (1975: 394) noted that this species was not ordinarily considered economically significant in causing degradation of blowdown spruce lumber, since its depth of penetration into the wood rarely exceeded 2.5 cm. However, it was capable of working extensively in very dry material long after its normal developmental period, and was thus a fairly frequent nuisance in homes and other buildings, emerging through walls and ceilings of buildings in northern Ontario. Craighead (1923) and Furniss and Carolin (1977) also stated that *M. proteus* may damage rustic woodwork and occasionally emerges through finished wood in buildings.

Emergence

After collecting over 200 beetles in just 2 days, I realized that many more would continue to emerge daily, so I began checking the logs many times during the day and into the night starting on May 26. In fact, I wore a path in the grass from so many trips to the log pile over the next 7 weeks! The beetles were considerably more active on warm afternoons, but some activity occurred from early morning into the evening down to 15 ˚C, and there was still limited activity and mating behaviour in the dark by the time I retired at night around 11:00 PM. On a number of occasions during the afternoon, evening and night, I could hear repeated rasping sounds (about six rasps, then a pause) emanating from the interior of certain logs, which I assumed came from the adults gnawing their way to the surface. Fresh piles of frass under emergence holes continued to appear as the study progressed. I peeled back the bark on one log and observed that burrows in the sapwood approached the cut end to within only 5 mm, as if the edge was too desiccated for feeding (Figure 2). Finding such large numbers of this species in my backyard surprised me, since I had never captured it before in over two decades of collecting, often in boreal forest with abundant spruce and pine trees. I learned subsequently through the literature and personal communications from several cerambycid specialists (cited below) that most studies of boreal-forest cerambycids have produced few or no specimens.

The commonly stated size for *Meriellum proteus* is 10-16 mm, with a female range of 12-16 mm, and males 10-14 mm (originally in Linsley 1964). The large series in my possession revealed a range of 8 to 18 mm: 9 to 18 mm for females and 8 to 15 mm for males. As is typical

Figure 2. Log with bark removed to illustrate burrows in the cambium layer. Note that mining activity ceases before reaching the cut end.

of cerambycids, males have longer antennae than females, extending to the posterior leg in males when the specimen is pinned and barely reaching past the middle leg in females. One fact I found interesting, considering that all the larvae had been feeding in the same spruce logs, was the great disparity in size, with large females having a biomass over five times that of small males. Perhaps the largest females and males found better nutrition by confining their feeding to the cambium layer, rather than mining into the sapwood.

The spruce logs were acquired from the next-door neighbour who had removed his only two live, mature white spruce, plus several bur oak (*Quercus macrocarpa*) and aspen poplar (*Populus tremuloides*), on his property in 2016. The spruce pieces had been drying at my place for the past 2 years. I did not notice any long-horned beetles emerging in 2017, but I did capture two buprestid beetles (*Chrysobothris femorata*) and a checkered beetle (*Enoclerus nigripes*) on or near the spruce. Gardiner (1975) reported small numbers of *M. proteus* in white spruce during the first 2 years after blowdown. In early June, 2018, I captured four other species of long-horned beetles in the vicinity of the firewood — *Saperda candida*, *Phymatodes dimidiatus, Anoplodera pubera*, and *Cyrtophorus verrucosus*. The latter species likely emerged from the bur oak logs — a known larval host (Lingafelter 2007). Other beetles found on the spruce logs were *Scolytus* sp. (Curculionidae), *Litargus tetraspilotus* (Mycetophagidae), and *Alphitobius diaperinus* (Tenebrionidae). A camel cricket (*Ceuthophilus maculatus*) and several flies and ants were also collected incidentally.

I placed pieces of ceramic tile on the tops of seven upper logs to provide the beetles with hiding sites to slow their dispersal, and to attract them into locations where I could easily secure them with my fingers. When I lifted each piece of tile, most beetles remained motionless and were well camouflaged against the bark. Others departed rapidly to escape the approach of my hand, but all refused to fly. I saw only three beetles on the wing — one of which flew off but promptly returned

Figure 3. Mating pair of *Meriellum proteus*.

to the log pile. I picked up one individual and it scrambled around on my hand for some time, as if searching for a place to hide, before finally deciding to fly, whereupon its flight was rapid and direct. This reluctance to escape by flying is in stark contrast to species of small, flower-feeding, long-horned beetles, which are quick to take evasive flight. The farthest I found specimens dispersing was 25 metres — one landed on my gazebo deck and one dead one was noted on a window sill.

When approaching the log pile, especially during warmer temperatures, I often observed several individuals running over the logs apparently searching for mates. Over the days I observed about 70 pairs coupled (Figure 3); occasionally two males were in pursuit of a female. As noted above, the males were considerably smaller than their female partners, and were often dragged along when the female attempted to escape. An 8-mm male of one such coupling (interrupted by me) had an exposed aedegus measuring 6 mm — almost equalling its body length. One night I used a flashlight to peer into cut-end burrows and observed the head of a wasp, which groomed excessively (perhaps stimulated by the strong light) and in another hole what appeared to be the head of *M. proteus*. Both withdrew when touched lightly with a stick.

In the many hours of observation, I saw only one individual that appeared to arrive from another location, but additional recruitment was certainly possible; I wondered if spruce volatiles and beetle pheromones had attracted some individuals from afar, or whether this large population had all emerged on-site from eggs laid by females the previous summer. On several warm afternoons and evenings in early June (at the height of emergence), I also observed a total of 28 beetles (7 at one time) running or mating on the trunk of a mature live white spruce 16 metres away; these individuals had likely dispersed from the log pile and were attracted to the first spruce they encountered. Saint-Germain et al. (2009) studied landing patterns of cerambycids, buprestids, and curculionids on black spruce (*Picea mariana*) in Quebec, and found one *M. proteus* among 10 species of cerambycids. Their tests indicated some level of pre-landing selection via host volatiles, plus frequent trial-and-error landings on suboptimal hosts or non-hosts. This would explain the presence of beetles attracted to the live spruce, as well as several other individuals that landed on my nearby patio, distant gazebo, and the back of my neck.

While mating on the spruce tree, pairs were on the move intermittently, but sometimes hid under pieces of upturned bark. I was curious whether the females could be laying eggs under the bark of this living tree, or possibly in the dead wood surrounding large old knots. Craighead (1923, p. 11) found that species such as the black-horned pine borer *Callidium antennatum* (in the same tribe Callidiini as *Meriellum*), which require dry seasoned wood, can be reared in freshly cut wood, but the resulting adults are far below normal size and the life cycle is greatly lengthened. He described the larva under the name *Merium proteus* (pages 48-49, and plates XV, XIX). Hanks (1999) reported that very few wood-feeding species of insects can thrive on healthy or weakened coniferous trees in North America, due in part to the trees' production of oleoresins (monoterpenes and resin acids).

I checked other nearby live trees but found no beetle activity on mature Scots pine (*Pinus sylvestris*), bur oak, aspen poplar, green ash (*Fraxinus pennsylvanica*), Manitoba maple (*Acer negundo*), and Amur maple (*Acer ginnala*). No exit holes were present in poplar or oak firewood stacked beside the spruce. White spruce is a common species planted in home yards and parks in Winnipeg, but I did not notice dead trees or outside stores of spruce firewood in my immediate neighbourhood; it would be interesting to know the source of the breeding stock of the *M. proteus* at my home well within the city of Winnipeg (south of the boreal coniferous forest).

Piuze-Paquet (2017) found *M. proteus* in low numbers in boreal forest of central Quebec (including 21 larvae), and reported that individuals were able to disperse 800 metres over a clearcut area to intact stands of spruce. Perhaps this species utilizes olfaction to detect volatile substances from stressed or recently killed spruce trees. Bezark (2016) noted that well-developed olfactory sensors on the antennae are important in locating host plants for oviposition, often at great distances. He also noted that male cerambycid antennae are usually longer than those of the females, suggesting that they may also be used to detect female pheromones. Since my observations suggest that adult *M. proteus* survive for only 2 or 3 weeks, the use of olfaction to rapidly detect possible sex/aggregation pheromones and host-tree volatiles would seem to be critically important for feeding, mating, and egg laying.

Daily records

I began taking daily records on 1 June to compare beetle presence in relation to temperature and time of appearance. On cool and/or rainy days and nights (e.g., 11 ˚C), the beetles sought refuge among the logs and remained inactive. 5 June was sunny with a high of 27 ˚C, and I collected 126 specimens, including many after dark at 11:00 PM. During the next 2 weeks, 20% of the beetles were captured in the morning, 48% in the afternoon, 24% in the evening, and 8% at night (n=584).

As numbers of beetles began to decline in early July, I wondered if the several that I caught each day might had flown in from other locations, but I still heard the gnawing of emerging individuals coming from inside the logs. When beetle activity ceased on 14 July, I was astonished to determine that I had collected a total of 1308 specimens of this uncommon species from only 30 pieces of spruce firewood. This figure does not include the large number missed earlier in May (possibly over 500 in the period prior to the start of my observations), and many others that no doubt dispersed while I was away from the site, as evidenced by the individuals collected on the nearby live spruce. The actual total may have been as high as 2000. The only other long-horned beetles I had ever encountered emerging and mating in even close to this number were the cottonwood borer (*Plectrodera scalator*) on black willow (*Salix nigra*) and cottonwood (*Populus fremontii*) shrubs on the floodplain of the Red River at the Texas-Arkansas border, and the black stenaspis (*Stenaspis solitaria*) on velvet mesquite (*Prosopis velutina*) in desert grassland at Madera Canyon in Arizona. In both instances, hundreds of these large beetles were observed.

To further my knowledge about *Meriellum proteus*, I reviewed the literature and contacted several cerambycid researchers who might be able to provide details on the beetle's life history. I also asked curators at several major Canadian museums to provide me with the number of specimens, the locations, and dates of specimens in their collections. This exercise revealed that specific information on this species was both meagre and scattered in numerous sources, and that the number of specimens was rather limited, considering significant collecting in suitable habitats over the last century. Consequently, I thought it would be worthwhile to assemble these data in relation to my observations.

Life history

Linsley (1964) reported that adults are active in June and July — a flight period that has subsequently being quoted in other works on cerambycids (Yanega 1996, Lingafelter 2007). Bousquet et al. (2017) indicated that adults may be active from March to September in Canada, but mostly in early June to late July. The University of Manitoba's J.B. Wallis-R.E. Roughley Museum's specimens are dated from 22 May to 25 August, but mainly in June and July. My observations commenced on 24 May, and considering the large population on that date (over 100 collected), emergence was well underway much earlier. The last date I recorded a beetle was 11 July. Rice et al. (2017) noted one specimen from Moscow Mountain, Moscow, Idaho, dated 1 August 1953 — the only specimen ever recorded in the state.

The female deposits eggs in the bark of dead conifers and the larvae mine into the wood, where they pupate and adults emerge a year later — a 1-year life cycle (Craighead 1923, Linsley 1964, Furniss and Carolin 1977). Haack et al. (2017) reported that females of small cerambycid species deposit eggs singly or in small clusters, with a lifetime fecundity ranging from tens to several hundreds of eggs. Eggs hatch in a few days up to 5 weeks, 2 weeks being average. Craighead (1923, p.9), while not mentioning *M. proteus* specifically, stated: "... in the Cerambycinae, although legs are usually present [in larvae], they are absent or represented by only minute spines in those genera which feed consistently in solid dead wood in close-fitting burrows." Bezark (2016) noted that most species feed on wood, with cellulose digestion carried out by enzymes rather than symbiotic microorganisms. Berenbaum (1995, p. 255) confirmed this pattern in at least some species: "In at least four species of longhorn beetles that infect dead or dying trees, digestion of cellulose and other wood components is made possible by the fact that the beetles capture and make use of enzymes produced by fungi growing in decayed wood."

Long-horned beetles spend most of their life in the larval stage, requiring only a few days to a few months for adult emergence, dispersal, and reproduction (Bezark 2016). Pupation occurs at the end of the larval feeding gallery between the bark and wood or in the sapwood, with the pupal stage lasting 7–10 days (Craighead 1923, Linsley 1961). While I was unable to find out in what stage *M. proteus* overwinters, Serge Laplante (pers. comm.) thought that the species may: ... "overwinter as full-grown larvae and transform into pupae about 3 weeks before they emerge as adults, as for most species whose adults are active in June and July. However, it is possible that the specimens emerging in early spring spend the winter in their pupal cell as pupae or even teneral adults." Craighead (1923, p. 10) concluded that: "No species are known to hibernate except in the pupal cell." In contrast, Haack et al. (2017, p. 84) noted that: "The vast majority of cerambycids overwinter in the larval stage." I plan to open up a few logs in the spring to see if I can shed more light on this question.

Two flowering varieties of French lilac (*Syringa*) (identified by Larry de March and Elizabeth

Punter), only 2 metres away from my logs, attracted large numbers of wasps, bees and flies, and I captured four long-horned beetles (*Anoplodera pubera*) feeding on nectar and pollen, but not a single *M. proteus*. Also, none were observed on any other the numerous flowering plants in my garden. On 18 and 20 June, I collected five species of cerambycids (*Anoplodera pubera, Brachysomida bivittata, Cyrtophorus verrucosus, Purpuricenus humeralis,* and *Trogonarthris proxima*) at Kings Park in south Winnipeg, feeding on flowers of spiraea bushes (*Spiraea*) and wild prairie rose (*Rosa*), with numerous white spruce nearby, but again no *M. proteus* were present — all suggestive that this species is not attracted to flowers and likely does not feed as an adult. Interestingly, Todd Lawton (pers. comm.) found one *M. proteus* in a sugar trap at Marchand, Manitoba. Craighead (1923) stated that most cerambycid adults (except Lepturinae and Lamiinae) do not feed and are therefore short lived. Shibata (1994) found that adult *Callidiellum rufipenne*, another wood-boring cerambycinae from Japan, lived for only 17 or 18 days after emerging from logs of its conifer host *Cryptomeria japonica*.

On the afternoon of 6 July (28 ˚C), I was checking the logs and collecting a few small wasps when a *M. proteus* landed on the back of my neck and sought refuge under my shirt. I decided to keep this and four other individuals alive for observation in an aquarium, offering them slices of ripe fruit and a small dish of water, but I never observed any interest in these offerings. At first they spent significant time moving in start-stop exploratory fashion, investigating with their antennae, mating, and occasionally taking short, rapid flights. With the dexterity of a fly, they were able to run in any direction on the clean vertical sides of the glass, demonstrating the species' remarkable climbing ability. On warm afternoons they spent considerable time and energy mating vigorously, and remaining coupled for over half an hour if the female was still. However, from frequent chases, mounting, and tumbling from near the aquarium lid, two individuals' delicate antennae and legs dislodged, rendering the beetles unable to move properly or remain upright. Under these unnatural captive conditions, they survived for only 3 days. Among the other three, which soon demonstrated limited mating behaviour, two lived for 16 days and one was still moving (although weakly) at 22 days. Compared to hundreds of other cerambycid species that I have collected and mounted, *M. proteus* was the most delicate, and easily lost legs and antennae even with careful handling. I presume this fragility is associated with the brief adult life span and secretive habits.

Distribution

This has been described as an uncommon, transcontinental (boreal-forest and western-montane) species which attacks recently dead *Picea glauca, Pinus mariana, Pinus contorta*, *Pinus ponderosa*, and *Abies* (Linsley 1963, Gardiner 1975, Furniss and Carolin 1977, Haffern 1998, Lingafelter 2007, Saint-Germain et al. 2007, Boulanger et al. 2013). *Meriellum proteus* is known in Canada from the Yukon Territory, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Labrador (Bousquet et al. 2013), but oddly remains unrecorded from the Maritime Provinces (McCorquodale 2010). Webster et al. (2009, p. 306) noted: "Although this study adds substantially to our knowledge of the overall composition of the cerambycid fauna of the Maritime Provinces, additional species undoubtedly occur." *M. proteus* will likely be found in this region in future studies, since prime boreal-forest habitat (rich in spruce and pine) is widespread, and there appears to be no geographic or climatic barriers in effect. In fact, the map for *M. proteus* in Bousquet et al. (2017) shows two specimen records in the Gaspé close to the New Brunswick border. The cerambycid fauna of the Maritimes now stands at 127 species (Majka et al. 2010).

In the United States, the species has been reported in Alaska, Colorado, Idaho, Minnesota, Wisconsin, Ohio, Michigan, Indiana, New York, New Jersey, Connecticut, and Maine (Downie and Arnett 1996, Bousquet et al. 2017), Oregon (Hatch 1971), and Pennsylvania (Kirk and Knull 1926). The Montana Entomology Collection (Montana State University) now has records from five counties (http://mtent.org). I suspect the species will also be found in Vermont and New Hampshire. The Frost Entomological Museum (Penn State University, State College, Pennsylvania) lists a specimen from Nebraska or New England (i.e., abbreviated NE). Guy Hanley (2005) did not include *Meriellum proteus* in his *Cerambycidae of North Dakota* (among 87 species), although my Winnipeg home and an old record at Onah, Manitoba, both lie only 90 km north of the border. I thought that the species would occur in conifer stands on both sides of the border (e.g., in the Turtle Mountains). I therefore contacted Guy to determine if it had turned up in more-recent field surveys, and he responded: "Yes we do have that species on record here now...I have 8 specimens collected in Minot, one in 2008 in the vicinity of the North Dakota State University experimental station in a line of evergreens, which was the first state record, and then 7 in 2014 from a stand of spruce trees... all collected in Lindgren funnel traps." He added that with recent surveys, the North Dakota cerambycid list now stands at 103.

Due likely to its rarity, and to the fact that it is not known to attack live commercially valuable conifers, this species is seldom mentioned in most entomology and forestry texts (e.g., Blatchley 1910, Essig 1929, Craighead 1950, Drooz 1985, Ives and Wong 1988, Solomon 1995), nor in recent online sources such as Van Driesche et al. (2013) and *Bark and wood boring beetles of the World* (www.barkbeetles.org). However, Furniss and Carolin (1977) lists *M. proteus* attacking trunks and large branches of *Abies* and *Pinus ponderosa*, but do not mention if the trees were stressed or dead. Saint-Germain et al. (2009, p. 801) concluded that: "Most coniferophagous species from this family [Cerambycidae] are restricted, at least in the boreal forest, to heavily stressed or recently dead trees." Werner (2002) found *M. proteus* occurring in experimental plots in white spruce forest in Alaska in dead wood within 1 year after a burn, and in 5 years after shelterwood cutting. Boulanger et al. (2013) identified factors affecting the survival of long-horned beetle larvae and early post-fire colonization by adults in lightly to moderately burned stands of black spruce in the James Bay region of Quebec. *M. proteus* (4 specimens) and 16 other cerambycids spent at least part of their life cycle as larvae at the xylem-bark interface. Saint-Germain et al. (2007) reported finding 12 specimens of *M. proteus* (among 10 species of cerambycids) in early-decay stages of standing snags of black spruce (none in aspen) in four of five plots in the boreal forest of southern Quebec.

Melvin et al. (1970) listed 11 specimens of *M. proteus* in a survey of Manitoba and Saskatchewan. The BOLDSYSTEMS database, http://v3.boldsystems.org, lists only 25 specimens (from 1-12) in six major Canadian and Alaskan institutions. An example of its rarity along the southern edge of the range is found in Gosling's (1973, p. 76) annotated list of the 225 species of cerambycids of Michigan. "This boreal species was recorded from Chippewa County by Andrews (1921). I have not seen his specimen, but this species should occur in the upper Peninsula and I believe it is a valid record." At the northern boreal-forest treeline, three specimens have been found at Inuvik, Northwest Territories (Pohl and Hammond 2005), one at Churchill, Manitoba (Serge Laplante, pers, comm.), and four in the James Bay area of Quebec (Boulanger et al. 2013).

Michel Saint-Germain (pers. comm.) at the Montreal Insectarium reported that: "*Meriellum proteus* was an uncommon to rare species but was regularly collected in our studies... in both western and eastern Quebec, so it is probably widespread throughout the province's boreal forest. We never collected this species in fire-killed trees; it rather appears to be closely associated with over-mature, spruce-dominated stands. I have a feeling that this species may be particularly associated with snags of high-density, stunted-growth trees like other Callidiini have shown to be in Scandinavia. In our studies it was at its most common in 800 to 1000-year-old black spruce stands that were in slow transition towards forested peatland."

I contacted Serge Laplante (Biodiversity-Collections, Ottawa Research and Development Centre, Agriculture and Agri-food Canada) and he kindly provided me with the following information on *Meriellum proteus*: "Your observations about *Meriellum proteus* are very interesting. The number of specimens emerging from your white spruce logs is indeed quite remarkable. Most of the very serious active cerambycid collectors have never found a single specimen of that species, including myself. I hope that I will find that species one day...The species is known from the coniferous belt of North America but is seldom seen in the southern parts of Canada; it is mostly boreal. This is why there is so little information on that species in the literature...Yet its geographical distribution is well known and our map for that species in our book on Cerambycidae of Canada shows numerous dots across Canada...We have here in the CNC a bit more than 80 specimens from Canada, quite a few from the Northwest Territories and Yukon, and 20 from Manitoba from the following localities: Aweme (6), Onah (1), Brandon (1), Winnipeg (1), Victoria Beach (2), Cross Lake (1), Husavik (4), Berens River (2), mile 214 Hudson Bay Railway (1), Churchill (1). All these specimens are old, the most recent being the one from Brandon, which was caught in 1948, and most of them were caught between 1910 and 1926. Only one specimen, from Aweme, has host data ("bred from spruce"). Considering the age of our *Meriellum* specimens, a donation of recently found specimens from Manitoba to the CNC would be highly appreciated."

The fact that the CNC collection of Canadian *M. proteus* consists mainly of old records may be significant and is corroborated by a study of the loss of cerambycid richness in Ontario (McCorquodale et al. 2007), with more species collected prior to 1950 than between 1950 and 1999. Among the 24 Ontario specimens of *M. proteus*, 20 were dated from the 1800s to 1950, and only 4 since 1950. Their data demonstrate a 10% decline in the number of species collected since 1950, which is believed to be due to the loss of habitat and host plants, and replacement of old-growth forests with younger forests in the Carolinian Forest Region of southern Ontario. Only one species from the Boreal Forest Region was not found from 1950 to 1999. The data were insufficient to determine whether the lack of specimens since 1950 represents significant population declines or extirpations.

Bousquet et al. (2017), in *Cerambycidae (Coleoptera) of Canada and Alaska*, examined 388 specimens, including those listed below at other institutions. The J.B Wallis-R.E. Roughley Museum of Entomology at the University of Manitoba has 22 specimens from the following localities: Aweme (8), Winnipeg (5), Onanole (1), Dominion City (1), Whiteshell Provincial Park (1), Swan River (1), Hilbre (1), Hecla Island (2), The Pas (1), Manitoba (no location) (1). These specimens are also all old, dated from 1905 to 1962, including six specimens collected at Aweme from 1905 to 1918 by Norman Criddle. Todd Lawton (pers. comm.), who has collected numerous species of cerambycids in the boreal forest of central Canada over the years, told me that he has taken only one specimen of *M. proteus*, near Marchand, Manitoba.

Matthias Buck (pers. comm.) at the Royal Alberta Museum reported 7 specimens: 4 from Manitoba (mile 214 and mile 332 Hudson Bay Railway (2) 1917, Winnipeg (1) 1911, Aweme (1) 1911; George Lake, Alberta (1) 1973; and Edmonton (2) 1975. The Royal Ontario Museum holds 35 specimens (Brad Hubley pers. comm.) — Ontario (31) 1907 to 1956; Edmonton (2) 1910; Godbout Quebec (1) 1918; and Teulon Manitoba (1) no date.

Terry Galloway (pers. comm.) informed me that there have been few comprehensive inventories of beetles in Manitoba's boreal forest in recent decades; consequently a collecting bias certainly exists at least in this province. On 22 June, as members the Scientific Advisory Committee of the Nature Conservancy of Canada (Manitoba Region), Terry Galloway and I had an opportunity to survey insects at four properties (Douglas Marsh and Yellowquill Prairie) in the vicinity of Norman Criddle's Aweme records from a century ago. Although each site had extensive forests containing abundant white spruce, no *M. proteus* were among the five species of cerambycids I collected.

Collecting on old wood is a well-known technique for finding certain long-horned beetles. In his monumental *Coleoptera or Beetles Known to Occur in Indiana*, Blatchley (1910, p. 1008) recommended: "Dead logs should be searched, on both the upper and under surfaces, and particularly fresh-cut timber or sawed lumber. A morning spent in a woodyard will often repay one richly in rare specimens. Some are to be found commonly under bark and may be trapped by loosely fastening pieces of bark to a tree over night and examining the under side of the bark in the morning." MacRae (1993, p. 225) provided numerous examples of cerambycid species emerging in large series from logs. "Adult host associations were determined by beating and examining dead wood, including logpiles and slash left behind by wood-cutting operations. Selected wood piles were examined over the course of a season, often attracting different species during the day than at night or as the season progressed." Among the 13 specimens of *M. proteus* in the Entomology Collection at the University of Alberta, 1 (UASM136572) was reported to have emerged from firewood at Brudenheim, 40 km N Edmonton (http://entomology.museums.ualberta.ca) (accessed 12 June 2018).

Predators

Linsley (1961) presented three extensive tables of clerid beetles, braconid wasps and ichneumonid wasps, reported by other researchers to be parasitic on specific species of cerambycids, and noted a variety of other groups of insects, fungi, nematodes, lizards, birds, and mammals known to destroy cerambycids. *Meriellum proteus* was not listed as a host/prey, likely due to its rarity. Since at least 1308 *M. proteus* larvae were feeding in only 30 pieces of spruce in my study, possibly some conspecific larval predation occurred. Beeson and Bhatia (1939) reported that when larvae are crowded and their burrows intersect, they injure and destroy one another.

Large dragonflies were observed swooping past the log pile, but it is unlikely they could prey on departing *M. proteus*. Spiders were often seen at night amid the logs, and I found six *M. proteus* tangled in webs — three desiccated specimens, two freshly killed, and one barely alive. When I examined one of the former under a microscope, there were numerous collembolans moving on the beetle remains. David Wade kindly identified several spiders that I captured on the logs.

Agelenopsis actuosa (Agelenidae) 2 females
Araneus gemmoides (Araneidae) 1 male
Steatoda borealis (Theridiidae) 1 male

Renters and their inquilines

From 24 May to 6 July, I observed over 200 Hymenoptera investigating (circling, entering and departing) the beetle emergence holes, presumably in search of nest sites or potential hosts. It was amazing how rapidly certain of the smaller wasps (*Chrysis*) located and flew directly into a burrow and remained inside for over 20 minutes. On occasion there were up to four species of Hymenoptera present at one time, searching actively over the logs, and additional individuals often arrived if I stood motionless.

On 17 June, at 5:30 pm, I lifted a tile and found a *M. proteus* and a *Gasteruption* wasp sitting only 6 cm apart. The beetle slowly ambled off but the female wasp approached a nearby beetle burrow and tested it with her vibrating antennae for several seconds, then turned around and began probing the burrow with her ovipositor (Figure 4). She remained in this position for 15 minutes, and then again searched and probed two more burrows; she inserted her antennae and head into one burrow before turning around and inserting her ovipositor. I watched from 1-metre away for 18 minutes before this female moved to the underside of the log and disappeared from

Figure 4. This *Gasteruption* wasp inserted fully its long ovipositor into several burrows in the log.

view. When beetle numbers dropped to only a few specimens by the end of the first week in July, wasp numbers on the logs declined dramatically and wasps were absent by 11 July. Several North American species of *Gasteruption* have been recorded as predators or predator-inquilines of solitary bees nesting in wood (Carlson, 1979).

During this study, I collected a large sample of wasps and a few bees and other insects. Jason Gibbs provided initial genus-level identifications of *Chrysis* and *Passaloecus*. Matthias Buck examined and identified a large selection of the Hymenoptera. The species were identified as follows, including his notes on their biology and distribution:

Crabronidae: nest in abandoned beetle burrows, etc. in wood.

Passaloecus monilicornis, 5 females: provision their nests with aphids. First record for Manitoba.

Passaloecus cuspidatus 21 females, 1 male: provision their nests with aphids.

Ectemnius cephalotes 2 females: provision their nests with flies, primarily Calyptratae. Within Canada previously known from Ontario, Quebec and British Columbia. First record for Manitoba.

Rhopalum clavipes 3 females: provision their nests with barklice (Psocoptera). First record for Manitoba.

Vespidae: nest in abandoned beetle burrows, etc. in wood.

Ancistrocerus albophaleratus 4 females: provision their nests with caterpillars.

Ancistrocerus adiabatus 3 females: as above.

Ancistrocerus antilope 1 female: as above.

Symmorphus cristatus 1 female: provision their nests with the larvae of leaf beetles (Chrysomelidae: Chrysomelinae).

Chrysididae: nest parasites.

Chrysis cessata (before 2006 this species was incorrectly referred to in the literature as *C. nitidula*), 4 females: nest parasites of mason wasps (*Ancistrocerus*, *Euodynerus*, *Symmorphus*; Vespidae). First record for Manitoba. Within Canada previously known from Alberta, Ontario, Quebec and New Brunswick.

Chrysis nitidula (syn.: *C. coerulans*) 7 females, 1 male: nest parasites of mason wasps (*Ancistrocerus*, *Euodynerus*, *Parancistrocerus* and *Symmorphus*).

Pompiliidae

Dipogon sayi 1 female: nest in decaying wood, provision their nests with spiders.

Gasteruptiidae: nest parasites.

Gasteruption sp., 1 female; nest parasites of Megachilidae and Hylaeus (Colletidae).

Parasitoids of xylophagous insects

Helcon cf. *pedalis* (Braconidae), 34 males: solitary endoparasitoids of Cerambycinae larvae (*Callidium*, *Neoclytus*, *Xylotrechus*). The species identification is tentative because there is no recent taxonomic treatment of the genus for the Nearctic region.

Helcon sp., 4 males: differ from the previous in having the hind femora entirely red or with minor darkening at the apex. Presumably solitary endoparasitoids of cerambycid larvae, like other species in the genus.

Doryctes sp., 2 females (Braconidae): ectoparasitoids of wood-boring beetle larvae.

Digonogastra sp., 1 female (Braconidae): ectoparasitoids of concealed larvae of Coleoptera or Lepidoptera.

Ichneumonidae, 6 females belonging to at least three species. Without identification to genus or species the host association cannot be ascertained.

Incidental, or connection to deadwood unknown

Gorytes deceptor (Crabronidae), 18 males: the connection of this rare species to logs remains unclear. Other species of the genus are known to nest in the ground. It is remarkable that all collected specimens are males. First record for Manitoba. Within Canada previously known from Ontario and Quebec.

Andrena sp. (Andrenidae), 1 male: probably incidental; ground-nesting bees.

Physocephala furcillata (Conopidae), 1 male: a thick-headed fly and wasp mimic; probably incidental; parasitoids of adult bumble bees (*Bombus*).

Tetanocera sp. (Sciomyzidae), 1 male: flies that are parasitoids of snails.

Tenthredinidae, 1 adult, sex unknown: the larvae of sawflies eat green plants.

I sent an additional vial of 24 wasps to the Canadian National Collection of Insects, Arachnids and Nematodes, where Andrew M.R. Bennett identified 10 Ichneumonidae, and José Fernandez identified 14 Braconidae, as follows (along with their comments):

Ichneumonidae (unlikely to parasitize *Meriellum proteus*).

Cubocephalus prolixus 1 female: generally associated with Tenthredinidae.

Poemenia americana 3 females: usually parasitize Aculeata nesting in wood, first record for Manitoba.

Poemenia thoracica 5 females: first record for Manitoba.

Genus undetermined, Ichneumoninae, 1 female: internal parasitoids of Lepidoptera.

Braconidae

Bracon sp. (Braconinae) 2 females: no up-to-date keys for 900 described species.

Bracon sp. (Braconinae) 1 female.

Helcon sp. (Helconinae) 1 female, 10 males: have been reared from Cerambycidae but none recorded from *Meriellum*.

Specimens were deposited at the Canadian National Collection and the Royal Alberta Museum.

Conclusion

Judging by the many hundreds of emergence holes mined by *M. proteus* in my spruce logs, this and other long-horned beetles that attack dead wood must accelerate significantly the decay of standing and fallen dead trees by allowing increased entry into the sapwood and heartwood of moisture, air, fungi, bacteria, saproxylic beetles, and other organisms of decomposition. The prodigious emergence of *M. proteus* observed within only 30 pieces (about 11 metres combined length) of spruce firewood in the present study is indicative of both the tremendous reproductive capacity of this and other long-horned beetles, and the significant roles they (especially the larvae) must play in forest ecosystems.

While *M. proteus* may be described as uncommon or even rare, Terry Galloway (pers. comm.) pointed out that a rare species may not in fact be rare, but simply rarely collected. Factors likely involved in the apparent rarity of adult *M. proteus* are: small size, remarkable camouflage while resting on spruce/pine bark, reluctance to take wing, quick to seek cover and remain hidden under bark and other debris, adult life span of only 2 or 3 weeks, no apparent attraction to night-lighting, and they do not feed, and hence seldom show up at bait traps or on flowers.

Having collected 1308 specimens, and missed at least 2 weeks of emerging beetles prior to the start of my observations, I estimate that around 2000 adult *M. proteus* emerged from early May to mid-July in the present study. If a female laid an average of 50 eggs the previous spring (2017), it would have required 40 females to generate the 2018 population. Considering the large number of mating pairs I observed on the logs, and the species' 1-year life cycle, it will be interesting to see how many individuals emerge in 2019 and 2020; the logs' density, moisture content, nutritional value, and possibly other factors will have changed from 2017 and 2018. In an attempt to determine an estimate of the emerging population (i.e., avoiding counting an individual multiple times), I had to collect an excessively large number of specimens. However, I have prepared most of them and plan to donate series to a number of cerambycid specialists and museums. The fact that specialists identified over 32 species of Hymenoptera on firewood in the backyard of my city home during the couple of weeks of this study is truly remarkable. Seven species are first records for Manitoba, and fresh specimens from Canada of some species have not been deposited in the CNC for over 50 years (Andrew Bennett pers. comm.). This study demonstrates that even a small isolated patch of habitat in an urban environment may be significant in supporting rare species and a diverse biota.

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they not quickly secured these specimens, I would have missed this fascinating entomological event occurring only 3 metres away from where I was sitting on my patio. Arlene also made daily observations of emergence and survival while I was away conducting other field work.

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William G. "Bill" Friend
(1928-2018)

William George Friend, WGF, or Bill as he was known to most of his colleagues and friends, was a man of many parts. Born in 1928 in the Ottawa Valley, he showed an early interest in biology much to the consternation of his mother, who would find jars of collected creatures welcoming her when she opened the fridge. At the age of 15, he began 6 years as a summer-student assistant in the Field Crop Insects Laboratory in the Science Service of the Canada Department of Agriculture. He continued this as he worked on his bachelor's degree in agriculture at McGill, graduating in 1950. On a study leave from Agriculture Canada he went to the Entomology Department at Cornell to do research under the supervision of R.L Patton, gaining his PhD in 1954 with a thesis on the vitamin requirements of the onion maggot. He returned to Agriculture Canada as a research officer for the next 4 years until he was persuaded by his good friend William "Bill" Beckel to apply for a job in academia. Thus began a 38-year career as a professor in the Department of Zoology, University of Toronto.

Bill Friend, he of many parts, was equally enthusiastic about research and teaching, and being a professor enabled him to indulge in both. He also had a lifelong fascination with technology, and his choice of career allowed him to pursue that interest too. During his first years at the University of Toronto, he became heavily involved with the design and implementation of a new building for the Department of Zoology, which opened in 1965 to national and international acclaim. The Ramsay Wright Zoological Laboratories (named after the department's first chair) was a state-of-the-art building that incorporated technical innovations such as all services being routed in the walls of the main internal corridor, allowing flexibility in future reconfiguration of the labs and offices on the outside, all of which had windows. Labs were provided with non-chlorinated water for aquatic research, physiology teaching labs were equipped with low-voltage DC as well as standard AC power and darkrooms for photography and many of the teaching labs were designed for 20 students and a teaching assistant. All teaching labs were equipped with closed-circuit TV for introductory talks and practical demonstrations; at the time, TV was thought to be the medium of the future for university teaching, and Bill was a great proponent of this technology. A footnote: much later, when TV had gone out of fashion for teaching, much of the old equipment was still around, and Bill and I used some of it to film how the blood-sucking bug *Rhodnius prolixus* deployed its mouthparts during feeding. Bill loved doing things like that; he was inventive and creative in his research and teaching, as well as his outside life. More than once, as we closed a day trying out a new approach to getting *Rhodnius* to reveal its secrets, he would say "wasn't that fun? And you know, the amazing thing is I get paid for doing this!"

Bill was an inspiring and knowledgeable educator. He taught mostly at the first and second year levels, and his wide-ranging interests were evident in their subject matter: insect physiology, general animal physiology, introductory biology, biology for non-specialists, and biology for non-scientists. In the latter course, he presented contemporary ideas about human evolution. He was also keen about curricular design and teaching methodologies. He was a member of the MacPherson Committee that in the late sixties fundamentally changed the approach to undergraduate teaching in the Faculty of Arts and Science, eliminating the long-standing division between specialist and general programs in favour of a more flexible and custom approach to course selection. In the seventies, he was a key member in a group of us that totally redesigned the approach to teaching the 2000 students in first-year biology, earning a teaching award from the Ontario Conference of University Faculty Associations. In the eighties, he served on a Council of Ontario Universities advisory group involved with important changes to the high-school science curriculum, and the development of the biology courses.

His research focused on various aspects of insect feeding. His PhD work and pre-university years looked at phytophagous pest insects and their dietary requirements, with a view particularly to the development of artificial diets for rearing purposes. During this period he formulated the first chemically-defined diet for a plant-feeding insect. After his move to Toronto, he became fascinated by the classic model organism for insect physiology, *Rhodnius prolixus*, first applying his experience with artificial diets to this haematophagous insect in determining its nutritional requirements, and guiding half a dozen graduate students through related projects. On his return from a sabbatical in Cambridge, England, in 1967, he shared with me his excitement about a novel method of studying the act of feeding in an insect such as *Rhodnius* using changes in electrical resistance. Thus began a fruitful decade and a half of collaborative research on the mode of feeding, and the chemical signals inducing gorging in these insects. Though Bill was 12 years my senior, it is a testament to his generosity and lack of ego that he always accepted me as an equal partner. I don't recall a single moment for instance where order of names on a publication was an issue!

In the 1980s, Bill added to his repertoire of insects, studying in collaboration with myself and others, chemical signals and other factors affecting the feeding of blackflies, mosquitoes and tabanids. He was particularly interested that these insects, unlike *Rhodnius*, are not exclusively haematophagous, consuming nectar as well as blood, and thus have two different modes of feeding and a more complex set of feeding stimuli. In 1988 he started a collaboration with Bernie Roitberg of Simon Fraser University to build a theoretical model of mosquito blood feeding. In Bernie's words: "We enjoyed working together and were able to develop our ideas, which led to two of the first-ever analytical models being published on malaria mosquito feeding. Over time, our ideas became accepted by the scientific community and form part of malaria-management models currently under development in the east and south African continent."

The third part of his life was equally rich. He married his forever partner, Shirley, in 1954, and together they looked after their mothers in Ottawa, sailed, cooked, travelled, entertained, "adopted" several godchildren, and enhanced the lives of those they knew and cherished. When Bill joined the University of Toronto, they bought a house in Port Credit near the lake, and maintained a sailboat (a "Shark") in the local yacht club. I remember many an evening coming close to last in the weekly race, but having more fun than other competitors. After a few years, they moved to a larger house in Thorncrest Village, where they had a rich social life. On Bill's retirement, they decided to join lifelong friends on the west coast, and relocated to West Vancouver. Here, Bill continued involvement in academe, becoming an adjunct professor at Simon Fraser University, where he helped students in Bernie Roitberg's lab with microscopic and dissection techniques, writing their theses, and providing critical comments at lab meetings. Outside academe, he and Shirley continued to sail and travel. Bill pursued his interest in music, practicing the flute and the ukulele, and took up First Nations-inspired carving, producing many beautiful masks. He was active in the elder community, helping others with their technological and computer challenges. He continued to nurture and inspire his godchildren.

Bill passed away quietly on 16 December 2018 from complications following a fall. He will be greatly missed by his friends, adopted family, and colleagues.

J.J. Berry Smith
Emeritus Professor, University of Toronto

Walter Krivda (1932-2018)
A Manitoba Naturalist

Walter Vladimir Krivda was born of Ukrainian parents in The Pas, Manitoba in 1932. During his youth, Walter was fascinated with Nature, and could often be found catching insects, pressing plants, picking mushrooms, and wandering through the fields and forests around his home. After graduating from high school in 1952, Walter was hired at the Entomological Research Station in Ottawa. He later pursued his education by attending United College (now the University of Winnipeg) and the University of Ottawa, where he graduated in 1954. He taught in Gillam, Hecla and Virden, Manitoba, and in 1961, became the first Park Naturalist for Riding Mountain National Park, at Wasagaming, Manitoba. In 1965, he transferred to Prince Albert National Park at Waskesiu, Saskatchewan. His next position was with the Canadian Wildlife Service in Edmonton, but he returned to teaching as Supervisor of Extension Services at the Vocational Centre in The Pas (now Keewatin Community College). In 1970, Walter was awarded a Manitoba Centennial Medal by the Manitoba Historical Society for his "contributions to Manitoba in the teaching profession and for his many years of research in natural history and work for museums". Walter was particularly active with the Sam Waller Museum in The Pas.

Walter was particularly interested in entomology, and over the decades, accumulated vast collections of moths, butterflies, and beetles. Michael Leblanc recalls that Walter came by their house every Thursday night and over tea, crackers and preserves, he would discuss insects, life, and solutions for all of the world's problems. Walter was always willing to share his knowledge; he loved to teach, and loved entomology and his insect collection. Even in hospital, a few weeks before his death, he was still trying to teach, regaling stories of some of the history of The Pas to Michael's son Riley during their hospital visit. Even though Riley only met Walter shortly before his death, he knew Walter through the stories his family would tell him. Riley's love for entomology was enhanced by the knowledge Michael gained from Walter and passed onto him. Walter passed away on 17 September 2018 at the age of 86 years. He will be missed by his many friends in The Pas, and by his natural-history colleagues down south.

(A full obituary is available in the Newsletter of the Entomological Society of Manitoba, ***42****, Issue 1, 2018).*

Robert Wrigley, Terry Galloway and Michael Leblanc
Winnipeg

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://esc-sec.ca/publications/bulletin/#toggle-id-2) 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://esc-sec.ca/publications/bulletin/#toggle-id-2) 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.

Currently available for review / Disponibles pour critique

Allison, J.D. and R.T. Cardé [Eds.]. 2016. Pheromone communication in moths: Evolution, behavior and application. University of California Press. ISBN: 978-0-520-27856-1.

Curtain, C.G. & T.F.H. Allen [Eds.]. 2018. Complex Ecology: Foundational perspectives on dynamic approaches to ecology and conservation. Cambridge University Press. ISBN: 9781108235754.

Dale, M.R.T. 2017. Applying graph theory in ecological research. Cambridge University Press. ISBN: 9781316105450.

Danks, H.V. 2017. The Biological Survey of Canada: A Personal History. Biological Survey of Canada. ISBN: 978-0-9689321-9-3 [e-book]

Pohl, G.R. et al. 2018. Annotated checklist of the moths and butterflies (Lepidoptera) of Canada and Alaska. Pensoft *Series Faunistica* No 118. ISBN 978-954-642-909-4 [e-book]

Saguez, J. 2017. Guide d'identification des vers fil-de-fer dans les grandes cultures au Québec. Centre de recherche sur les grains. ISBN: 978-2-9813604-5-8 [e-book]

69th Annual Meeting of Members and Board of Directors Meetings (JAM 2019)

The Annual Meeting of Members of the Entomological Society of Canada will be held at the Fredericton Convention Centre, 670 Queen Street, Fredericton, New Brunswick, on Tuesday, 20 August 2019, from 1:30 pm to 2:30 pm, in Barker's Point A. The Board of Directors Meeting will be held on Sunday, 18 August 2019, from 8:00 am to 3:30 pm, in Marysville A, Fredericton Convention Centre, 670 Queen Street, Fredericton, New Brunswick. The incoming Board of Directors will meet immediately following the Annual Meeting of Members, also in Barker's Point A at the Fredericton Convention Centre, on Tuesday, 20 August 2019, from 2:30 pm to 3:00 pm. Matters for consideration at any of the above meetings should be sent to Neil Holliday, Secretary of the Entomological Society of Canada (see inside back cover for contact details).

69e assemblée annuelle des membres et réunions du conseil d'administration (RAC 2019)

L'assemblée annuelle des membres de la Société d'entomologie du Canada se tiendra au Palais des congrès de Fredericton, au 670 Queen Street, Fredericton, Nouveau-Brunswick, le mardi 20 août 2019, de 13h30 à 14h30, dans la salle Barker's Point A. La réunion du conseil d'administration se tiendra le dimanche 18 août 2019, de 8h00 à 15h30, dans la salle Marysville A, Palais des congrès de Fredericton, 670 Queen street, Fredericton, Nouveau-Brunswick. Le nouveau conseil d'administration se réunira immédiatement après l'assemblée annuelle des membres, également dans la salle Barker's Point A, au Centre des congrès de Fredericton, le mardi 20 août 2019, de 14h30 à 15h. Tout sujet à considérer pour une de ces réunions doit être envoyé à Neil Holliday, secrétaire de la Société d'entomologie du Canada (voir la troisième de couverture pour les informations de contact).

Announcement of Changes in the ESC Standing Rules

Changes in By-law 34 that were approved by the membership at the Annual Business Meeting of 13 November 2018 allow the Board of Directors to make changes to the ESC Standing Rules; members must be advised of these changes in a timely manner. The Board of Directors has completed a major revision of the ESC Standing Rules, and the new Standing Rules were approved by the Board at its meeting of 8 January 2019. The new Standing Rules are in the members' area of the ESC website in the item entitled "Current standing rules, approved 8 Jan 2019 PDF". For comparison purposes, the previous Standing Rules will be retained in the members' area in the item named "Superseded standing rules, replaced 8 Jan 2019PDF" for a period of 60 days following publication of this notice.

Annonce de changements dans les règles permanentes de la SEC

Des modifications dans le règlement administratif 34, approuvées par les membres à l'assemblée générale annuelle du 13 novembre 2018, permettent au conseil d'administration de faire des changements dans les règles permanentes de la SEC; les membres doivent être avisés de ces changements dans des délais raisonnables. Le conseil d'administration a complété une révision majeure des règles permanentes de la SEC, et les nouvelles règles permanentes seront approuvées par le conseil d'administration lors de sa réunion du 8 janvier 2019. Les nouvelles règles permanentes sont dans la section des membres du site web de la SEC dans le document intitulé "Règles permanentes actuelles, approuvées 8 janv 2019". À des fins de comparaison, les anciennes règles permanentes ont été conservées dans la section des membres dans le document intitulé " Anciennes règles permanentes, changées 8 janv 2019 " pour une période de 60 jours suivant la publication de cet avis.

Highlights of Recent Board of Directors Meetings

The Board of Directors met twice at the time of the Joint Annual Meeting in Vancouver, 11–14 November 2018. The Board met by teleconference on 8 January 2019.

Follow-up on the Strategic Review

The Board continued with several initiatives arising from the Strategic Review that was conducted in late 2017. In the area of improving ESC governance, the Board fine-tuned amendments to By-law 34 to allow the ESC Standing Rules to be changed without the need for validation at the next Annual Members' Meeting. These amendments were approved by the Annual Members' Meeting of 13 November 2018. Subsequently the Board received major revisions of the Standing Rules and Committee Guidelines from the By-laws, Rules and Regulations Committee, and these were approved at the Board meeting in January 2019. The changes in these documents were to remove obsolete references to a headquarters building and office manager; to spread the *ex-officio* position of the President on all committees so that the *ex-officio* load is divided among the four Executive Council members; and to move all details of committee composition and duties to the Committee Guidelines, retaining only broad statements of the function of each committee in the Standing Rules. Another initiative in the governance area is more effective orientation for Directors, particularly those new to the Board. A slide presentation has been developed for this purpose; it was reviewed by the Board in Vancouver, and implemented in time for the January 2019 Board meeting.

The Board considered issues of membership and, following recommendations from the Membership Committee and from the Finance Committee, has approved a new membership category: "Entomology Enthusiast" for a 3-year trial period. The category is intended to allow amateur entomologists to join the Society and gain access to all member benefits, but at a lower membership rate than that paid by those whose entomological activities are part of their employment. The new membership category will first be available in the 2020 membership year. In the interim, wording defining eligibility for the "Entomology Enthusiast" category will be developed, as will a campaign advertising the new category to amateur entomologists.

After consultation with the Entomological Society of America Entomology Outreach Committee, the Board approved the concept of a National Insect Appreciation Day, to be observed annually on 8 June. An application for North America-wide registration of National Insect Appreciation Day has been made. The idea is to make this day a focus for public education activities, particularly for schools, museums and regional entomological societies. ESC is anxious not to impinge upon established regional society public events, and through its recently-established program of semi-annual meetings with representatives of regional societies, ESC will be working with regional societies to promote activities associated with National Insect Appreciation Day.

The efforts of ESC to engage with regional entomological societies have been well received resulting, among other things, in increased content from regional societies in the *ESC Bulletin.* ESC has set aside funds in the 2018–19 financial year, to provide $1000 to each regional society for public education initiatives. This is in addition to the normal Public Education Grant program.

Treasurer's Report

Treasurer Joel Kits reported that during the 2017–18 financial year, the Society's surplus of income over expenditures was $80,000. This was mainly due to unanticipated sources of income, particularly a signing bonus associated with renewing the publishing contract with Cambridge University Press, and continued strong sales of digital back-issues of *The Canadian Entomologist*.

It is anticipated that the market for back-issues of the journal will soon be saturated, and this source of revenue will diminish drastically.

The Treasurer expressed concern about the accumulation of funds for the John and Bert Carr Award. This award is funded from payments to ESC from the Carr family trust, but there have been too few applicants for the award to use the funds received. ESC has been in touch with the Carr family and is working on modifications to the award to make it more attractive to potential applicants.

The Board learned that there was no policy for annual increases to the salary of the Assistant Editor of *The Canadian Entomologist*. The Board agreed that in future annual budgets the Treasurer should propose an increase of the salary by 2% for discussion by the Board.

Annual Meetings

As President in 2017–18, Patrice Bouchard was the ESC's lead representative of the Planning Committee for the 2018 Joint Annual Meeting with the Entomological Societies of America and British Columbia. He reported that the meeting attracted 3800 registrants from 54 countries, which exceeded attendance at all other North American entomological conferences except the 2016 International Congress. Feedback through registrant surveys was overwhelmingly positive. It is anticipated that both ESC and ESBC will receive considerable income from the meeting surplus, although fiscal accounting for the meeting is not yet finalized.

President Kevin Floate reported to the January 2019 Board meeting that a Memorandum of Understanding governing arrangements for the 2019 Joint Annual Meeting had been signed by representatives of ESC, the Canadian Society for Ecology and Evolution, and the Acadian Entomological Society. The agreement covered sharing of any surplus between the three societies based upon the number of registrants from each society. ESC will be paid by the meeting for the costs of Strauss, its association management company, which will be providing on-line registration, paper submission and related services.

Codes of Conduct

The Board reviewed a draft of a code of conduct at joint annual meetings. The code will be finalized after receiving input from the Entomological Society of America, which already has such a code. The code will first be applied in 2020. The Board was informed that the 2019 Joint Annual Meeting will use a code that has already been developed by the Canadian Society for Ecology and Evolution.

At its 11 November 2018 meeting, the Board approved a Statement of Diversity and Inclusion, which states the Society's position — and the expectations it has of its members, directors, officers and representatives — on matters of diversity and inclusion. The statement can be viewed on the ESC website under the tab "The Society".

The Canadian Entomologist

The Board received reports from the Editor-in-Chief and the Publications Committee regarding several changes to *The Canadian Entomologist.* Efforts continue to include a plagiarism detection system within the manuscript processing workflow of ScholarOne. It is hoped that such a system can be included as part of the arrangements with Cambridge University Press, but if this is not feasible or is prohibitively expensive, the Society will investigate obtaining its own plagiarism detection software.

The board reviewed potential changes to the current format and page size of the journal. The current two-column format is inconvenient for those reading the journal on a screen. It was agreed that the journal will retain its current page size, but will change to a single column of text on each page.

The Board is considering whether *The Canadian Entomologist* should cease to accept manuscripts in French. A very small number of French manuscripts are being received, virtually none of these have a Canadian author, and the quality of submissions is very poor. The Bilingualism Committee has recommended that the journal cease to publish manuscripts in French but allow the option of publication of a French abstract for an English paper; instructions to authors should continue to be in both official languages. The Publications Committee, while generally in favour of ending the publication of French manuscripts, has some concerns. The Board approved in principle the recommendation to cease publication of French manuscripts in *The Canadian Entomologist*. Implementation of the decision will be delayed until the Publications Committee has reviewed and recommended upon a full proposal, which is to be developed by the Editor-in-Chief and Bilingualism Committee.

Executive Meeting - Call for Agenda Items

If members have any items they wish to be discussed at the next Board of Directors or Executive Council meeting, please send them to the Secretary, Neil Holliday (see inside back cover for contact details), as soon as possible.

Réunion du conseil exécutif – Points à l'ordre du jour

Si des membres aimeraient ajouter des points à l'ordre du jour pour discussion à la prochaine réunion du Bureau des directeurs ou du Conseil de l'exécutif, merci de les envoyer au secrétaire, Neil Holliday (voir le troisième de couverture pour les informations de contact), le plus tôt

Members' discounts

Entomological Society of Canada members can enjoy discounts on publications from Annual Reviews, Elsevier, Cambridge University Press, and the Entomological Society of America. Details of how to benefit from these discounts are available on the member's area of the Entomological Society of Canada website at: https://esc-sec.site-ym.com/.

Remise pour les membres

Les membres de la Société d'entomologie du Canada peuvent bénéficier d'une remise lors d'achats de publications de : Annual Reviews, Elsevier, Cambridge University Press et de la Société d'entomologie d'Amérique. Les informations nécessaires pour profiter de ces remises sont disponibles dans la section des membres du site de la Société d'entomologie du Canada à : https://esc-sec.site-ym.com/.

68^{th} Annual Members' Meeting

Meeting Room 211, Vancouver Convention Centre, Vancouver, British Columbia
13 November 2018, 2:30 pm

MINUTES

1 Call to Order

The meeting was called to order at 2:31 pm by President Pat Bouchard, with 44 members present.

2. Notice of Meeting

Notice of the meeting was sent to all members by email on October 16, 2018, and was published in the March, June, and September 2018 issues of the *Bulletin*.

3. Additions to and approval of the Agenda

Motion: that the agenda be approved as circulated.
Moved by Boyd Mori, seconded by Sean McCann. **Carried.**

4. Minutes of the 67^{th} Annual Members' Meeting

The minutes of the 67^{th} Annual Members' Meeting were published in the December 2017 issue of the *Bulletin*.
Motion: that the minutes of the 67^{th} Annual Members' Meeting be approved as distributed.
Moved by Jeremy McNeil, seconded by Boyd Mori. **Carried.**

5. Commemoration of deceased members of the entomological community

The Heritage Committee reported the passing of four members since the previous Annual Members' Meeting: Ron Hodges (Eugene, Oregon), Jan Volney (Edmonton, Alberta), Bruce Heming (Edmonton, Alberta), and Sam Loschiavo (Winnipeg, Manitoba).

A moment of silence was observed in memory of all deceased members.

6. Report from the Board of Directors

President Pat Bouchard presented the report.

Everyone involved in the activities of the ESC during the past year (in particular those in the group photograph taken at the Board of Directors meeting on Sunday November 11, 2018) were thanked sincerely. A brief summary of strategic review activities (governance, membership, financial sustainability, communication) was given. Details regarding $7000 in funds set aside for new outreach initiatives were provided. Members were made aware that two new important documents/policies (Meeting Code of Conduct; Statement of Diversity and Inclusion) were accepted by the ESC Board of Directors. Members will receive more details about these shortly.

The current number of members was presented:

Membership category	Number of members
Student	142
Early Professional	34
Regular	281(51)
Emeritus	64
Total	527

The importance of maintaining and growing membership numbers for the ESC was emphasized. A list of advantages of being an ESC member (e.g., access to all *The Canadian Entomologist* and *Memoirs of the Entomological Society of Canada* current and back issues) was given. A list of people involved in planning the 2018 Joint Annual Meeting in Vancouver was shown and everyone thoroughly thanked for making the meeting a successful one.

Details regarding the Joint Annual Meetings planned for 2019 and 2020 were mentioned. Members were made aware that the ESC has accepted in principle to meet with the Entomological Society of America and Entomological Society of British Columbia again in Vancouver in 2022.

7. Resolution to approve the actions of the Board

Motion: that all Bylaws, contracts, acts and proceedings of the Board of Directors of the ESC enacted, made, done or taken since 24 October 2017, being the date of the last Annual Members' Meeting, be approved, adopted, ratified, sanctioned and confirmed.
Moved by Pat Bouchard, seconded by Peter Mason. **Carried.**

8. Treasurer's Report

8.1. Financial Statements for 2017–2018

Treasurer Joel Kits reviewed the Financial Statements for 2017 – 2018, which have been posted in the Members' Area of the website.
Motion: that the 2017–2018 financial statements for the Entomological Society of Canada be approved.
Moved by Christopher Dufault, seconded by Hugh Danks. **Carried.**
Motion: that the members receive for information the 2017–2018 financial statements of the Entomological Society of Canada Scholarship Fund.
Moved by Charlie Bailey, seconded by Alex Smith. **Carried.**

8.2. Review Engagement for 2018–2019

Motion: that Bouris, Wilson LLP of Ottawa be appointed as public accountants to ESC and the ESC Scholarship Fund to conduct the review engagement of both sets of financial statements for the 2018–2019 financial year.
Moved by Bill Riel, seconded by Christopher Dufault. **Carried.**

9. Amendment of Bylaw 34

Motion: that Bylaw 34 be amended as follows:
Replace:

> "34. Rules Managing Corporations' Affairs
> The Board may prescribe, amend or repeal rules and regulation not inconsistent with these By-Laws, relating to the management and supervision of the affairs of the Corporation as Standing Rules of the Corporation. Such rules and regulations shall be submitted for confirmation at the next annual members' meeting, and unless approved by a simple majority vote, shall cease to be valid."

With:

> "34. Rules Managing the Corporation's Affairs
> The Board may prescribe, amend or repeal rules and regulations, not inconsistent with these By-Laws, relating to the management and supervision of the affairs of the Corporation as Standing Rule of the Corporation."

Moved by Bill Riel, seconded by Tyler Wist.

In discussion, several members indicated that there should be an agreed-upon mechanism by which members are notified of the changes to the standing rules that are made by the Board. Although it was originally suggested that the mechanism be a report to the AMM, it was generally

agreed that the Board should undertake to report changes "in a timely manner."
With this understanding, the motion was **Carried**.
***Action*:** ESC Secretary to notify Corporations Canada of the change in Bylaw 34.
***Action*:** Bylaws, Rules and Regulations Committee, to include among its duties that it is to notify the membership in a timely manner of changes in the Standing Rules that are approved by the Board.

10. Election of Directors

Motion: that the following candidates be elected as Directors:

Position	Candidate	Length of term	Ends at AGM
Societal Director (2nd VP)	Bill Riel	3 years	2021
Director at Large	Suzanne Blatt	3 years	2021
Regional Director, ESBC	Brian Van Hezewijk	3 years	2021
Regional Director, ESO	Alex Smith	3 years	2021
Regional Director, AES	Peggy Dixon	1 year	2019

Moved by Bob Lamb; seconded by Tyler Wist.

Suzanne Blatt, Brian Van Hezewijk, and Peggy Dixon were not present at the meeting. As required by the *Canada Not-for-profit Corporations Act*, Suzanne, Brian, and Peggy sent a statement to the Board indicating agreement that they be elected as Directors of the Society.
Carried.
At this point, Pat Bouchard presented the gavel to incoming President Kevin Floate, and Neil Holliday escorted the newly-elected 2nd Vice-President to the podium.

11. Presentation of Service Awards

President Kevin Floate presented service awards to:

Pat Bouchard (Former President)
Vincent Hervet (Former Secretary)
Christopher Dufault (Former Treasurer)
Chris MacQuarrie (Co-Chair of the 2018 JAM)

12. Resolutions on behalf of the ESC

12.1. Resolution of thanks

Hugh Danks presented the resolution of thanks on behalf of the ESC:

"Whereas the Entomological Society of Canada has met jointly with the Entomological Society of British Columbia and the Entomological Society of America at the Vancouver Convention Centre, Vancouver, British Columbia; and
Whereas there has been a full and interesting meeting of lectures, symposia, papers, and posters; and
Whereas the meeting has been planned with care and concern for those attending; and
Whereas there has been ample opportunity for social interaction and visits to Vancouver and surrounding areas;
Be it resolved that the Entomological Society of Canada expresses its sincere thanks to the joint ESA/ESC/ESBC conference planning committee for their hard work and skill in arranging a worthwhile and entertaining program; and
Be it further resolved that the Society expresses its thanks to the staff of the Entomological Society of America, in particular Ms Rosina Romano, ESA Director of Meetings, for their efficient and

accommodating support to the Society in the lead-up to the meeting; and
Be it further resolved that the Society expresses its thanks to the corporate sponsors that generously donated funds to support activities at the meeting and travel for some students to attend the meeting; and
Be it further resolved that the Society expresses its thanks to the Management and Staff of the Vancouver Convention Centre and the conference hotels for their courteous assistance during the Meeting."

Carried by a round of applause.

13. Notice of 69th Annual Members' Meeting

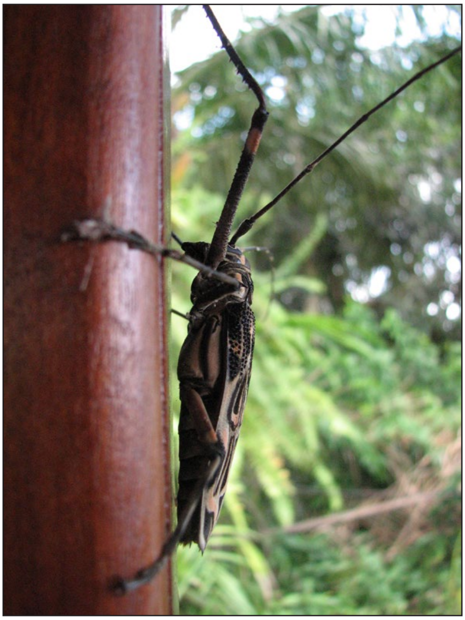
Next year's AMM is scheduled to take place on Tuesday August 20, 2019, at the Convention Centre, in Fredericton, New Brunswick.

The Secretary reminded members present that next year's JAM will be held jointly with the AES and the Canadian Society for Ecology and Evolution. A call for symposia has been made. The meeting theme will be "Connected by nature".

14. Adjournment

Motion: that the meeting be adjourned.
Moved by Tyler Wist, seconded by Kenna MacKenzie. **Carried.**

The meeting was adjourned at 3:03 PM.



D. Giberson

Harlequin beetle (*Acrocinus longimanus*; Coleoptera: Cerambycidae) on a post in Drake Bay, Costa Rica, April 2010.

Fifteenth Annual Photo Contest

The 15th Annual Photo Contest to select images for the 2020 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 31 August 2019. 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.

Quinzième concours annuel de photographie

Le quinzième 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 2020 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 31 août 2019. 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.

National Biodiversity Cryobank of Canada

The National Biodiversity Cryobank of Canada (NBCC), located at the Canadian Museum of Nature's (CMN) Natural Heritage Campus (1740 Pink Road, Gatineau (Aylmer Sector, Quebec), is the result of a donation by the Beaty family and officially opened in September 2018. The NBCC is a natural history biorepository of specimens from across Canada and abroad, with a capacity for over a million standard 2 mL cryovials. This state-of-the-art facility uses innovative liquid Nitrogen freezer technology and greatly enhances the CMN's ability to store frozen collections at -170 °C.

The core objective of the NBCC is to provide excellent specimen care with easy access for scientific use. Storage is available for vouchers from research projects outside of the CMN. The collections may contain representatives from all kingdoms of taxonomic classification in the form of tissues, environmental samples, phenotype vouchers, and DNA extractions. As an extension of CMN's collection facility, the operation of the NBCC is compliant with all other policies and procedures for the CMN.

For more information about the facility, send inquiries to nbcc-cncb@nature.ca, visit our webpage (https://nature.ca/en/research-collections/collections/cryobank), or write to National Biodiversity Cryobank of Canada, Canadian Museum of Nature, P.O. 3443, Station D, Ottawa, Ontario, K1P6P4, Canada.

canadian museum of nature
nature
musée canadien de la nature

Cryobanque nationale canadienne de la biodiversité

Fruit d'un don de la famille Beaty, la Cryobanque nationale canadienne de la biodiversité (CNCB), a officiellement ouvert ses portes en septembre 2018 au Campus du patrimoine naturel du Musée canadien de la nature (MCN) (1740, chemin Pink, Gatineau [secteur Aylmer], Québec). La CNCB est un biodépôt de spécimens d'histoire naturelle de tout le Canada et de l'étranger. Elle peut stocker plus d'un million de cryovials standard de 2 mL. Cette installation à la fine pointe de la technologie utilise la technologie novatrice de congélation à l'azote liquide. Elle améliore grandement la capacité du MCN à entreposer avec la plus grande intégrité les collections congelées (à -170 °C).

La mission de la CNBC est de fournir d'excellents soins à nos spécimens et un accès facile à des fins scientifiques. Elle peut aussi accueillir les spécimens de référence provenant de projets de recherche menés à l'extérieur du MCN. Les collections peuvent contenir des représentants de tous les règnes de classification taxonomique sous forme de tissus, d'échantillons environnementaux, de spécimens témoins de phénotypes et d'ADN. Comme il s'agit du prolongement de notre entrepôt de collections, l'exploitation de la CNCB est conforme à toutes les autres politiques et procédures du MCN.

Pour obtenir de plus amples renseignements sur l'installation, envoyez vos questions à nbcc-cncb@nature.ca, visitez notre page Web (https://nature.ca/fr/recherche-collections/collections/cryobanque), ou écrivez à Cryobanque nationale canadienne de la biodiversité, Musée canadien de la nature, C.P. 3443, succursale D, Ottawa (Ontario), K1P6P4, Canada.

Contents of Newsletters / Contenu des bulletins

THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

LA SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE

CPS-SCP News

VOL. 62, NO. 4 (Dec 2018)

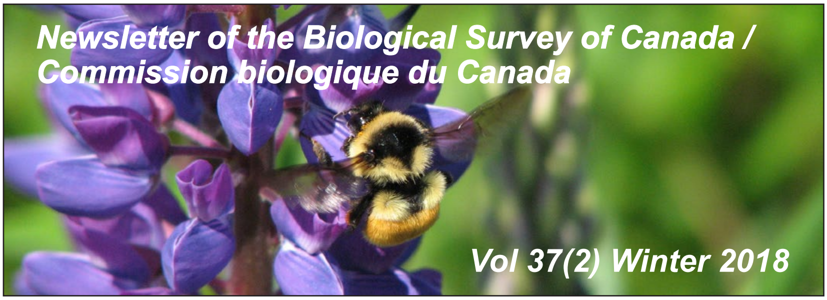
https://phytopath.ca/wp-content/uploads/2018/12/CPS-SCP-News-62-4-December2018.pdf

Canadian Weed Science Society
Société canadienne de malherbologie

CWSS-SCM Newsletter

January 2019

https://weedscience.ca/wp-content/uploads/2019/02/CWSS-SCM-Newsletter-January-31-2019.pdf



https://biologicalsurvey.ca/newsletter/bsc-winter-2018.pdf

In this issue

Meeting announcements / Réunions futures

1st International Molecular Plant Protection Congress
Adana, Turkey, 10-13 April 2019
http://www.imppc2019.org/

Joint Meeting of the Entomological Society of Canada, the Acadian Entomological Society and the Canadian Society for Ecology and Evolution
Fredericton, 18-21 August 2019
http://csee-esc2019.ca

7th International Entomopathogens and Microbial Control Congress
Kayseri (Turkey), 11-13 September 2019
http://emc2019.erciyes.edu.tr/

14th International Symposium: Ecology of Aphidophaga (IOBC-Global Working Group meeting)
Montreal, 16-20 September 2019
http://www.aphidophaga14.uqam.ca

26th International Congress of Entomology (Entomology for our planet)
Helsinki, Finland, 19-24 July 2020
http://www.ice2020helsinki.fi/

Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Alberta
Calgary, 18-21 October 2020

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.

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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.

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ISSN: 0071-0741

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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.

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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:
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ISSN: 0071-0741

Date de tombée pour le prochain numéro: 30 avril 2019

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

Cedric Gillott, Editor / Rédacteur

Lucky us!

Entomologists are among the most fortunate of scientists! They are in constant demand by the public and media to identify 'this strange bug', to offer wise comment/advice on such topics as 'Will there be many mosquitoes this summer?', 'Where did all these box-elder bugs/forest tent caterpillars come from?', and, of course, 'How do I get rid of …..[insert at your pleasure any number of 6-legged pests, woodlice, and spiders]?'.

More seriously, we are fortunate because we study the most diverse group of animals in the world. Whether it be their evolution, population biology, morphology, physiology, or molecular biology, they present an array of challenges for we who pursue insect science. But, their very diversity also means that sometimes we have to consult others with more expertise in an area than ourselves. As members of the ESC community, we have multiple opportunities to network with colleagues to obtain information on matters outside our own limited sphere of knowledge. Occasionally, these opportunities arise in serendipitous ways, as shown by the following example.

During a recent winter break in Antigua (highly recommended, by the way), the Editor met a rather attractive creature – a long-horned beetle (below) which presented itself at the door to our room, begging to be photographed. Of course, having 'shot' it, I was eager to learn its name. But how? I'm no taxonomist and the

Que nous sommes chanceux

Les entomologistes sont parmi les scientifiques les plus chanceux! Ils sont en demande constante de la part du public et des médias afin d'identifier « cette étrange bibitte », pour offrir de sages commentaires/conseils sur des sujets comme « Y aura-t-il beaucoup de moustiques cet été? », « D'où viennent toutes ces punaises de l'érable négondo/livrées des forêts? », et, évidemment, « Comment puis-je me débarrasser de… [insérer à votre goût tout ravageur à 6 pattes, cloportes et araignées]? ».

Plus sérieusement, nous sommes chanceux parce que nous étudions le groupe d'animaux le plus diversifié au monde. Que ce soit par leur évolution, la biologie des populations, la morphologie, la physiologie ou la biologie moléculaire, ils présentent une variété de défis pour nous qui étudions la science des insectes. Mais leur grande diversité signifie également que nous avons parfois besoin de consulter d'autres personnes avec plus d'expertise que nous dans un domaine précis. En tant que membres de la communauté de la SEC, nous avons de multiples occasions de faire du réseautage avec nos collègues pour obtenir des informations sur des questions en dehors de notre propre sphère très limitée de connaissances. Occasionnellement, ces opportunités surgissent de façon totalement fortuite, comme le montre l'exemple suivant.

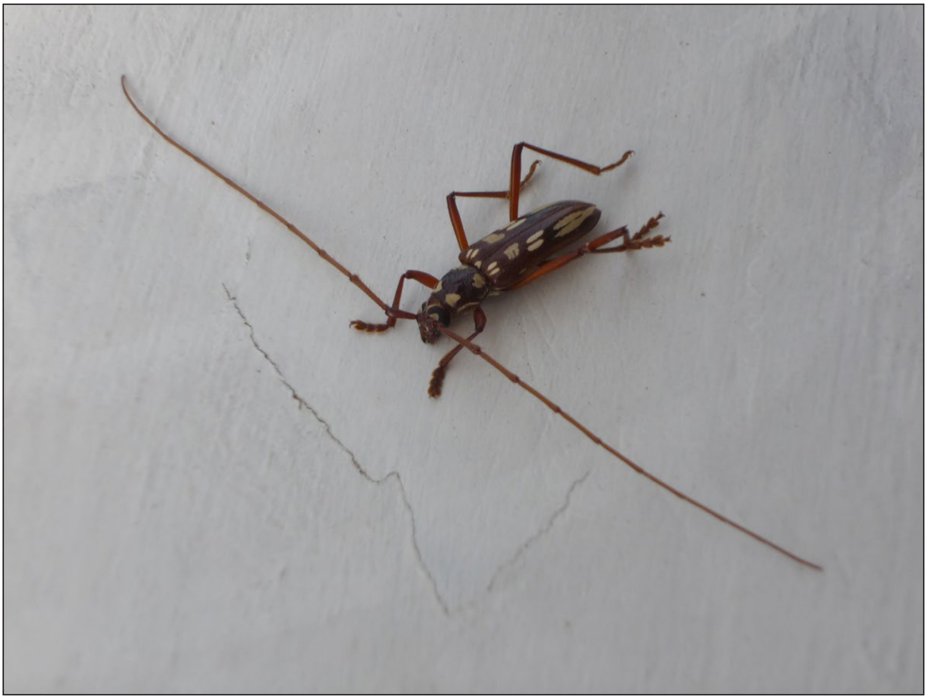
Durant une récente pause hivernale à Antigua (que je recommande fortement en passant), le rédacteur a rencontré une créature plutôt attirante – un longicorne (ci-dessous) qui s'est présenté à la porte de notre chambre, nous suppliant d'être photographié. Évidemment, après l'avoir photographié, j'étais impatient de connaître son nom. Mais

Cerambycidae is a large family. On my return to Saskatoon and assembling the *Bulletin*, I was in contact with Robert Wrigley over his article on another cerambycid, *Meriellum proteus* (page 36). Could he help? I sent the image to him, and in very short order, he had it 'pinned' – *Eburia decemmaculata*. The species is endemic to the Lesser Antilles, and is also found in Puerto Rico; though quite common it is not a pest.

So, the take-home message is simple: if you have a question that is outside your own sphere of knowledge, don't be shy about contacting an expert. If they cannot supply an answer, chances are that they'll know someone who can.

comment? Je ne suis pas un taxonomiste, et les Cérambycidés sont une grande famille. À mon retour à Saskatoon en assemblant le *Bulletin*, j'étais en contact avec Robert Wrigley concernant son article sur un autre cérambycidé, *Meriellum proteus* (page 36). Pourrait-il m'aider? Je lui ai envoyé la photo, et dans un délai très court il l'avait trouvé – *Eburia decemmaculata*. L'espèce est endémique aux Petites Antilles, et se trouve aussi à Porto Rico; bien que commune, il ne s'agit pas d'un ravageur.

Alors, le message est très simple : si vous avez une question qui est à l'extérieur de votre champ de connaissances, ne soyez pas gêné de contacter un expert. S'ils ne peuvent pas fournir une réponse, il y a de fortes chances pour qu'ils connaissent quelqu'un qui le pourra.


C. Gillott

Eburia decemmaculata

Entomological Society of Canada, 2018-2019
Société d'entomologie du Canada, 2018-2019

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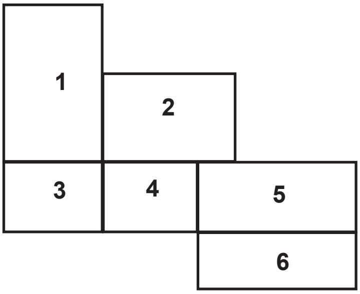

Front cover/Plate supérieur:

1. Female ambush bug (Hemiptera: Reduviidae: Phymata) (Centreville, Ontario, Canada).
Punaise femelle (Hemiptera : Reduviidae : Phymata) (Centreville, Ontario, Canada).
[Photo: Andrea Brauner]

2. *Philanthus multimaculatus* (Hymenoptera: Crabronidae) resting on a *Solidago* inflorescence in the fall (Kelowna, British Columbia, Canada).
Philanthus multimaculatus (Hymenoptera : Crabronidae) se prélassant sur une inflorescence de *Solidago* à l'automne (Kelowna, Colombie-Britannique, Canada).
[Photo: Robert LaLonde]

3. *Buprestis aurulenta* (Coleoptera: Buprestidae) relaxing on an aged deck on Hornby Island (British Columbia, Canada).
Buprestis aurulenta (Coleoptera : Buprestidea) se prélassant sur un patio vieillissant sur l'île Hornby (Colombie-Britannique, Canada).
[Photo: Debra Wertman]

4. Tabanidae (Diptera) collecting device: no alpine entomological survey is complete without it (Lillooet, British Columbia, Canada).
Un outil de récolte de tabanidés (Diptera) : aucun inventaire entomologique alpin n'est complet sans lui (Lillooet, Colombie-Britannique, Canada).
[Photo: Ward Strong]

5. Portrait of a tiger beetle, *Cicindela campestris* (Coleoptera: Carabidae) (Delémont, Switzerland).
Portrait d'une cicindèle champêtre, *Cicindela campestris* (Coleoptera : Carabidae) (Delémont, Suisse).
[Photo: Tim Haye]

6. The western bean cutworm, *Striacosta albicosta* (Lepidoptera: Noctuidae), is becoming a major concern for producers in Ontario and Québec. Colourful egg masse on corn leaf collected in Saint-Anicet (Québec, Canada).
Le ver-gris occidental des haricots, *Striacosta albicosta* (Lepidoptera : Noctuidae), devient une préoccupation importante pour les producteurs de l'Ontario et du Québec. Des masses d'oeufs colorés sur une feuille de mais récoltée à Saint-Anicet (Québec, Canada).
Cambridge Core [Photo: Julien Saguez]

Back cover/Plate inférieur:

Stiretrus anchorago (Hemiptera: Pentatomidae) from Okaloacoochee Slough State Forest (Hardy County, Florida, United States of America).
Stiretrus anchorago (Hemiptera : Pentatomidae) de la forêt d'état d'Okaloacoochee Slough (Hardy County, Floride, États-Unis).
[Photo: Matthias Buck]

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