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## Images

**Sur le dos:** Une mouche Asilidae rarement observée, *Ommatius bromleyi* Pritchard (Diptera: Asilidae), Guadaloupe Canyon, Arizona. Photo: S.A. Marshall

**Sous le titre:** Une larve d'oestre humain, *Dermatobia hominis* (Linnaeus, Jr.) (Diptera: Oestridae), excisée de sous la peau de son hôte, Costa Rica. Photo: W.B. Strong.

**1** Un bombyle, *Bombylius aurifer* Osten Sacken (Diptera: Bombyliidae), battant des ailes sur une feuille, Vernon, Colombie-Britannique. Photo: W.B. Strong

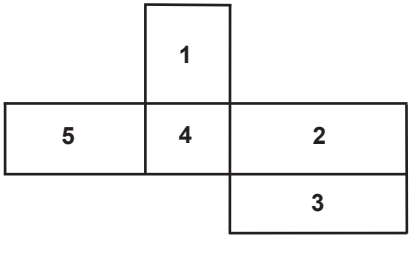
**2** Les coordinateurs du Manuel des Diptères néarctiques en compagnie du diptériste allemand Willi Hennig lors de sa visite à l'Unité Diptères de la Collection nationale canadienne d'insectes (Ottawa) à l'automne 1967. Derrière de gauche à droite: Frank McAlpine, Herb Teskey, Guy Shewell; devant, de gauche à droite: Monty Wood, Dick Vockeroth, Bobbie Peterson, Willi Hennig. Photo: inconnu

**3** Une mouche Stratiomyidae, *Caloparyphus decemmaculatus* (Osten Sacken) (Diptera: Stratiomyidae), Nouveau-Méxique. Photo: S.A. Marshall

**4** Une tête de mouche des narcisses, *Merodon equestris* (F.) (Diptera: Syrphidae), une espèce introduite en Amérique de Nord à partir de l'Europe, Vernon, Colombie-Britannique. Photo: W.B. Strong

**5** Parade/accouplement de mouches à longues pattes, *Dolichopus* Latreille (Diptera: Dolichopodidae), tourbière Copetown, Wentworth Co. Ontario. Photo: S.A. Marshall

**Couverture arrière:** Une mouche Stratiomyidae, *Odontomyia cincta* Olivier (Diptera: Stratiomyidae), près de parc national Elk Island, Alberta. Photo: H.C. Proctor



# Up front / Avant-propos

**Michel Cusson, President of ESC / Président de la SEC**

## No winter diapause for the ESC!

There may not be too many life-history traits that we, entomologists, envy our favorite animals for, except perhaps their ability to get through the harsh Canadian winter by entering diapause: a well-deserved rest, some of us might say! But I can assure you that I've seen no sign of quiescence or metabolic slowdown among those whose responsibility it is to keep the ESC machine going forward this winter.

First, the move of *The Canadian Entomologist* (*TCE*) to its new "home", Cambridge University Press (CUP), was finalized on 1 January 2012. In preparation for the first CUP-produced *TCE* issue, slated for the beginning of 2012, the transition from NRC Research Press to our new publisher began last September, after Chris Buddle stepped in as new *TCE* Scientific Editor. Thus, since September, authors wanting to submit manuscripts for publication in *TCE* have had the privilege of

## Pas de diapause hivernale pour la SEC!

Rares sont les attributs biologiques que les entomologistes envient aux bestioles qu'ils affectionnent, sauf peut-être leur aptitude à survive aux rigueurs de nos hivers par le truchement de la diapause: un repos bien mérité, certains oseraient peut-être scander! Toutefois, je peux vous confirmer n'avoir détecté aucun signe de quiescence ou de ralentissement métabolique parmi ceux et celles qui avaient la responsabilité de faire fonctionner la « machine ESC » cet hiver.

Tout d'abord, la migration de notre revue, *The Canadian Entomologist* (*TCE*), vers sa nouvelle « résidence », Cambridge University Press (CUP), a été finalisée le 1e janvier 2012. En préparation pour le premier numéro de *TCE* sous la bannière CUP, prévu pour le début de 2012, la transition de NRC Research Press vers la nouvelle maison d'édition a débuté en septembre dernier, après l'entrée en fonction de Chris Buddle comme nouveau Rédacteur scientifique. Ainsi, depuis septembre, les auteurs désireux de soumettre un manuscrit pour publication dans *TCE* ont eu le privilège d'utiliser ScholarOne, le système convivial de soumission en ligne administré par CUP. De plus, les premiers utilisateurs de ce système ont pu mettre à l'essai la nouvelle structure du Comité de rédaction (avec ses Rédacteurs thématiques) et le nouveau processus d'évaluation élaboré par Chris l'été dernier. Le résultat renversant de ces changements est le suivant : depuis septembre, le temps moyen de traitement des manuscrits, de la soumission à la décision, est passé sous la barre des 30 jours! Croyez-moi, peu de revues scientifiques internationales peuvent se vanter d'une efficacité aussi phénoménale.

Vous êtes déjà au fait des principaux avantages associés à la publication de *TCE* par CUP : aucun coût de page pour les auteurs et l'impression gratuite des illustrations en couleur.

using CUP's user-friendly online manuscript submission system, ScholarOne. In addition, early users of this system were given the opportunity of testing the new Editorial Board structure (with Subject Editors) and review process developed by Chris last summer. The astonishing result is that, since September, the average turnaround time, from manuscript submission to decision, has been less than 30 days! Believe me, few international scientific journals can boast such phenomenal efficiency.

You are already aware of some of the advantages of having *TCE* published by CUP, with the two most striking ones being the absence of page charges and the printing of colour illustrations at no cost to authors. Another important advantage is the EarlyView feature of the new *TCE*-CUP website (http://journals.cambridge.org/action/displayJournal?jid=tce), which allows users to download PDF versions of papers as soon as they are ready for online viewing, typically weeks before they appear in print. As you may have noticed, several such EarlyView papers were already available for download at the beginning of February. With respect to back issues, those of you who have visited the new *TCE* website may have observed that their transfer (as PDF files) from NRC Research Press to CUP was not complete at the time CUP officially became the publisher of *TCE*, although access to these earlier volumes was maintained through a link to the old website. By the time you read this column, the transfer of all back issues should have occurred.

In an effort to further enhance the status and prominence of *TCE*, the Editorial Board has put forward the idea of scheduling themed issues, for which internationally renowned experts will be invited to contribute manuscripts. The first of such a series will be entitled "Perspectives on Arctic Arthropods", and a call for papers is now posted on the *TCE*-CUP website (http://journals.cambridge.org/images/fileUpload/images/TCE_Call_for_Papers_Perspectives_on_Arctic_Arthropods.pdf), as well as in this issue of the *Bulletin*. The deadline for manuscript submission is 1 June 2012, with

Un autre attribut non moins avantageux est la fonctionnalité « EarlyView » du nouveau site web de *TCE*-CUP (http://journals.cambridge.org/action/displayJournal?jid=tce), laquelle permet aux usagers de télécharger les versions PDF d'articles quelques semaines avant la parution des versions imprimées. Comme vous l'avez peut-être remarqué, plusieurs articles « EarlyView » étaient déjà disponibles pour téléchargement au début de février. En ce qui concerne les numéros antérieurs, ceux d'entre vous qui avez consulté le nouveau site web de *TCE* ont peut-être remarqué que le transfert de ces anciens numéros, sous forme de fichiers PDF, de l'ancien éditeur à CUP n'avait pas encore été complété au moment où celle-ci devenait la maison d'édition officielle de *TCE*, bien que l'accès aux volumes antérieurs ait été maintenu grâce à un lien vers l'ancien site web. Lorsque vous lirez cette chronique, le transfert des numéros antérieurs devrait avoir été complété.

Dans le but de poursuivre les efforts entrepris pour améliorer le statut et le rayonnement de *TCE*, le Comité éditorial a mis de l'avant un projet visant la publication de numéros thématiques auxquels des experts de renommée internationale seront invités à contribuer. Le premier de cette série sera intitulé « Perspectives on Arctic Arthropods », et une invitation à présenter des manuscrits est maintenant disponible sur le site web *TCE*-CUP (http://journals.cambridge.org/images/fileUpload/images/TCE_Call_for_Papers_Perspectives_on_Arctic_Arthropods.pdf), ainsi que dans ce numéro du *Bulletin*. La date limite pour la soumission des manuscrits est le 1e juin 2012 et la publication du numéro spécial est prévue pour février 2013. Il est à prévoir que cette initiative aura un impact très positif sur l'évolution de notre revue.

Et, croyez-le ou non, la liste des nouvelles palpitantes à propos de *TCE* ne s'arrête pas là! En effet, notre revue est maintenant présente sur Twitter, une initiative de notre Rédacteur scientifique. Si vous accédez au site web de *TCE*-CUP via le lien fourni sur la page d'accueil du site de la SEC, vous pourrez

a planned publication date of February 2013. This is promising to be another very positive step in the evolution of our journal.

And believe it or not, there are yet other exciting things happening with *TCE*, including the journal's presence on Twitter, an initiative of our Scientific Editor. If you go to the *TCE*-CUP website through the link provided on the ESC homepage, you'll see a Twitter button that you may click to access recent tweets related to *TCE*. In addition to providing a means of communicating short comments on papers published in *TCE,* this system offers early alerts for *TCE*-related news items [e.g., "Papers from our first issue of 2012 are now available on-line ("First View"): http://journals.cambridge.org/action/displayJournal?jid=tce (Part 2 of the Diptera Festschrift)"]. Other Web 2.0 features are currently on the drawing board for the ESC website – stay tuned!

Members of the organizing committees of both the last (Halifax) and upcoming (Edmonton) JAMs have been quite busy in the past few months. First, the Acadian Entomological Society produced and released its final report on the meeting it hosted last November at The Westin Nova Scotian. The report not only confirmed what we already knew about the success of the meeting, but it highlighted the ability of the Organizing Committee to generate a substantial profit without skimping on those items that contribute to making our annual meeting an enjoyable experience. Their report also contained several recommendations for improving the JAM registration/abstract submission webpage, which the Web Content Committee is taking action on so that the recommendations are implemented before the next JAM. If you've enjoyed the Halifax meeting and wish to reminisce about some of its pleasurable moments, I invite you to go to the ESC website and browse through the photo album that our webmaster, Rick West, has put together for us. Not only will you appreciate the slide show, but it will make you look forward to the next JAM!

On the topic of the next meeting, development of the scientific program on the theme of

cliquer sur le bouton Twitter et accéder à une liste de « tweets » récents en lien avec *TCE*. Non seulement ce système constitue-t-il une méthode efficace pour transmettre des commentaires brefs sur des articles publiés dans *TCE*, il permet aussi la transmission d'avis instantanés à propos de sujets qui concernent la revue [par exemple: "Papers from our first issue of 2012 are now available on-line ("First View"): http://journals.cambridge.org/action/displayJournal?jid=tce (Part 2 of the Diptera Festschrift)"]. D'autres nouveautés dans la mouvance du Web 2.0 sont présentement à l'étude pour le site web de la SEC – restez à l'écoute!

Les membres des comités organisateurs de la dernière (Halifax) et de la prochaine (Edmonton) réunions annuelles conjointes se sont passablement affairés au cours des derniers mois. D'abord, la Société entomologique acadienne a produit et distribué son rapport final sur le congrès qu'elle a organisé en novembre dernier à l'hôtel The Westin Nova Scotian. Ce rapport ne fait pas que confirmer ce que nous savions déjà à propos du succès de cet événement, mais il met en lumière l'habileté du Comité organisateur à générer un profit substantiel sans avoir eu à lésiner sur les éléments qui contribuent à faire de notre réunion annuelle une expérience agréable pour tous. Le rapport contenait aussi plusieurs recommandations visant à améliorer la page web dédiée à l'inscription et à la soumission des résumés en ligne. D'ailleurs, le Comité du contenu internet a entrepris des démarches pour que ces recommandations soient mises en application avant la prochaine réunion annuelle. Si vous avez apprécié la réunion conjointe d'Halifax et que vous avez envie de vous retremper dans son atmosphère en vous remémorant les meilleurs moments, je vous invite à visiter le site web de la SEC et à explorer l'album photo que notre webmestre, Rick West, a mis en ligne pour nous. Non seulement allez-vous apprécier ce diaporama, mais il vous donnera envie de participer à la prochaine réunion conjointe!

Parlant du prochain congrès, des progrès importants ont été réalisés dans l'élaboration

Arthropod Diversity has made great progress, starting with an impressive slate of speakers for the Plenary Symposium: Jeremy Kerr (University of Ottawa), Wayne Maddison (University of British Columbia), and Daniel Rubinoff (University of Hawaii). In addition, seven other symposia, with topics ranging from insect behaviour to insect genomics, are currently being developed. Clearly, the Scientific Program co-chairs, Maya Evenden and Felix Sperling, are working hard to concoct a high-quality and varied scientific event. Another promising development is the organization of a pre-conference (Sunday morning) workshop on the publication process, a project proposed by Chris Buddle, Rose DeClerck-Floate and Kenna MacKenzie. Those who wish to improve their skills in navigating through the publication maze will definitely want to attend this workshop. So, there's little doubt that the Organizing Committee, chaired by Greg Pohl, is taking every possible step to ensure that all ESC members will want to put the Edmonton JAM (4-7 November 2012) on their agenda.

I hope I've convinced you that winter diapause is not an option that your ESC representatives have had time to contemplate this year … at least, not for themselves. In the meantime, "The Waters of March" (title of one of Antonio Carlos Jobim's greatest songs) will soon start trickling in your backyard, heralding the return to activity of your favorite insects. I wish you a most enjoyable spring season!

Michel Cusson
President

du programme scientifique, lequel est axé sur le thème de la diversité des arthropodes. Il faut d'abord faire mention du choix impressionnant de conférenciers pour les Conférences plénières : Jeremy Kerr (Université d'Ottawa), Wayne Maddison (University of British Columbia), et Daniel Rubinoff (University of Hawaii). De plus, sept autres symposiums, sur des thèmes variés allant du comportement à la génomique des insectes, sont en cours de préparation. De toute évidence, les Coprésidents du programme scientifique, Maya Evenden et Felix Sperling, travaillent très fort pour nous concocter un événement scientifique à la fois varié et de haute qualité. Une autre initiative prometteuse est l'organisation d'un atelier en pré-conférence (le dimanche matin) sur le processus de publication, un projet mis de l'avant par Chris Buddle, Rose DeClerck-Floate et Kenna MacKenzie. Ceux et celles qui souhaitent améliorer leur capacité à négocier les virages sur le parcours parfois tortueux du processus de publication voudront, sans hésitation, participer à cet atelier. Donc, il ne fait aucun doute que le Comité organisateur, présidé par Greg Pohl, fait tout en son pouvoir pour s'assurer que les membres de la SEC voudront inscrire la réunion annuelle d'Edmonton (4-7 novembre 2012) à leur agenda.

J'espère vous avoir convaincu que vos représentants de la SEC n'ont pas eu le temps d'envisager la diapause hivernale cette année comme méthode d'évitement…du moins, pas pour eux-mêmes. Quoiqu'il en soit, les « Eaux de mars » (titre d'une chanson célèbre d'Antonio Carlos Jobim) commenceront bientôt à ruisseler dans vos jardins, annonçant l'imminent retour à la vie active de vos bestioles préférées. Je souhaite à toutes et à tous un printemps des plus agréables!

Michel Cusson
Président

Murray Isman

## The Beneficiaries of My Efforts

It is impossible to start without stating how deeply honored and humbled I am to receive this award from the Society. When I perused the list of past recipients – an august group including many scientists that I have looked up to for years – I had to wonder whether I was really worthy of joining this most distinguished 'club'. After all, receiving the Gold Medal isn't exactly something that young entomologists aspire to; it is only after years of research and teaching and a considerable body of accomplishments that one can even have a fleeting daydream of being so honored – some day…

Receiving an award of this magnitude certainly gives one pause for thought and reflection, something we don't do much of given the pace and pressures of our daily lives. My first thought was that I've spent over 28 years as a professional entomologist (i.e., "doing this stuff"). That raised some salient questions I had to ask myself:

Why did I do what I've done? What was my motivation?

Does anyone care? Has it really mattered to anyone?

If so, who are the beneficiaries of my efforts?

Let's start at the beginning – my childhood. Although I was born and raised in urban Vancouver, I was an innate lover of the natural world. My mother would be quick to point out that I was an avid collector – rocks, shells, "bugs" – and enamored with small living things like frogs and garter snakes that used to be common throughout residential areas of the city. We had a small (artificial) pond in our back yard, mostly covered with water lilies and algae. I remember the excitement of finding dragonfly naiads in that pond, one of my first positive entomological experiences. As I progressed into high school, I became particularly interested in marine invertebrates. Living close to the ocean I was able to have a large seawater aquarium at home stocked with small sea stars, urchins, tubeworms and the like. Indeed, as I entered the University of British Columbia (UBC) as a freshman I anticipated studying these creatures in depth through a curriculum in Zoology. Early in my second year I took the first available course in invertebrate zoology; I enjoyed it and did quite well.

But, as so often happens, something – or more correctly, someone – came along and changed the course of my studies, and ultimately, my career. That person was Geoff Scudder, at the time Head of the Department of Zoology and the instructor for Introduction to Entomology, a third year course. It quickly became apparent that entomology was my karma. Even though I was only in second year, I finished either with the top mark in the course or within the top two or three (you'll have to excuse my memory of an event that took place 38 years ago), in a class predominantly populated by third and fourth year students. I followed this up by taking Geoff's fourth year 'advanced entomology' course in my third year, and then conducted a small research project in his lab as a directed study in my fourth year.

Midway through my final year, Geoff asked, "What are you planning on doing when you graduate?" I replied, "I have no idea." To which Geoff said, "Good, you can do a Masters with me." I said, "Okay."

I went on to have a very productive Masters program, culminating in five peer-reviewed journal papers. My research examined acquired chemical defenses (cardiac glycosides) from milkweed plants (*Asclepias* species) and the brightly coloured seed bugs (*Oncopeltus fasciatus* [Fig. 1] and *Lygaeus kalmia*, Lygaeidae) that specialize on them. I had a love affair with those insects.

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Figure 1. The large milkweed bug, *Oncopeltus fasciatus* (Lygaeidae), launched my research career and remains a beloved insect of mine.

Ironically, my first paper (Isman et al. 1977), documented cardiac glycosides in other insects (e.g., the beetles *Tetraopes* and *Labidomera*). In answer to the self-imposed question "Does anyone really care?", I was pleasantly surprised to find that this paper has been cited 33 times according to the Thomson Reuters' (ISI) Web of Science, including two citations in 2011!

Although I loved the research I conducted with the milkweed bugs, I found explaining my work, and moreover, explaining the merits of curiosity-driven ('basic') research to non-science friends, family and neighbours (i.e., the lay public) quite challenging. This was especially so as part of the work was federally funded (through NSERC) by their tax dollars.

For my doctoral work at the University of California-Davis, under the supervision of Sean Duffey, I examined the role of plant secondary compounds in foliage of commercial tomato cultivars in host-plant resistance to a major pest, the fruitworm (*Helicoverpa zea*), a noctuid (Isman & Duffey 1982). This project opened my eyes to the world of agricultural entomology and pest management; I also learned that you could ask some rather basic biological questions in your research, but in working with crop plants and pest species, there were many more funding opportunities! One of the saddest occasions of my career was an afternoon in May 1997 when a tearful colleague from Davis called to tell me that Sean had died very suddenly, at age 53, while teaching a class.

From Davis I moved south to the University of California's Irvine campus, for a postdoctoral stint with Eloy Rodriguez. At Irvine I investigated the potential of secondary plant compounds from desert plants (including the Mexican rubber plant, guayule) as natural insecticides (Isman & Rodriguez 1983). The discovery and development of botanical insecticides and antifeedants later became a predominant theme of my research program, particularly after I had the remarkable fortune to land a tenure-track position in 1983, back at UBC where my education had started. Some 23 years later I published a review on botanicals (Isman 2006), that seems destined to become my best known paper, currently with more than 350 citations according to Thomson Reuters. For some reason that completely escapes me, this is also the most heavily cited review paper in that particular volume (Number 51).

Then doctoral student Don Champagne (now a tenured professor at the University of Georgia) encouraged me to consider working on neem, a natural insecticide obtained from seeds of the Indian neem tree, *Azadirachta indica*, a member of the mahogany family (Meliaceae). The 'discovery' of neem by German entomologist Heinrich Schmutterer in the late 1950s (about 2000 years after the first records of its use for pest control in India!) and the isolation of the active principle azadirachtin in the late 1960s spawned immense interest in this material in research labs worldwide (Fig. 2). This was followed by numerous international conferences on the subject of neem (including one at UBC in 1999 that I organized) and many published volumes dedicated to the topic, among which the most reputable is simply titled *The Neem Tree*, published first in 1995 with a second edition in 2002 (Schmutterer 2002). Azadirachtin is truly a remarkable chemical, owing to its unique modes-of-action in insects (as an ecdysone antagonist and independently as an antifeedant), its lack of toxicity in mammals, and its structural complexity that defied synthetic duplication until very recently.

Twenty years ago the prevailing wisdom was that although azadirachtin was the most bioactive

Figure 2. With Heinrich Schmutterer and Ramesh Saxena (c. 1996), two of the best known scientists in the "neem world".

substance in neem seed extracts, there were several related triterpenes ('limonoids') that while individually less active, created some magical harmony with azadirachtin. We set out to rigorously determine the relationship between azadirachtin concentrations in neem seed oils, obtained commercially from India, and insecticidal and antifeedant bioactivities of those oils. In the resulting paper (Isman et al. 1990), we concluded that bioactivity was highly correlated with azadirachtin content, with the other limonoids playing far less important, if not trivial, roles. Further work corroborated that conclusion. To date, this paper remains my most highly cited original research work, with 185 citations.

We went on to assist a Canadian company in developing a neem-based insecticide in the early 1990s, but the regulatory environment in Canada at the time was not very welcoming for a product like neem, and the company decided they lacked the resources to see the product through to registration. Neem insecticides have yet to receive full regulatory approval from the Pest Management Regulatory Agency (Health Canada), in spite of the fact that the Environmental Protection Agency in the USA granted full registration in 1990. We also discovered along the way that a sibling species of the Indian neem tree, the sentang tree of Malaysia and Thailand (*Azadirachta excelsa*) produces azadirachtin analogs not only in its seeds, but also in its wood. The commercial significance of this finding is that sentang is being grown in large plantations in Malaysia as a substitute for teak – harvested to near extinction – with the prospect of thousands of tonnes of sentang wood waste that could be extracted to produce botanical insecticides. To that end we filed a patent in Malaysia that was eventually approved and assigned to the Malaysian government (Isman et al. 1997).

Generous funding from NSERC in the late 1980s to the late 1990s and an excellent collaboration with John Arnason (University of Ottawa) and the late Neil Towers (UBC) greatly facilitated the expansion of my laboratory to include several graduate students and postdoctoral fellows in addition to my research technician (Figs. 3, 4). Building a medium to large research program requires people – students (graduate and undergraduate), fellows, technicians, research associates and visiting scholars. Properly composed and stratified, members of a research lab do much of the actual learning from each other; the role of the lab leader is to provide the philosophical, ethical and intellectual foundation for all the work conducted by the team. In as much as some graduating members of the lab will go on in their own careers to eschew the philosophy imparted by their former supervisor, they become immediate beneficiaries of the professor's efforts.

Figure 3. Isman laboratory, circa 2007. Research associate Yasmin Akhtar (front row, far left) and research technician Nancy Brard (back row, third from left) are the longest standing members of the lab at 13 and 24 years, respectively.

My second, and more commercially successful, foray into the development

Figure 4. With Opender Koul (and a taller friend) in Zambia, 2011. Opender, one of the most recognized authorities on botanical insecticides, was a member of my lab from 1988-1992.

of botanical insecticides started when a local stock promoter wandered into my office in 1995 touting a new insecticide that was going to be the greatest thing since sliced bread! After my BS alarms stopped ringing, we applied a small amount of the white powder onto a couple of mature tobacco cutworms (*Spodoptera litura*) and, sure enough, they almost immediately convulsed and then died! Thus began my long relationship with EcoSMART Technologies (now headquartered in suburban Atlanta) that led to their commercialization of pesticides (insecticides, miticides, herbicides and fungicides) based on plant essential oils (Fig. 5). And I can confidently say that as a founding member of the company's scientific advisory panel (in 1996), I have learned that commercialization of a pest control product is 20% about science and 80% about other considerations.

I did find it quite intriguing that common culinary herbs and spices could produce neurotoxic insecticides, but it was a legal loophole that facilitated the commercial development of these as pesticides. Certain among these plants and the oils distilled from them can be found on FIFRA's (Federal Insecticide, Fungicide and Rodenticide Act) List 25B – "Exempted Active Ingredients". Precluding the need for extensive and expensive toxicological and environmental data to support pesticide registration, and the ready availability of the oils owing to their worldwide use as flavourings and fragrances, created a fast-track to the marketplace. Fortunately the founders of the company were sincere in their quest to understand what they had, and invested considerable funds (roughly $5 million) in a handful of university and private laboratories in the USA and Canada, mine included. This allowed us to conduct a wide range of basic and applied studies into the modes-of-action, chemistry and non-target effects of plant essential oils (Isman 2000).

A most striking finding emerged from our studies aimed at "deconstructing" rosemary oil, a major constituent in several of the EcoSMART products. Chemical analyses of 30 commercial rosemary oils revealed about 10 major volatile terpenoid constituents (monoterpenes and sesquiterpenes) that account for over 90% of the oil by weight. We attempted to relate chemical composition of the oils to their toxicity to cabbage loopers (*Trichoplusia ni*) and armyworms (*Pseudaletia unipuncta*), but found that few, if any, individual constituents were correlated to toxicity (Isman et al. 2008). We then turned to the two-spotted spider mite (*Tetranychus urticae*) and created 'artificial' rosemary oils comprised of the 10 major constituents blended in their natural ratios. By removing individual constituents from the artificial oils, we hoped to determine which constituents made the greatest contribution to overall toxicity of the oil. Five of the major constituents appeared to contribute to toxicity, whereas the five others could be removed without influencing toxicity. We expected a mixture of the five putative 'actives' alone to be as efficacious as the natural rosemary oil or an artificial oil containing all major constituents. To our great surprise, the mixture of the five putative actives only produced 25% mortality in mites. As expected, a mixture of the five putative 'inactives' produced no mortality. But magic occurred when we admixed the putative actives with the inactives – full toxicity (actually around 90% mortality) was restored (Miresmailli et al. 2006). We concluded that the putative inactive constituents in some manner facilitate the toxicity of the active constituents; in other words, there is internal synergy among all constituents. This phenomenon is precisely the opposite

of what we observed in working with azadirachtin and neem insecticides, where azadirachtin appeared to carry the day and the remaining limonoids were little more than biological jetsam and flotsam in the mix! We were later able to corroborate our spider mite results in toxicity tests with artificial mixtures of constituents from two insecticidal essential oils from China using the cabbage looper (Jiang et al. 2009), and we even found that the phenomenon of internal synergy of terpenoids in plant essential oils extends to their antifeedant effects in the cabbage looper.

Among small pesticide manufacturers, EcoSMART Technologies has seen moderate success in getting products into the marketplace. They have a well-developed line of professional pest control products (i.e., for management of cockroaches, ants, flies, termites and other pests in warehouses, commercial kitchens, schools, etc.) that was recently spun off to Prentiss Corporation of Atlanta. In the early days of their scientific advisory panel I encouraged the company to develop products for agriculture and this became one of our major research contributions for several years. About 10 years ago, they began marketing an insecticide-miticide (Ecotrol™), along with an herbicide and a fungicide, all based on plant essential oils. Two years ago this line of organically-certified agricultural pesticides was licensed by Brandt Consolidated of Illinois; the insecticide-miticide (with rosemary oil as a major active ingredient) is now sold under the Ecotec™ brand (Fig. 5). I found it particularly gratifying to review field trial data obtained by a private research firm in California (Pacific Ag Research) that showed, for example, that Ecotec provided significantly better control of western flower thrips (*Frankliniella occidentalis*) on strawberry than spinosad, a widely-used and organically-certified insecticide produced by Dow Chemical Co.

EcoSMART also produced some animal care products (flea and tick control products for dogs and cats) that were licensed to Sergeants, a major manufacturer in this market sector. In the past 3 years EcoSMART has concentrated their efforts on consumer products for home and garden pest control. Their products have steadily gained ground in a very competitive marketplace, and are currently sold in more than 10,000 retail outlets in the USA as well as in over a dozen other countries. Unfortunately Canada is not yet among the 'other countries', but the company is in discussion with potential partners in this country and with the PMRA with the goal of introducing the consumer products in the near future. Having lent a hand in helping EcoSMART reach its current position expands the list of beneficiaries of my efforts to now include growers (with a new tool in the arsenal, especially for organic food production), farm workers (who usually suffer the worst health effects from pesticide use) and consumers. The last group should not be underestimated; according to the USDA, roughly 75% of US households use pesticides in the home.

Throughout my involvement in pesticide development research I've tried to maintain my natural curiosity, you might even say 'wonder', about insects, and translate that into tangential research projects. We had been studying the ability of noctuid larvae to habituate (i.e., become desensitized) to antifeedant plant compounds following repeated or continuous exposure. We also recognized that a number of substances that were feeding deterrents to larvae deterred oviposition by adult moths. Could larval exposure to a deterrent influence subsequent adult response to the same deterrent? Indeed, we found that to be the case with both the cabbage looper and the diamondback moth (*Plutella xylostella*). Plant compounds that normally deter oviposition in 'naïve' moths, either failed to deter moths exposed to low concentrations of the compounds in the larval stage, or in some cases, became oviposition stimulants (Akhtar et al. 2003)! We believe this to be one of the very few rigorous examples of 'memory through metamorphosis' which is all the more remarkable when you consider that oviposition deterrents are perceived by chemosensilla on the moths' ovipositor and possibly on the tarsi, but not on the mouthparts. We eventually determined that there was a critical period for the memory to be fixed in the


Figure 5. EcoSMART Technologies' line of essential oil-based pesticides for the US consumer market (top), and Brandt Consolidated's line of essential oil-based pesticides for agriculture (bottom). I was directly involved in the development of all of these products.

last larval instar; if exposure to the deterrent was discontinued prior to that critical period, the insects 'forgot' (i.e., emergent moths behaved like naïve moths with no previous exposure) (Shikano & Isman 2009).

Returning to my main programmatic focus on botanical insecticides, after several years working on the development of such products based on neem and essential oils, it occurred to me that there are two, quite distinct domains in which botanicals could play a role in pest management. The first is for production of 'safe' and 'green' pesticides for consumers and organic growers in the highly regulated but affluent G20 countries of the Northern Hemisphere; the second is for subsistence farmers in the least developed countries where losses to pests both in crop production and post-harvest storage can be massive and even incremental gains in pest suppression could have important consequences for human nutrition. Moreover, least developed countries tend to (1) have the majority of pesticide poisonings worldwide, when conventional products are used; (2) have farmers who can least afford conventional crop protectants; and (3) often have pesticidal plants readily available at minimal or no cost. I tried to articulate this case in an invited perspective paper (Isman 2008).

That paper played a role in my invitation to serve as an international advisor for a European Union-funded research network covering seven sub-Saharan countries, known as the ADAPPT network ('African Dryland Alliance for Pesticidal Plant Technologies'). The main thrust of the network is to increase farmers' awareness of the potential utility of endemic (or introduced) plants

widely available for pest management. Recent trips to Zambia and Rwanda have shown me that even our most basic knowledge of plant chemistry and entomology and the most low-tech applications of selected plants can have substantial value to some of the world's most vulnerable populations. Prior to this we had some experience in projects of this type. A former doctoral student from Indonesia evaluated the use of seeds from the sweetsop and soursop (*Annona* species), edible fruits closely related to the custard apple, as potential sources of insecticides. These fruits are eaten fresh or used to make juice throughout south east Asia, and the seeds are a waste product. In greenhouse tests we found that aqueous emulsions of crude ethanolic seed extracts were as effective as rotenone (a botanical insecticide sold in the USA, Canada and Europe) in protecting cabbage plants from larvae of the diamondback moth (Leatemia & Isman 2004)

In summary, I think I can say that the beneficiaries of my efforts include:

Farmers and farm workers, especially in least developed countries

Consumers, especially in industrialized countries

Students, postdoctoral fellows and other trainees who have worked in my laboratory

Colleagues, through my service to scientific societies, journals and grant agencies.

That my endeavors may have benefitted others is in no small part a consequence of the influence of several mentors from whom I benefitted greatly. These include my graduate supervisors (Geoff Scudder and the late Sean Duffey) and my major collaborators early in my career (John Arnason and the late Neil Towers). To that list I would like to add John Borden, with whom I never actually collaborated but who nonetheless promoted my career in subtle ways, and Jeremy McNeil, whom I have long valued for his inspiration, guidance and friendship.

To be completely fair, what stands on record as my accomplishments would have been all but impossible without many other dedicated people – namely my 24 graduate students, dozen postdoctoral fellows, dozen visiting scientists, and others who have contributed to my research program. Two people deserve special mention: my research associate, Dr Yasmin Akhtar who has been in my laboratory for over a dozen years, and my research technician, Nancy Brard who has been a cornerstone of my program for over 24 years!

And no research program runs very long without financial support. I've been fortunate to have received support from a number of government agencies and grower organizations, but I'd like to single out NSERC – who have generously supported my projects continuously (through their various programs) for over 25 years – and EcoSMART Technologies Inc. who supported work on essential oils in my laboratory – even encouraging basic studies – for over 15 years. I've always had supportive administrators at UBC and the University has provided a stimulating and beautiful working environment for the past three decades.

Finally I must acknowledge my wife of 25 years, Susie. She is not an entomologist, biologist, scientist or academic. She has suffered through innumerable dinner conversations between my colleagues and myself that would bore most "normal people" to tears. And she has occasionally been in the middle of a conversation with me only to discover that my mind was far, far away – probably planning the next research trip or agonizing over the outcome of an experiment. But she has allowed me to follow my professional passions while providing a stable and loving family life (Fig. 6).

Figure 6. Murray receives some helpful pointers from son, Adam (right), who is an accomplished goaltender.

Let me conclude by again expressing my deep

gratitude to the Society for honoring me with the Gold Medal. This has surely been – to use a well-worn metaphor – the icing on the cake that has been my career thus far, and what a rich cake indeed!

### References


Akhtar, Y., and Isman, M.B. 2003. Larval exposure to oviposition deterrents alters subsequent oviposition behavior in generalist, *Trichoplusia ni* and specialist, *Plutella xylostella* moths. Journal of Chemical Ecology, **29**: 1853-1870.

Isman, M.B. 2000. Plant essential oils for pest and disease management. Crop Protection, **19**: 603-608.

Isman, M.B. 2006. Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. Annual Review of Entomology, **51**: 45-66.

Isman, M.B. 2008. Botanical insecticides: For richer, for poorer. Pest Management Science, **64**: 8-11.

Isman, M.B., and Duffey, S.S. 1982. Phenolic compounds in foliage of commercial tomato cultivars as growth inhibitors to the fruitworm, *Heliothis zea*. Journal of the American Society of Horticultural Science, **107**: 167-170.

Isman, M.B., Duffey, S.S., and Scudder, G.G.E. 1977. Cardenolide content of some leaf- and stem-feeding insects on temperate North American milkweeds (*Asclepias* spp.). Canadian Journal of Zoology, **55**: 1024-1028.

Isman, M.B., Koul, O., Luczynski, A., and Kaminski, J. 1990. Insecticidal and antifeedant bioactivities of neem oils and their relationship to azadirachtin content. Journal of Agricultural and Food Chemistry, **38**: 1406-1411.

Isman, M.B., and Rodriguez, E. 1983. Larval growth inhibitors from species of *Parthenium* (Asteraceae). Phytochemistry, **22**: 2709-2713.

Isman, M.B., Towers, G.H.N., Gunning, P.J., Spollen, K.N., and Ng, L.T. 1997. "An Environmentally Safe Pesticide Composition". Malaysian Patent P970207 (1997).

Isman, M.B., Wilson, J.A., and Bradbury, R. 2008. Insecticidal activities of commercial rosemary oils (*Rosmarinus officinalis*) against larvae of *Pseudaletia unipuncta* and *Trichoplusia ni* in relation to their chemical compositions. Pharmaceutical Biology, **46**: 82-87.

Jiang, Z., Akhtar, Y., Bradbury, R., Zhang, X., and Isman, M.B. 2009. Comparative toxicity of essential oils of *Litsea pungens* and *Litsea cubeba* and blends of their major constituents against the cabbage looper, *Trichoplusia ni*. Journal of Agricultural and Food Chemistry, **57**: 4833-4837.

Leatemia, J.A., and Isman, M.B. 2004. Efficacy of crude seed extracts of *Annona squamosa* against diamondback moth, *Plutella xylostella* L. in the greenhouse. International Journal of Pest Management, **50**: 129-133.

Miresmailli, S., Bradbury, R., and Isman, M.B. 2006. Comparative toxicity of *Rosmarinus officinalis* L. essential oil and blends of its major constituents against *Tetranychus urticae* Koch (Acari: Tetranychidae) on two different host plants. Pest Management Science, **62**: 366-371.

Schmutterer, H. (ed.) 2002. The Neem Tree, 2nd Edition. Neem Foundation, Mumbai, 893 pp.

Shikano I., and Isman, M.B. 2009. A sensitive period for larval gustatory memory influencing subsequent oviposition choice by the cabbage looper moth, *Trichoplusia ni*. Animal Behavior, **77**: 247-251.

Dan Quiring

# History of Forest Entomology at the Canadian Forest Service - Atlantic Forestry Centre (Fredericton) from 1911-1985: A celebration of the first 75 years of this institution on its 100-year anniversary

Canada has a distinguished heritage of groundbreaking research in entomology. One of the areas for which we are best known is research in forest entomology. Research carried out by staff at the Canadian Forest Service's research facility (hereafter known as CFS-Atlantic) in Fredericton, New Brunswick, which is currently celebrating its 100 year anniversary, played a major role in establishing this reputation. I am honored to provide a short synopsis of some of the research that was carried out during the first 75 years of this institution, 1911-1985. Much of the information that I used for this article was taken from Simpson (1999), and from various biographies and other reports prepared by Doug Eidt, a former editor of *The Canadian Entomologist* and the *Memoirs*, who worked tirelessly for Canadian entomology throughout his life. In 1911, the Dominion Department of Agriculture's Entomology Division began a cooperative effort with the Forestry Branch of the Department of the Interior to address outbreaks of forest insects. Provincial outposts were established to study insect pests and their control, and to carry out educational work. In New Brunswick, R.C. Treherne and G.E. Sanders carried out surveys of brown-tail moth populations from June to October in 1911. They were joined in November 1911, by J.D. Tothill, who was appointed Field Officer by the Division of Entomology and placed in charge of field work on the ecology of the brown-tail moth and its eradication from New Brunswick.

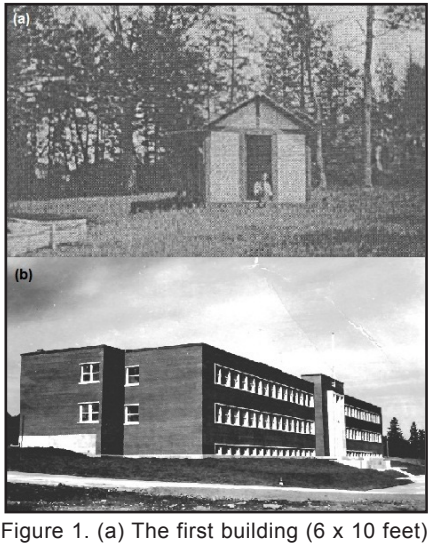


Figure 1. (a) The first building (6 x 10 feet) of the Canadian Forest Service-Atlantic in Fredericton, built in 1912, with John Tothill sitting in the entrance; and (b) building constructed in 1953. Both buildings were located on the campus of the University of New Brunswick.

The first CFS-Atlantic building was a very small two-room structure that was built on the campus of the University of New Brunswick in Fredericton in 1912 (Fig. 1a). A much larger two-storey structure was built on the same campus in 1915, and was enlarged with an addition in 1937. With increasing

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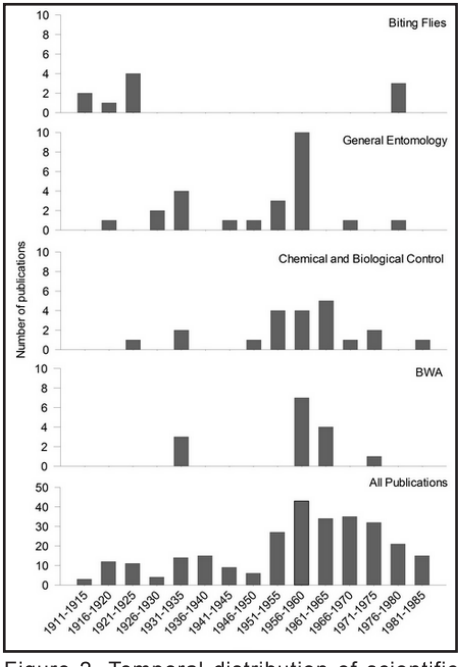


Figure 2. Temporal distribution of scientific publications from CFS-Atlantic (Fredericton) between 1911 and 1985 on biting flies, general articles on entomology, chemical and biological control (not including papers on European spruce sawfly and winter moth), balsam woolly adelgid (BWA), and all entomological topics combined, including many not mentioned above.

two classic biocontrol studies that are discussed below) (Fig. 2, authored by Reginald Balch, Ed Kettela, Charlie Miller, Murray Neilson, Malcolm Prebble, Bill Varty and Frank Webb); off-target effects of biological and chemical insecticides (Doug Eidt and Bill Varty); elaterid ecology (Doug Eidt and Frank Morris); aphids and adelgids (Reginald Balch, Reginald Underwood and Bill Varty), especially the balsam woolly adelgid (Fig. 2, authored by Reginald Balch, R.C. Clark and David Greenbank); mountain ash sawfly (Bob Forbes); red pine sawfly (Reginald Underwood); spruce bud moth (Murray Neilson); bark beetles (Malcolm Prebble); and the blackheaded budworm (Charlie Miller and Leonard Mook).

Under John Tothill (Officer-in-charge from 1911-1924) and Lee Simpson (Acting Officer-numbers of employees and research projects, the research centre moved to a large new building on the University of New Brunswick campus in 1953 (Fig. 1b).

Forest entomologists at CFS-Atlantic were very productive, as can be seen by the number of peer-reviewed publications that they produced during the institution's first 75 years (Fig. 2, bottom histogram). Researchers published 3 to 15 publications per 5-year period from 1911 to 1950 and averaged just over 25 per 5-year period from 1951 to 1985. Slight reductions in publication rates were associated with the Great Depression (1929-1933) and the end of the Second World War. A searchable database of research publications can be accessed on the CFS-Atlantic website at https://cfs.nrcan.gc.ca/publications.

Due to space limitations, I will not be able to comment on many studies, including: general entomology articles (Fig. 2, authored by Reginald Balch, Doug Eidt, Frank Morris, John Tothill and Frank Webb); biological and chemical control of insect pests (excluding


Figure 3. Field work during the period 1911-1932. (a) Temporary field station in Upsalquitch, New Brunswick, made from small tree trunks and blankets; (b) clearing and construction of a more permanent (log cabin) station.

in-charge until Reginald Balch took over in 1930), many field studies were carried out to elucidate the ecology of biting flies (Fig. 2) as well as the ecology and possible eradication of the brown-tail and gypsy moths. There were few forest roads during this period and much of the travel inside the forest was by canoe and by foot, with overnight accommodations ranging from "lean-tos" constructed with large sticks and blankets to small log cabins (Fig. 3). Two of the first entomologists to work with John Tothill were Alfred Baird, who later became director of the biocontrol centre in Belleville, and Leonard McLaine, who left for Ottawa where he eventually rose to become Dominion Entomologist.

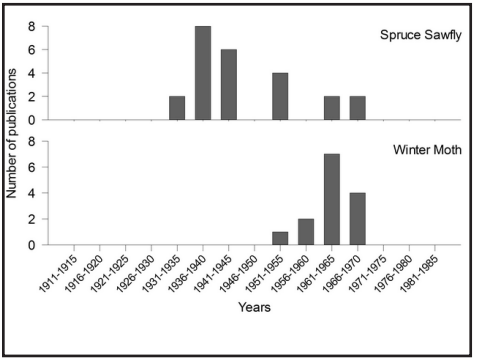


Figure 4. Temporal distribution of scientific publications from CFS-Atlantic (Fredericton) between 1911 and 1985 on classical biological control of the European spruce sawfly and the winter moth.

Probably the best-known studies from this early period were those on the ecology and successful classical biological control of the European spruce sawfly (Fig. 4, authored by Reginald Balch, Ed Reeks, Murray Neilson and Malcolm Prebble). Accidentally introduced from Europe in 1922, by 1936 the sawfly had caused "severe damage" in > 2.5 million ha in all eastern provinces of Canada and in the north-eastern U.S.A. Approximately 30 people collected 0.5 million eggs and 0.5 million cocoons (all parasitoids, except egg parasitoids, overwintered in cocoons) in Europe and sent them to Canada. Almost 900 million parasitoids were either directly imported or lab reared (primarily in Belleville under the direction of Alfred Baird) and released by 1951.

Unfortunately, only a few of the 27 parasitoid species released became well established. Fortunately, however, a nucleopolyhedrovirus (*Borrelinavirus hercyniae*) that was accidentally introduced from Europe caused an epizootic in 1939-1940, and European sawfly populations have never since reached unacceptably high densities, presumably due to the NPV and two parasitoids.

Another major success story in classical biological control occurred several decades later when several parasitoids were introduced from Europe to suppress epidemic populations of the winter moth, a pest of many deciduous trees that was introduced into Nova Scotia (Embree 1965). Although Ed Reeks, Doug Eidt and Frank Morris also carried out studies on the winter moth, a classic study was carried out by Doug Embree, during which he followed winter moth populations, using the life-table approach pioneered at Green River, for 10 years, including years before and after the introduction of a tachinid and ichneumonid wasp that suppressed winter moth densities (Fig. 4). He later collaborated with Jens Roland to write a review (Roland and Embree 1995) that harmonized his results with those of Jens, who had demonstrated that pupal predation by indigenous species was an important factor in the suppression of winter moth populations in British Columbia.

Two other CFS-Atlantic projects that made outstanding contributions to forest entomology are briefly described below. Whereas the Green River project is well known and still frequently cited, the contributions of the studies on fall webworm have probably not received the attention they deserve.

### Green River Project

The Green River project, which was carried out in north-western New Brunswick from 1944 to 1973, was one of the most influential studies ever carried out in forest entomology. Approxi-

mately 106,000 ha of spruce- and balsam fir-dominated forest were included in the study, which was supported by two federal departments, one provincial department, and Fraser Companies Ltd. The goal of the project was to examine "natural" and "applied" control of epidemic spruce budworm populations by comparing the dynamics of spruce budworm in a continuous forest without insecticide spraying or harvesting to that in mixed forests with sprayed and unsprayed blocks.

The large main camp of the Green River project usually housed 30-40 people (Fig. 5a, b)during spring and summer, and contained a large number of laboratories and storage facilities. Life at the main camp is delightfully described by Muriel Miller in a previous issue of the *Bulletin* (Miller 1984).

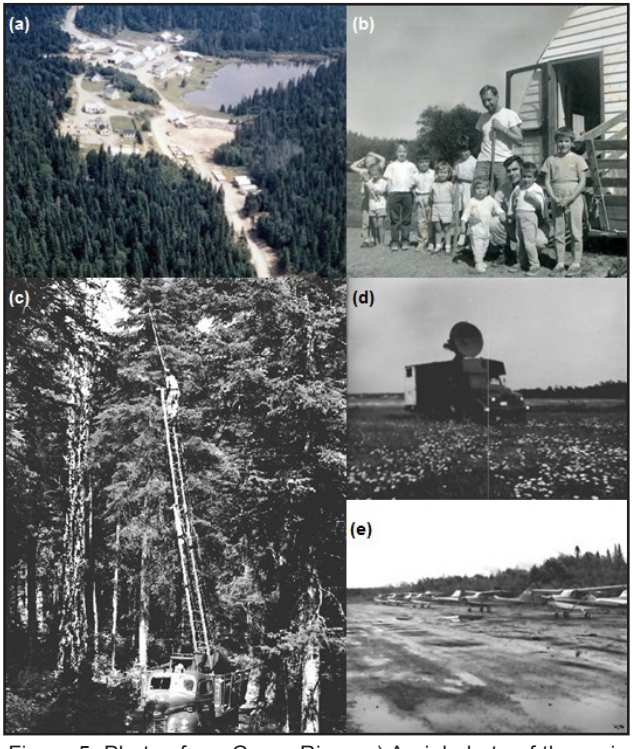


Figure 5. Photos from Green River. a) Aerial photo of the main compound; b) some of the "Green River children" (see letter by Muriel Miller), accompanied by Thaddée Renault (crouching) and a summer student; c) man using a pole-pruner while standing at the top of a revolving ladder that was fastened to a truck; d) a travelling laboratory used to monitor adult budworm dispersal using radar; and e) some of the planes used to catch juvenile budworm at different altitudes.

Under the direction of Frank Morris, a life-table approach was devised to tabulate changes in the abundance of the different development stages and in the number of eggs produced per adult during the years that spruce budworm populations increased, peaked and declined. A large team of researchers, including, but not limited to, Gordon Baskerville, David Greenbank, Ed Kettela, Charlie Miller, Leonard Mook, Frank Morris, Murray Neilson, Ian Outram, Tom Royama, George Shaw, Tony Thomas and Bill Varty, carried out research on all aspects of the population dynamics of the spruce budworm. Whereas pole-pruners were used to collect juvenile stages from trees, planes with traps or radar and a radar-equipped truck were used to sample dispersing budworm (Fig. 5c, d, e).

The conclusions of the Green River study were summarized in many publications (Fig. 6), the most famous of which was a *Memoir of the Entomological Society of Canada* that was edited by Frank Morris (Morris 1963). The memoir was over 300 pages in length and contained 40 chapters by 12 authors. Although there was much debate about many points, the major conclusions of the study were that: the life-table approach pioneered at Green River, along with regression and key-factor analyses, were useful to elucidate mechanisms influencing population dynamics; budworm outbreaks were associated with maturing of extensive areas of balsam fir and climatic variation; three or four summers of clear, dry weather "seemed" to release populations; dispersal

from epicentres and starvation were important influences on budworm dynamics; parasites and predators did not exert a large influence on budworm populations during the outbreak; stand structure had a large influence on budworm dynamics and could be manipulated to "prevent" high defoliation; and insecticides or sex pheromones could be used to reduce densities in incipient outbreaks.

The need for new analytical tools to elucidate the role of the many factors influencing spruce budworm population dynamics led to a large increase in the number of theoretical papers on analytical techniques for studying population dynamics (Fig. 6). The Green River project also stimulated subsequent theoretical and field work in various systems. Using only the eastern spruce budworm as an example, a reanalysis of the Green River data by Tom Royama resulted in a new method of analysis and in different conclusions regarding the underlying factors determining the second-order process (i.e., variations in survival of old larvae and pupae and in the egg:moth ratio). It also formed a good portion of his subsequent book on analytical population dynamics (Royama 1992). The Green River study also helped stimulate long-term and detailed studies of the dynamics of spruce budworm in New Brunswick (Eldon Eveleigh and Tom Royama), Quebec (David Perry and Jacques Regnière) and Ontario (Jacques Regnière and Vince Nealis).

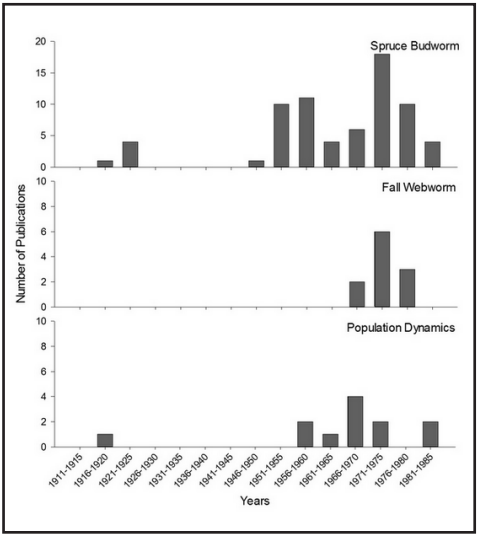


Figure 6. Temporal distribution of scientific publications from CFS-Atlantic (Fredericton) between 1911 and 1985 on the spruce budworm, fall webworm, and population dynamics.

## Fall Webworm Studies

The population dynamics of the spruce budworm were difficult to elucidate for many reasons, not the least of which were the long length of budworm cycles (approximately one outbreak every 35 years) and the difficulty of sampling and estimating dispersal. Consequently, Frank Morris decided to hone his analytical skills by studying the population dynamics of the fall webworm, which had four outbreaks in eastern Canada between 1939 and 1974. Defoliation by webworm larvae, which feed on a large variety of deciduous trees, occurs at the end of summer, and so has a minimal effect on hosts. Larvae are easy to locate because they make large webs that can enclose entire trees. Frank Morris carried out a large series of surveys and manipulative field experiments on the fall webworm (Fig. 6). Peter Price (2003; page 36), who obtained his masters degree at the University of New Brunswick and who greatly appreciated his interactions with Frank Morris, articulated his evaluation of Morris's webworm research in the following way: "*He noted the improved explanatory power of his process studies compared with field studies alone and correlational interpretations. He was also examining the role of density dependence, the genetic quality of populations, and intrinsic mechanisms in population regulation. Host plant phenology and quality variation were constituents of the model, as was the geographic variation of land use and climate. Morris's legacy is a vastly more comprehensive enquiry into the distribution, abundance, and population dynamics of a species than had been achieved up to his time and remains to this day as an example we can all benefit from*."

## Conclusion

Research at CFS-Atlantic during its first 75 years was dominated by entomologists, who published almost half of the scientific publications from the research centre. The large number of publications was not as impressive as the quality of the published works, and the large impact they had on forest entomology, forest management, and insect ecology. To mention just a few of their accomplishments, forest entomologists at CFS-Atlantic: pioneered biological control in Canada (John Tothill and Alfred Baird); were responsible for two of the greatest success stories in classical biological control (European spruce sawfly and the winter moth); were the first (Morris et al.), along with independent studies in Britain (e.g., Richards and Waloff 1954; Varley and Gradwell 1958), to develop the use of life-tables for insects; were among the first to promote (Morris) and then discourage (Royama) the use of key-factor analysis; were among the first to incorporate "process studies" and evolutionary ecology into population dynamics studies (e.g., Morris's work on the fall webworm); and developed more rigorous models for predator-prey interactions and population dynamics (Royama). The incredible creativity and productivity of forest entomologists at CFS-Atlantic during the first 75 years of the institution may be unparalleled and constitute one of the most important components in Canada's rich entomological heritage.

## Acknowledgements

I thank Caroline Simpson, Doug Eidt, Doug Embree, Suzanne Renault and Taddy Renault for historical information, Caroline Simpson, Suzanne Renault and Taddy Renault for photos, Lindsay May and Allen Graves for scanning photos and organizing publication data, and Caroline Simpson and Cedric Gillott for comments on an earlier version of the manuscript. I am especially grateful to Doug Eidt for the many biographies of forest entomologists that he prepared and to Caroline Simpson and Gerritt Van Ralte, who previously summarized some of the early history of CFS-Atlantic in a short publication. Finally, I thank Muriel Miller for her humorous and insightful story that was published in the Bulletin of the Entomological Society of Canada 28 years ago. All photographs were obtained from Thaddée and Suzanne Renault and from photos stored at CFS-Atlantic (Fredericton).

## References

Embree, D.G. 1965. The population dynamics of the winter moth in Nova Scotia, 1954-1962. Memoirs of the Entomological Society of Canada, No. **46** (57pp.).

Miller, M.E. 1984. My life with the spruce budworm. Bulletin of the Entomological Society of Canada **16**:70-73.

Morris, R.F. 1963. The dynamics of epidemic spruce budworm populations. Memoirs of the Entomological Society of Canada, No. **31** (332pp.)

Price, P. 2003. Macroevolutionary Theory on Macroecological Patterns. Cambridge University Press, Cambridge, United Kingdom.

Richards, O.W., and Waloff, N. 1954. Studies on the biology and population dynamics of British grasshoppers. Anti-Locust Bulletin **17**: 1-182.

Roland, J., and Embree, D.G. 1995. Biological control of the winter moth. Annual Review of Entomology **40**:475-492.

Royama, T. 1992. Analytical Population Dynamics. Chapman and Hall, London.

Simpson, C.M. 1999. Our history... Selected musings on events, people, and places. Canadian Forest Service-Atlantic publication, Fredericton, New Brunswick.

Varley, G.C., and G.R. Gradwell. 1958. Oak defoliators in England. Proceedings of the 10th International Congress of Entomology **4**:133-136.

# The student wing / L'aile étudiante

**Chandra Moffat**

While you are reading this in March, it was of course written much earlier – in January to be specific – and we all know we must submit things for 'publication' far in advance of when they will be published! I find January a very contemplative time of year: not only do I plan all the ways to better myself in the current year, but I find myself reflecting on the highs and lows of the previous year. I must say, one of the best things about being the ESC Student Representative for the last year and a bit has been meeting and communicating with so many of the friendly, intelligent, interesting and fun-loving entomologists that make up our Society! In particular, I speak of the entomology students from across the country. The ESC Joint Annual Meetings, the Bulletin, the ESC Student Affairs Committee and our Facebook page, Entomological Society of Canada student group, are all wonderful forums to connect students studying entomology in Canada. My role is trying to connect us as much as possible, and as a result I have come to know so many of the ESC students. This winter has been a very active thesis defense season, and when I have seen the Facebook posts or other announcements of these important occasions, I have been so proud of everyone! I am in the midst of writing my thesis, so I know how much

Bien que vous lisiez ceci en mars, je l'ai écrit bien avant – en janvier pour être précise – car nous savons tous que nous devons soumettre des textes pour 'publication' bien avant la date de publication ! Je trouve que janvier est un temps de l'année très contemplatif : je ne réfléchis pas seulement à des façons de me rendre meilleure pour la prochaine année, mais je réfléchis également à tous les hauts et les bas de l'année précédente. Je dois dire qu'un des plus grands bénéfices que j'ai retiré à être représentante étudiante pour la SEC a été la rencontre et la communication avec tous ces entomologistes amicaux, intelligents, intéressants et aimant s'amuser qui forment notre Société ! Je parle en particulier des étudiants en entomologie dans tout le pays. Les réunions conjointes annuelles de la SEC, le comité des affaires étudiantes et notre page Facebook du groupe étudiant de la Société d'entomologie du Canada sont tous d'excellents forums afin de connecter les étudiants en entomologie au Canada. Mon rôle est d'essayer de créer le plus de liens possibles, le résultat étant que j'ai commencé à connaître beaucoup des étudiants de la SEC. Cet hiver a été une saison très prolifique côté défenses de thèse, et quand j'ai vu les annonces, sur Facebook ou ailleurs, de ces importantes occasions, je me suis sentie fière de tout ce monde ! Je suis au milieu de la rédaction de mon mémoire, alors je comprends combien d'efforts et de détermination sont requis afin de terminer. Dans ce numéro de l'aile étudiante, je présente les membres du comité des affaires étudiantes de la SEC 2011-2012 et je publie les noms de sept fantastiques étudiants de la SEC qui ont défendu leur thèse dans les derniers mois. Félicitations à ces étudiants ayant réussi et bonne chance à tous les autres étudiants de la SEC qui travaillent dur sur leur recherche ! Si vous voulez nous contacter, merci de nous écrire, de joindre notre page Facebook et de planifier d'assister à la réunion conjointe annuelle 2012 à Edmonton ! N'oubliez pas que sur la page des emplois de la SEC, http://www.esc-sec.ca/fr/f-jobs.html,

effort and determination it takes to complete. In this issue of the Student Wing, I introduce the members of the 2011-2012 ESC Student Affairs Committee, and publish the names of seven great ESC students who defended their thesis in the last few months. Congrats to go these successful ESC students, and good luck to all the other ESC students who are working hard at their research!

If you want to connect with us, please email us, join our Facebook group, and plan to attend JAM 2012 in Edmonton! Don't forget that on the ESC Job Board, http://www.esc-sec.ca/jobs.html, you can find job and graduate school postings, and that on the Entomological Society of Canada student group on Facebook, there are lots of other students to connect with about job and research postings, events, current research and much more! Postings for the job board can be sent to jobs@esc-sec.ca.

That's all for now, please get in touch!

~Chandra

students@esc-sec.ca

## The 2011-2012 ESC Student Affairs Committee

If you are interested in getting involved with the ESC Student Affairs Committee, please email us!

**Chandra Moffat** (Student Affairs Committee Chair, Kelowna)

Chandra is wrapping up her Master's degree at the Okanagan Campus of the University of British Columbia, which was a collaboration with Agriculture and Agri-Food Canada and CABI Europe-Switzerland. Her thesis investigated the ecological host range of a cynipid gall wasp which is a candidate classical biological control agent for hawkweeds invasive in North America. Using field surveys, common garden experiments and molecular methods, she documented two cryptic host-associated lineages of this gall wasp, which has important implications for the biocontrol program. Chandra is looking forward to beginning a PhD on

vous pouvez trouver des annonces d'emplois et d'études graduées, et que sur le groupe d'étudiants de la Société d'entomologie du Canada de Facebook, il y a beaucoup d'étudiants avec qui communiquer à propos d'emplois, d'évènements, de recherche et bien plus encore ! Les annonces pour la page des emplois peuvent être envoyées à jobs@esc-sec.ca.

Voilà, c'est tout pour maintenant, merci de rester en contact !

~Chandra

students@esc-sec.ca

## Le comité des affaires étudiantes de la SEC 2011-2012

Si vous êtes intéressé à vous impliquer dans le comité des affaires étudiantes de la SEC, merci de nous écrire!

**Chandra Moffat** (Présidente du comité des affaires étudiantes, Kelowna)

Chandra termine son mémoire de maîtrise au campus Okanagan de l'Université de Colombie-Britannique, en collaboration avec Agriculture et Agroalimentaire Canada et CABI Europe-Suisse. Son mémoire investiguait la gamme écologique d'hôtes d'une guêpe à galle Cynipidae qui est un agent de lutte biologique classique proposé contre les épervières envahissantes en Amérique du Nord. À l'aide d'échantillonnages de terrain, d'expériences en jardin expérimental et de méthodes moléculaires, elle a découvert deux lignées associées à des hôtes différents pour cette guêpe à galle, ce qui a des implications importantes pour le programme de lutte biologique. Chandra a hâte de débuter un doctorat sur l'écologie et l'évolution de la spécificité d'hôtes chez des insectes phytophages.

**Boyd Mori** (Edmonton)

Boyd a débuté ses études postsecondaires à l'Université de la Vallée Fraser à Abbotsford, en Colombie-Britannique, avant de changer pour l'Université de l'Alberta pour terminer

the ecology and evolution of host specificity of herbivorous insects.

**Boyd Mori** (Edmonton)

Boyd started his post-secondary education at the University of the Fraser Valley in Abbotsford, British Columbia, before transferring to the University of Alberta to finish his Bachelor's degree. During his time at the U of A, he was inspired by some fantastic faculty members to continue on in entomology. He is currently completing his PhD under the supervision of Maya Evenden exploring the use of pheromones to monitor and manage *Coleophora deauratella*, a significant pest of red clover in north-western Alberta. He also hopes to track the invasion of *C. deauratella* in Alberta, and possibly Canada, using molecular phylogenetic analyses.

**Alicia Leroux** (Winnipeg)

Alicia is a Master's student at the University of Manitoba. Luckily she does not have to spend the summer there, dodging mosquitoes, because her research is carried out in Delémont, Switzerland, in collaboration with CABI-Europe-Switzerland. She is researching the host range of a potential weed biological control agent, *Euphranta connexa* (Diptera: Tephritidae) on the invasive weeds *Vincetoxicum nigrum* and *V. rossicum*. As part of her project Alicia is also looking at *E. connexa*'s reproductive potential and developmental rates on different *Vincetoxicum* spp. Next summer will consist of more research followed by writing up in the cold wintry darkness of Manitoba.

**Brock Harpur** (Toronto)

Brock completed his undergraduate degree at the University of Northern British Columbia where he learned to love social insects (thanks, Staffan) and genetics. He decided to trudge across the country and start his Master's degree with Amro Zayed. He is currently completing this degree at York University; his thesis studies genomics and immunology in the honey bee. After completion of his Master's degree, Brock will enter a PhD program to continue his studies on arthropod genomics.

**Paul Abram** (Ottawa)

Paul just completed his Master's degree at

son baccalauréat. Pendant son passage à l'Université de l'Alberta, quelques fantastiques professeurs l'ont amené à continuer en entomologie. Il complète présentement son doctorat sous la supervision de Maya Evenden, explorant l'utilisation de phéromones afin de surveiller et gérer *Coleophora deauratella*, un important ravageur du trèfle des prés dans le nord-ouest de l'Alberta. Il espère également suivre l'invasion de *C. deauratella* en Alberta, et possiblement au Canada, à l'aide d'analyses moléculaires phylogénétiques.

**Alicia Leroux** (Winnipeg)

Alicia est étudiante à la maîtrise à l'Université du Manitoba. Heureusement, elle n'a pas à passer l'été là-bas, essayant de fuir les moustiques, puisque ses recherches prennent place à Délémont, en Suisse, en collaboration avec CABI-Europe-Suisse. Elle travaille sur la gamme d'hôtes d'un agent potentiel de lutte biologique contre les mauvaises herbes, *Euphranta connexa* (Diptera : Tephritidae), sur les mauvaises herbes envahissantes *Vincetoxicum nigrum* et *V. rossicum*. Une partie de son projet regarde également le potentiel reproductif et les taux de développement de *E. connexa* sur différents *Vincetoxicum* spp. L'été prochain consistera pour elle en davantage de recherches suivies de la rédaction dans la froide noirceur hivernale du Manitoba.

**Brock Harpur** (Toronto)

Brock a terminé son baccalauréat à Université du Nord de la Colombie-Britannique où il a appris à aimer les insectes sociaux (merci, Staffan) et la génétique. Il a décidé de se traîner à travers le pays et de débuter sa maîtrise avec Amro Zayed. Il termine présentement ce diplôme à l'Université York : sa maîtrise traite de génomique et d'immunologie de l'abeille domestique. Après avoir complété sa maîtrise, Brock entamera un doctorat afin de continuer ses études en génomique des arthropodes.

**Paul Abram** (Ottawa)

Paul vient de terminer sa maîtrise à l'Université Carleton où il s'est concentré sur le complexe de parasitoïdes de la cécidomyie du chou-fleur, *Contarinia nasturtii* (Diptera: Cecidomyiidae) en Europe. Il a regardé

Carleton University where the focus of his studies was the parasitoid complex of the swede midge, *Contarinia nasturtii* (Diptera: Cecidomyiidae) in Europe. He looked at the impact of the parasitoids on midge populations, their basic biology, and their temporal relationships to host populations, with the goal of assessing their potential as classical biological control agents of the swede midge in Canada. This work spurred an interest in the behavioural ecology of parasitoids, and Paul plans to pursue a PhD in this area starting in the fall.

**Julia Mlynarek** (Ottawa)

Julia completed her undergraduate and Master's degrees at McGill University - Macdonald campus. There, she learned so much respect for insects that she decided to tackle how insects become infected with parasites. Julia is now pursuing a PhD in host-parasite interactions at Carleton University, trying to determine what explains interspecific host variation in parasitism using damselflies as hosts and water mites as parasites.

**Léna Durocher-Granger** (Québec/Honduras)

Léna graduated last October with a Master's degree in entomology from McGill University, in collaboration with Agriculture and Agri-Food Canada. She left in June 2011 for 6 months to work with a Canadian NGO (SUCO) in Nicaragua, where she helped with the establishment of an entomological research laboratory. In mid-February 2012, she left for another year in Honduras to support capabilities in plant protection and improve biological control of pest crops. She will be available and happy to continue her work in the ESC even from far away!

l'impact des parasitoïdes sur les populations de cécidomyie, leur biologie de base ainsi que les relations temporelles avec les populations d'hôtes, dans le but d'évaluer leur potentiel en tant qu'agents de lutte biologique classique de la cécidomyie du chou-fleur au Canada. Ce travail a éveillé un intérêt pour l'écologie comportementale des parasitoïdes et Paul planifie de continuer avec un doctorat dans ce domaine cet automne.

**Julia Mlynarek** (Ottawa)

Julia a effectué son baccalauréat et sa maîtrise à l'Université McGill, au campus Macdonald. Elle y a tant appris à respecter les insectes qu'elle a décidé de regarder comment les insectes deviennent infectés par des parasites. Julia poursuit maintenant un doctorat sur les interactions hôtes-parasites à l'Université Carleton, essayant de déterminer ce qui explique les variations interspécifiques d'hôtes dans le parasitisme en utilisant les demoiselles comme hôtes et les mites d'eau comme parasites.

**Léna Durocher-Granger** (Québec/Honduras)

Léna a obtenu sa maîtrise en entomologie de l'Université McGill en octobre dernier, en collaboration avec Agriculture et Agroalimentaire Canada. Elle a quitté le Canada en juin 2011 pour 6 mois, afin de travailler avec une ONG (SUCO) au Nicaragua, où elle a aidé à l'établissement d'un laboratoire de recherche en entomologie. À la mi-février, elle est partie pour une autre année au Honduras afin de soutenir la protection des plantes et améliorer le contrôle biologique des ravageurs des cultures. Elle sera disponible et heureuse de continuer son travail avec la SEC même d'aussi loin !

## Thesis Round-up/ Foisonnement de thèses

As always, we like to know when a student defends their thesis. If you have (or anyone you know of has) defended a thesis recently, please send me your/their name, degree and date achieved, thesis title, supervisor's name, university and email address to students@esc-sec.ca.

Comme à l'habitude, nous aimons savoir quand les étudiants défendent leur thèse. Si vous (ou quelqu'un que vous connaissez) a récemment soutenu sa thèse, merci de m'envoyer vos nom, diplôme et date d'obtention, titre de la thèse, nom du directeur, université et courriel à students@esc-sec.ca.

**Abram, Paul K**. MSc, 2012. The parasitoid complex associated with the invasive swede midge, *Contarinia nasturtii* Kieffer (Diptera: Cecidomyiidae) in Europe: prospects for classical biological control in North America. (paul-abram@hotmail.com). Supervisors: Peter Mason and Naomi Cappuccino, Carleton University.

**Daoust, Simon**. PhD, 2011. Impacts de l'intensification agricole et de la structure du paysage sur les relations tri-trophiques entre un oiseau hôte, des mouches ectoparasites et leurs parasitoides. (daoust.simon@gmail.com). Supervisors: Jacques Brodeur and Jade Savage, Université de Montréal.

**D'Orsay, Clayton**. MSc, 2011. The influence of pasture management intensity on species richness and abundance of beetles (Coleoptera: Carabidae, Staphylinidae and Curculionoidea) on a managed Nova Scotia pasture. (cdorsay@upei.ca; dorsay@syd.eastlink.ca) Supervisors: Donna Giberson (UPEI) and David McCorquodale (CBU), University of Prince Edward Island.

**Gibson, Joel**. PhD, 2011. The evolutionary biology of Conopidae (Diptera): a life history, molecular, morphological, systematic, and taxonomic approach. Supervisors: Stewart Peck (Carleton University) and Jeff Skevington (Canadian National Insect Collection), Carleton University.

**Horton, Susan**. MSc, 2011. Identifying the locations, movement and habitat of the European Fire Ant, *Myrmica rubra*; an invasive species in the urban/suburban environment of Halifax, Nova Scotia. (susanmlhorton@gmail.com) Supervisor: Cathy Conrad, Saint Mary's University.

**Knee, Wayne**. PhD, 2011. Host specificity and species boundaries of beetle-associated mites. (wknee@connect.carleton.ca). Supervisor: Mark R. Forbes, Carleton University.

**Pinault, Lauren**. PhD, 2012. Aspects of spatial and habitat ecology of multiple *Anopheles* species (Diptera: Culicidae): malaria vectors in the highlands and foothills of Ecuador
Supervisor: Fiona F. Hunter, Brock University.

## Graduate Student Symposium 2012: Arthropod Biodiversity

## Call for Abstracts

Graduate students are invited to present their research at the 2012 Graduate Student Symposium (GSS). The GSS will be held during the **Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Alberta in Edmonton, 4-7 November 2012.** The purpose of the GSS is to provide a high profile opportunity for graduate students near the completion of their degrees to present a more in-depth overview of their thesis research.
The theme of the symposium this year will be Arthropod Biodiversity, and applicants are strongly encouraged to present their research within this broad context, although the specific topic need not be directly related.
Applicants to the GSS must:

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

Eligible candidates who wish to be considered for the GSS must follow these instructions:

1) **Submit online** a 100 word (500 character) abstract describing the proposed presenta tion, following the guidelines made available at http://www.entsocalberta.ca/JAM2012/, highlighting their work in the context of the theme;
2) Arrange to have the principal supervisor **e-mail** a letter of support that confirms the anticipated or actual date of graduation, and comments on the proposed presentation and the applicant's presentation abilities to gsscommittee@gmail.com;
3) **E-mail** a CV that includes a list of previous conference presentations and other presentation experience to gsscommitte@gmail.com.

All information must be submitted/e-mailed by **31 July 2012.** All applicants will be notified of the status of their application. Unsuccessful applicants to the GSS will have their abstracts *automatically* moved to a President's Prize (PP) Oral Competition.
Differences between the GSS and the PP Oral Competition include:

- presenters in the GSS are given more time to speak about their research (30 minutes - - - total, 25 for the presentation and 5 for questions) compared to the PP (15 minutes total);
- abstracts for papers presented in the GSS are published in the *ESC Bulletin*, an open access publication, received by all ESC members and over 300 libraries around the world;
- the selection process for the GSS is competitive (only selected students speak), compared to the PP where all students who enter speak but only one per category receives a prize;
- all presenters in the GSS receive a $100 honorarium.

We would like to encourage all eligible students to apply for the GSS. Supervisors, please encourage your students to apply and please help us to spread the word!
Any questions can be directed to gsscommittee@gmail.com

Boyd Mori and Paul Abram, Co-Chairs
Graduate Student Symposium Committee

## Symposium des étudiants gradués 2012: Biodiversité des arthropodes

## Appel à soumission

Les étudiants gradués sont invités à présenter leurs recherches au symposium des étudiants gradués 2012. Le symposium se tiendra au cours du congrès conjoint annuel des Sociétés d'entomologie du Canada et d'Alberta à Edmonton, du 4 au 7 novembre 2012. L'objectif du symposium est de fournir une opportunité unique, pour les étudiants gradués approchant la fin de leur diplôme, de présenter une revue plus approfondie de leur thèse de recherche.

Le thème du symposium de cette année sera la biodiversité des arthropodes, et les candidats sont fortement encouragés à présenter leurs recherches dans ce vaste contexte, bien que le sujet précis n'ait pas besoin d'être directement relié.

Les candidats doivent :

- avoir soutenu, ou prévoir de soutenir leur thèse dans une université canadienne à l'intérieur d'un an avant ou après la réunion,
- être le principal investigateur et le principal auteur des travaux présentés,
- être inscrits à la réunion.

Les candidats éligibles qui souhaitent être considérés pour le symposium des étudiants gradués doivent suivre les instructions suivantes :

1) **Soumettre en ligne** un résumé de 100 mots (500 caractères) décrivant la présentation proposée, en suivant les directives au http://www.entsocalberta.ca/JAM2012/, soulignant leur travail dans le contexte du thème ;

2) S'assurer que le principal directeur envoie, **par courriel**, une lettre confirmant la date réelle ou anticipée de graduation, commentant la présentation proposée et les habiletés du candidat à communiquer à **gsscommittee@gmail.com**;

3) Envoyer, **par courriel**, un CV incluant la liste des présentations données dans des conférences précédentes et l'expérience de présentation à **gsscommittee@gmail.com**.

Toutes les informations doivent être envoyées par courriel avant le **31 juillet 2012**. Tous les candidats seront informés du statut de leur application. Les candidats non-sélectionnés pour le symposium verront leur résumé automatiquement transféré pour une présentation orale pour le prix du président.

Les différences entre le symposium des étudiants gradués et le prix du président incluent :

- les participants du symposium ont davantage de temps pour présenter leurs recherches (30 minutes au total, 25 pour la présentation et 5 pour des questions) que les participants au prix du président (15 minutes au total);
- les résumés des présentations du symposium sont publiés dans le *Bulletin de la SEC*, une publication libre d'accès, reçue par tous les membres de la SEC et plus de 300 bibliothèques dans le monde;
- le processus de sélection pour le symposium est compétitif (seuls les étudiants sélectionnés présentent), alors que dans la compétition pour le prix du président, tous les étudiants qui soumettent un résumé présentent, mais un seul étudiant par catégorie reçoit un prix;
- tous les participants au symposium des étudiants gradués reçoivent un montant honoraire de 100$.

Nous encourageons tous les étudiants éligibles à appliquer pour le symposium des étudiants gradués. Merci aux directeurs d'encourager vos étudiants et de diffuser l'information! Toute question peut être adressée à **gsscommittee@gmail.com**.

Boyd Mori et Paul Abram, Co-Chairs
Comité du symposium des étudiants gradués

# JOINT ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF CANADA AND THE ENTOMOLOGICAL SOCIETY OF ALBERTA

The Coast Edmonton Plaza Hotel, Edmonton, Alberta
Sunday 4 November – Wednesday 7 November 2012

The Entomological Society of Alberta invites you to the 2012 Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Alberta, 4-7 November 2012, with the theme of **Arthropod Biodiversity.** Our venue is the Coast Edmonton Plaza Hotel, 10155 105th Street, Edmonton, Alberta T5J 1E2
(see http://www.coasthotels.com/hotels/canada/alberta/edmonton/coast_edmonton/overview)
Room rates are from $114 per night plus taxes: call 1-800-716-6199 for reservations.

**Program Highlights**
***Proposed Symposia***:
Plenary Symposium: Arthropod Biodiversity
Insects on the Internet
Honeybee Diseases
Insect Behaviour and Biodiversity
Spruce Budworm Genomics and Diversity
Agricultural Entomology
Graduate Student Symposium
Biological Survey of Canada Symposium
Heritage Lecture
Student paper and poster competitions
Regular poster and oral presentation sessions
Pre-conference workshop (Sunday morning)
Perspectives on the Publication Process
Associated event (Saturday: separate registration)
Celebration of Entomology at the University of Alberta 1922 - 2012

Check the ESA webpage (www.entsocalberta.ca/JAM2012/) for updated information on symposia and other events and the call for papers.

# RÉUNION CONJOINTE ANNUELLE DE LA SOCIÉTÉ D'ENTOMOLOGIE DU CANADA ET DE LA SOCIÉTÉ D'ENTOMOLOGIE DE L'ALBERTA

Hôtel Coast Edmonton Plaza, Edmonton, Alberta
Du dimanche 4 novembre au mercredi 7 novembre 2012

La Société d'entomologie de l'Alberta vous invite à la réunion conjointe annuelle 2012 de la Société d'entomologie du Canada et de la Société d'entomologie de l'Alberta, du 4 au 7 novembre 2012, sur le thème de la **Biodiversité des arthropodes**. L'évènement se tiendra à l'hôtel Coast Edmonton Plaza, au 10155 105$^{the}$ Street, Edmonton, Alberta, T5J 1E2
(voir http://www.coasthotels.com/hotels/canada/alberta/edmonton/coast_edmonton/overview).
Le tarif des chambres débute à 114$ plus taxes par nuit : composez le 1-800-716-6199 pour réserver.

**Aperçu du programme**
***Symposiums proposés :***
Session plénière : Biodiversité des arthropodes
Les insectes sur Internet
Les maladies des abeilles
Comportement et biodiversité des insectes
Génomique et diversité de la tordeuse des bourgeons de l'épinette
Entomologie agricole
Symposium des étudiants gradués
Symposium de la Commission biologique du Canada
Allocution du patrimoine
Compétition pour les présentations étudiantes
Sessions régulières de présentations orales et par affiches
Atelier pré-conférence (dimanche matin)
Perspectives sur le processus de publication
Évènement associé (samedi : inscription séparée)
Célébration de l'entomologie à l'Université de l'Alberta 1922-2012

Consultez la page Internet de la SEA (www.entsocalberta.ca/JAM2012/) pour des informations à jour sur les symposiums et autres évènements, ainsi que pour l'appel à soumission.

# Dear Buggy / Cher Bibitte

Dear Buggy,

*I've just been asked to review a manuscript. I've written a few papers but this is first time I've been asked reviewed one. What am I supposed to do?*

*Signed* 'Reviewing in Richmond'

Congratulations, RIR! You've been asked to take the next step towards becoming a member of the scientific community. One of my graduate mentors once advised that for each paper you submit you 'owe' the community three reviews to pay for the time and effort that someone took to review your work. Think of it as manuscript karma. It's now your turn to pay back the help you received with your papers.

In researching an answer to your question, I was surprised to find that there are few resources on how to write a peer review (but for some really excellent examples see Benos et al. 2003; Hoppin 2003; Ayres 2006; Nichols and Gordon 2011; and Buddle 2012). One view holds that most of us are never taught how to write a peer review (Nichols and Gordon 2011). Instead, we learn 'on the job'. This might explain why many reviews are superficial and unhelpful, while well thought out and constructive reviews are rare. Given the importance of the review process, why do we not learn as graduate students? For ecologists, students are rarely asked by editors to do reviews (Zimmerman et al. 2011) and are not given the opportunity to learn. Perhaps this is because most students aren't recognised as experts in their field based on their limited publication record. This is despite the fact that editors report that graduate students and post-docs often write *better* reviews than senior scientists because they are often more familiar with the recent literature, and have the time and the inclination to undertake a comprehensive review (Zimmerman et al. 2011).

Fortunately, for some young scientists, their graduate supervisors consider that teaching students how to write a review is an essential part of the graduate training process. However, for students who don't have this opportunity, the first request to review a paper can be daunting.

### Step 1: The request

A request to review will be sent to you via e-mail. The request may come straight from an editor or an editorial assistant in the case of larger journals. For the initial request you will likely be given just the names of the authors and the abstract. Most journals will also ask you if you can do the review by a deadline (4-8 weeks seems to be average). If you can't meet the journal's deadline, you should decline the review right away, preferably within 24 hours. If you do have time, read the abstract to decide if the paper is on a topic you're familiar with. Don't worry if you find that you are not familiar with all the aspects of the paper. This is why papers

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*Chris MacQuarrie is a research scientist with the Canadian Forest Service in Sault Ste. Marie where he studies the management of native and invasive insects. Currently, he's glad to be back in the pages of the Bulletin after a brief time off to learn the joys of parenting. Have an idea for a column? Send it to cjkmacquarrie@gmail.com or post in the Facebook student group*

have multiple reviewers. You may have been asked because the editor wanted your expertise on a specific system, method, or technique used in the study. If you agree to review the paper, don't forget to tell the editor your particular limitations. Finally, review the author list to see if you have any personal conflicts. You should decline to review the paper if you know any of the authors well or have a professional relationship that might make you biased towards, or against, the authors. Aim to respond to any request to review within 2 days of receiving the e-mail. Delaying your decision just makes the review process longer for the authors. You should receive the full manuscript soon after that.

**Step 2: The read through**

I like to treat each manuscript I review as if it were already published. This means I read the abstract to get a quick feel for the research, and then skip to the figures and tables to see if I can figure out what the authors have found. If their findings are clear (and their figures are good), I can start reading the manuscript with an idea of what to expect. I then read the article from start to finish looking for the basics: what type of paper is it? (Is it a review, a confirmatory study, a case study, or new findings?); and why was the research done? (What are the research questions? What are the hypotheses and predictions? Do the methods make sense? Do the results address the questions? Do the conclusions flow logically from the results?) I'll note the answers to these questions and my other general impressions on a printed copy of the manuscript (or more and more frequently using the commenting tool in a software package).

These answers and my first impressions will often become the framework of my final, written review. During this read, I'll also note any citations I'm not familiar with and statements of fact that I want to check.

The first time I read a manuscript I try not to decide if the paper is acceptable before I finish the whole thing. This can be difficult, as poor writing or bad figures will colour my overall impression of a paper. I try to assess the quality and significance of the work as best I can and tend to ignore any technical errors or problems with the presentation. However, I'll admit that too many errors (e.g., unclear language) make me feel less charitable towards a paper, even if it is scientifically sound. If there are a lot of errors, or when the paper may benefit from some attention by a copy editor, I will write a quick, general review, not going into great depth. Then, in my comments to the authors I will suggest they get help with their writing before resubmitting. The idea here is to allow the authors the opportunity to make the best case for their science without it being clouded by poor preparation.

**Step 3: The assessment**

I like to put a manuscript I'm reviewing aside for a few days after my initial read through so that I can gain some perspective. I do this because, after doing a few reviews, I found that my first impressions of a manuscript changed from first to second reading. Things that I thought were fatal blows to the paper later turned out to be minor flesh wounds. A little bit of time away also allows me read papers I may not be familiar with and to seek out advice on aspects of the paper that are outside my area of speciality.

With this new perspective, I go back to the paper and reread it with much more attention to detail. This time I'm looking for errors in logic (e.g., straw-man arguments, appeals to authority), at clarity in writing (does their argument make sense and do the sections flow together), technical errors (mistakes in the grammar, or spelling errors), problems with the literature review (e.g., poorly chosen citations, or citations that do not support the statement), inconsistencies among the sections (e.g., did they say they were testing four treatments but only three are shown), methodological errors or omissions (e.g., undefined acronyms, missing documentation about techniques), statistical or analytical errors (e.g., wrong tests or incorrect interpretation of results),

and discussion points that are not supported by the results (e.g., overreaching statements, poorly reasoned arguments). I also spend time critically assessing the quality of the figures and tables and making suggestions to clarify or improve the writing.

As I mentioned before, I find this second reading to be very important as my understanding of the paper often changes. I'll frequently revise or strike out the comments I made during my first read through. This part of the process can take a long time, but I find that it helps me get the best handle on the paper, setting me up to write a good review.

### Step 4: The written review

Writing the actual review is the longest part of the review process. When writing, I like to keep in mind that the work I'm reviewing represents a lot of effort by the authors, representing perhaps hundreds of hours of work and 1 or 2 years of their lives. When you write your review, try to keep your comments respectful and constructive. This is easy with a good paper, but can be very hard with a bad paper. Be vigilant!

My reviews have four sections: A summary, an assessment, general recommendations and specific comments. These sections help me organize the review so I can deal with the 'big' items (the assessment and the general recommendations) up front and then move on to the smaller, more technical items later. These sections are just a guide. Many journals have their own format for reviews, in which case you should use their template. I've found that for the journals I review my sections seem to work pretty well.

The first section is the summary. This is a brief statement (no more than two paragraphs) that describes the paper. Be careful as this should not be a re-writing of the abstract. It must be your take on the manuscript. What, in your opinion, did the authors do, and what did they find. Here's an example;

> Jones and Smith test the hypothesis that the leaping distance of grasshoppers is influenced by the number of intact legs. They randomly removed one to six legs from individuals selected from a population of lab reared grasshoppers and recorded the leaping distance of each individual. Their results show a negative relationship between the number of intact limbs and distance leaped. They interpret their results in relation to the migratory potential of legless grasshoppers.

Your summary serves two purposes; it signals to the authors that you actually read their paper and it provides an independent summary for the editor. The summary also gives context to your review. This can be helpful if by chance you've misunderstood the paper; then at least the authors and editor can understand where your review is coming from.

Next is my assessment. I state my overall impression of each section of the paper and tell the editor if I think it should be accepted for publication.

> I found Jones and Smith to be well written. The Introduction adequately explains the reason for the study; their hypothesis and predictions are sound; the Methods are appropriate to the question, the Results section is satisfactory but could benefit from editing; and the Discussion is somewhat superficial. It is my recommendation that this paper is acceptable for publication in the *Journal of Grasshopper Biology* with major revision.

You can go into more detail about each section in the paper, but this passage is intended to be an 'executive summary' of the entire manuscript that communicates whether, in your opinion, the paper should be accepted or rejected. The reasons for your decision will be given in the rest of the review. The journal you reviewing for will have different classes of acceptance, usually "reject", "accept", "accept with minor revision", and "accept with major revision", or variations thereof. I'd suggest you use the journal's terms to make your opinion clear to the editor and to the authors.

In this section you might also comment on the appropriateness of the paper for the journal. In my reviews I tend not to do this unless I'm asked to by the editor. If not, I won't make a recommendation because I'm of the opinion that the editor decides if a paper belongs in their journal. You can also use this section to comment on the study's overall contribution to the literature. If the study is merely repeating what has been done many times before, it's worth mentioning this to the editor. For both instances my guiding principle is this: If I receive a paper for review, I assume that the editor has already decided that the content might be appropriate for their journal.

Third, I provide general recommendations which are a set of major points that I want to bring to the attention of the author(s). These are parts of the paper that I feel require significant work or address issues that impact the entire paper (e.g., an analytical error in the results that leads to a wrong conclusion in the discussion).

> 1: The authors do not cite recent work by MacQuarrie (2009) on jumping distance in crickets or work by Roe (2010) on the migration patterns of legless beetles that appear to be directly applicable to their study. The authors should indicate why these studies do not apply to the formulation of their hypothesis and predictions.
>
> 2: The authors' statistical technique is not supported by recent literature (e.g., Jones 1999). They should use the appropriate technique (e.g., Smith and Jones 2001), or better justify their choice of method with citations from the recent literature.

When I write these general recommendations I try to support them with evidence (from the literature, or from within the manuscript) so that my comments don't appear to be arbitrary criticisms. Along with each general recommendation I'll also state what is needed to resolve the issue. Hoppin (2002) calls this an 'actionable' item.

Finally, I will list my specific comments. These are collected from the notes I made on the manuscript during my first and second readings. Often, these are items that don't rise to the level of general recommendation, such as errors in terminology, missing references, confusing sentence construction, and typos. I will also comment on the structure of tables and the formatting of figures if they need work. My specific comments tend to be short and given without detailed explanation. However, if the same error is repeated throughout the paper, I may just note it the first time with a request to check the whole document. I always cross-reference the specific comments with the line and page number to make them easy for the authors to find. However, if I receive a manuscript that allows me to annotate the file, I will use the software to make comments directly on the manuscript (e.g., with MS Word's track changes, or Adobe Acrobat's comment and mark-up toolbar). When this happens, I won't retype my specific comments, but will ask the authors to consult the marked up version of the manuscript file.

### Step 5: Submitting the review

Submitting the review to the editor usually involves some additional administrative work. Most journals will provide you with a form when they send you the manuscript. This form might include variations on the sections I've written about. It might also ask a series of standard questions to answer when completing your review (e.g., is the paper novel? Is the work statistically sound?) Often these forms also include space for you to give comments meant just for the editor. I'm never really sure what to put here. Sometimes I'll just reproduce my summary and assessment. With papers I've rejected I might give some extra explanation to the editor if I think it might help them understand my decision. However, I often think: If I'm being fair to the authors, shouldn't I also share that information with them? All I can advise is to use your judgement on a case by case basis.

Once you've finished with the review form, it's just a matter of sending the review. In your situation RIR, and for anyone who's submitting their first review, I would advise an additional

step. Ask your supervisor (or someone else you trust) to 'review your review'. The process of reviewing papers is not easy, and it takes a lot of work (one source cites 8 hours for each review!). You want to make sure that you've provided reasonable, helpful advice to these authors. You should also probably check that you haven't made any of your own formatting, grammatical, or spelling mistakes. Assuming your supervisor has written and received a lot of reviews, they should be able to help you improve the quality of yours.

Good luck!

Buggy

## References


Ayres, M. 2006. How to write a peer review. [online] available at www.dartmouth.edu/~mpayres/teach/HowToReview.pdf

Benos, D.J., Kirk, K.L., and Hall, E.J. 2003. How to review a paper. Advances in Physiological Education **27**: 47-52. doi: 10.1152/advan.00057.2002

Buddle, C. 2012. How to review a scientific paper. Available at http://arthropodecology.wordpress.com/2012/02/29.how-to-review-a-scientific-paper/

Hoppin, F.G. Jr. 2002. How I review an original scientific article. American Journal of Respiratory and Critical Care Medicine **166** 1019-1023. doi: 10.1164/rccm.200204-324OE

Nicholas, K.A., and Gordon, W. 2011. A quick guide to writing a solid peer review. Bulletin of the Ecological Society of America **92**:376–381. doi: 10.1890/0012-9623-92.4.376

Zimmerman, N., Salguero-Gomez, R., and Ramos, J. 2011. The next generation of peer reviewing. Frontiers in Ecology and the Environment **9**: 199. doi: 10.1890/1540-9295-9.4.199

Jules Hoffmann

## When a passion for insects leads to a Nobel Prize

**Michel Cusson**

None of us have chosen a career in entomology in the hope of becoming a Nobel laureate one day. And the reason is quite simple: there is no such thing as a "Nobel Prize in Entomology". However, in an astonishing turn of events, discoveries made by French scientist Jules Hoffmann on the immune system of insects brought him to Stockholm last December[1], where he was presented with the 2011 Nobel Prize in Physiology or Medicine, an award that he shares with co-recipients Bruce Beutler (USA) and Ralph Steinman (Canada).

Hoffmann, now 70, was born in Luxembourg in 1941, where he developed an interest in insects at a very young age, under the guiding influence of his father, a professor of natural sciences and an avid insect collector. At age 17, the budding entomologist published his first scientific paper in *Archives grand-ducales des sciences* on the grasshoppers of Luxembourg. He later moved to Strasbourg to undertake a PhD on the origins and roles of hemocytes in the migratory locust, which he completed in 1963. After a short postdoctoral fellowship at Marburg University, Germany, he returned to Strasbourg in 1964, where he was appointed Research Scientist at the *Institut de zoologie* of the *Centre national de la recherche scientifique* (CNRS). "When I began my career, in the mid-60s, the discipline of zoology was on a downward slope. As a result, my interest in insects did not predispose me for a high-profile career", recalls Hoffmann. Nevertheless, he first established a research program in insect endocrinology, publishing many key papers on ecdysteroids and their roles in locust reproduction (with the collaboration of Quebec-City-born Marie Lagueux).

In 1989, 19 years after trading his Luxembourg citizenship for the French, Hoffmann decided to phase out his research on endocrinology and to focus his investigations on the insect immune system. "When I first started working on insects, I realized that they were particularly resistant to microorganisms and wondered why that was so. And we hoped that from that, we would learn

*Michel Cusson (Michel.Cusson@RNCan-NRCan.gc.ca), whose early training was in insect endocrinology, first became acquainted with Jules Hoffmann's work through his early publications on locust ecdysteroids, which Michel read avidly as a PhD student. At the International Congress of Comparative Endocrinology held in Toronto in 1992, Michel met Marie Lagueux (first author on most of these papers) who told him about the changes in research directions taking place in Hoffmann's lab. Later, Daniel Doucet came to do a postdoc with Michel after completing a first one under Hoffmann's supervision. Daniel's account of the exciting work on insect immunity going on in the Strasbourg lab got Michel reading about Hoffmann's celebrated work on Toll receptors. Last October, when he heard Hoffmann was being presented with the Nobel Prize in Physiology or Medicine, Michel couldn't help but feel thrilled that a man with a career driven by a passion for insects had received such a high honour.*

something about human immunity", says Hoffmann. To help him in this endeavour, he switched experimental animal and adopted the well genetically characterized *Drosophila*.

Insects do not have an "adaptive" immune system like we and other vertebrates do. In other words, they lack the ability to produce pathogen-specific antibodies that confer long-lasting and protective immunity to the host. Rather, they have an "innate" immune system, which provides a non-specific first line of defense against infection. Innate immune responses to infection or injury include reactions such as melanization, phagocytosis of bacteria and encapsulation of larger parasites by hemocytes. In addition, invading microorganisms induce the production, by the fat body, of potent antimicrobial peptides that are released in the hemolymph to help kill the invader. Vertebrates too have an innate immune system; it helps them fight infection during its acute phase, long before antibodies have been generated. So, Hoffmann's first goal in tackling the immune system of *Drosophila* was to identify all the anti-microbial peptides this insect produces. And he did: the antibacterial peptides cecropin, diptericin, drosocin, attacin and insect defensin, as well as the antifungal peptides drosomycin and metchnikowin were all isolated from the fruit fly in the early 1990s. We now know that humans produce large quantities of similar peptides in their skin and digestive tract.

In 1992, Hoffmann moved to the *Institut de biologie moléculaire et cellulaire* (CNRS), Strasbourg, of which he became director in 1994. This is where the ground-breaking discoveries that would later be recognized by the Nobel Assembly at Karolinska Institutet were about to be made. In 1996, an article on the role of "Toll receptors" in *Drosophila* immunity was published in the journal *Cell*[2]. In this pivotal paper, first author Bruno Lemaître[3], then postdoctoral fellow in Hoffmann's lab, reported that the Toll receptor, already known for its role in dorsoventral patterning during embryonic development of *Drosophila*, was also required for induction of the antifungal response leading to the production of drosomycin: mutations in the Toll signaling pathway led to a dramatic reduction in fly survival following fungal infection. Complementary studies showed that induction of the antibacterial response was largely dependent on a different pathway, known as the *imd* ("immune deficiency") pathway, although full induction of the antibacterial peptide cecropin A also required components of the Toll pathway.

The above discovery triggered an avalanche of independent studies – 18,000 articles on Toll receptors have been published since the 1996 *Cell* paper appeared – aimed at identifying Toll receptor homologs in mammals and characterizing their roles in the immune response. To this end, Hoffmann collaborated with American colleagues (including Nobel co-recipient Bruce Beutler) who soon described the essential role of mammalian *Toll-like receptors* (TLRs) in the recognition of lipopolysaccharides (LPS) present in the outer membrane of gram-negative bacteria. In addition, one such TLR, TLR4, was shown to induce the activation of certain genes necessary for initiating an adaptive immune response.

Of course, the discovery of TLRs in humans was bound to have medical implications. Not surprisingly, if Hoffmann's work has earned him the Nobel Prize in Physiology or Medicine, it is because his research has paved the way to the development of preventative and therapeutic approaches to fight infections, cancers and inflammatory diseases. However, many did not suspect, even until recently, that research on fruit flies could have such far-reaching medical ramifications. For example, in one of her speeches during the 2008 US presidential campaign, vice-presidential nominee Sarah Palin criticized the American funding strategy for scientific research in those terms: "Some of these pet projects … they really don't make a lot of sense. Sometimes these dollars, they go to projects having little or nothing to do with the public good … things like fruit fly research in Paris, France … I kid you not!"[4]. No doubt, Hoffmann and his collaborators must feel a bit smug now when they recall this episode, which should be taken as a reminder of the importance of funding basic research as a prerequisite for the development

of practical applications.

The Nobel Prize is not the only prestigious award Jules Hoffmann received in 2011. Earlier in the year, he was one of three co-recipients of the Shaw Prize in Life Sciences and Medicine (Hong Kong). He was also awarded the CNRS Gold Medal, the highest honour given to a scientist in France. Finally, he was presented with the Canada Gairdner Award, which he shared with four other scientists. The latter prize is given out by the Gairdner Foundation to "recognize and reward the achievements of medical researchers whose work contributes significantly to improving the quality of human life". Because recipients of this award must agree to give a set of lectures in Canada during the year in which they receive the award, Hoffmann had accepted (before being told he was a Nobel laureate) to give a lecture at the Faculty of Medicine of Université Laval, in Quebec City, on 20 October – only 17 days after the official announcement of his Nobel Prize. This was his first North American lecture after the Nobel announcement. Needless to say, I was among those who attended his presentation in the jam-packed Fisher Lecture Hall. With his warm personality and outstanding communication skills, Hoffmann literally mesmerized his audience and was given a long-standing ovation at the conclusion of his lecture.

Of course, most entomologists don't even dream of ever reaching the level of recognition Jules Hoffmann has attained. But his career should be viewed as a source of inspiration and taken as a good example of the great things one can achieve by studying insects[5].

**Endnotes**

[1] The official announcement was made on 3 October but the award ceremony took place on 10 December.

[2] Lemaître, B., Nicolas, E., Michaut, L., Reichhart, J-M., and Hoffmann, J.A. 1996. The dorsoventral regulatory gene cassette *spätzle/Toll/cactus* controls the potent antifungal response in Drosophila adults. *Cell*, **86:** 973-983.

[3] As may be expected with the presentation of Nobel Prizes to principal investigators of large laboratories such as Hoffmann's, those who designed and carried out the experiments that constitute the pillar of the celebrated achievement may feel frustrated by the shadow the Nobel Prize casts on their contribution. And Bruno Lemaître is no exception. Although he did not challenge the Prize, he created a website where he provides an historical account of the Toll receptor research he was involved in and expresses his disappointment that neither the Nobel committee nor Hoffmann gave his contribution the attention it deserved.

[4] http://www.salon.com/2008/10/27/sarah_palin_fruit_flies/
http://www.youtube.com/watch?v=HCXqKEs68Xk. See also article entitled "Fruit-fly benefactors", published in The Globe and Mail on 1 November 2011.

[5] Several additional scientific papers and news paper/magazine articles (from Le Devoir, Le Point, Le Monde, Libération, etc.) were consulted to prepare the present article. The quotes from interviews with Hoffmann were translated from French, somewhat freely, by me. The photo of Hoffmann is reproduced with permission from *Au fil des événements*. I thank Daniel Doucet (Canadian Forest Service, Sault Ste Marie) for constructive comments on an earlier version of this article. Daniel, who did an MSc and a postdoc under my supervision, did his first postdoc in Hoffmann's lab (see *Cellular Microbiology*, **7:** 335-350; 2005).

## Cambridge University Press – ESC's new partner for publication of *The Canadian Entomologist*

**Peter Mason, Kevin Floate, Scott Brooks, Chris Buddle and Robb Bennett**

Entomological Society of Canada (ESC) members submitting manuscripts to *The Canadian Entomologist* (*TCE*) will notice that things have changed. As announced in the *Bulletin of the Entomological Society of Canada* Volume 43(3), September 2011, effective January 2012 the ESC has entered into a partnership with Cambridge University Press (CUP) for production of *TCE*. This decision was taken after over 2 years of reflection, hard work and negotiations.

The past 5 years have seen the costs to publish *TCE* soar. This became a major financial burden in part because the ESC was determined to minimize page charges. As well, competition from journals with no page charges was reducing submissions to *TCE*, including submissions by ESC members surviving on limited research funds. In recent years, the Editor-in-Chief has struggled to meet minimum page number commitments. Something needed to be done to ensure the survival of *TCE*.

In 2009, a private company approached the ESC with a partnership proposal for publication of *TCE* which included elimination of page charges for authors. The Governing Board considered this offer at the 2009 JAM in Winnipeg, concluding that the ESC needed to move in this direction if *TCE* was to survive. Publications Committee member Kevin Floate was appointed to lead an initiative whereby the ESC would solicit proposals from a number of publishing companies. Three proposals were submitted for consideration by the Governing Board at the 2010 JAM in Vancouver. The Board concluded that the proposal submitted by Cambridge University Press best met the needs of the Society. The Governing Board tasked the new Chair of the Publications Committee (Kevin Floate), incoming President (Peter Mason), and Treasurer (Scott Brooks) to negotiate with CUP. The incoming Editor-in-Chief (Chris Buddle) and outgoing Editor-in-Chief (Robb Bennett) were asked to play a consultative role.

Following the 2010 JAM, discussions between CUP and the ESC negotiating team resulted in a draft agreement by May 2011. Legal reviews done for both sides recommended only minor changes and a final agreement was signed by the ESC President on 5 August 2011 and, a few days later, by CUP's Director of Legal Services and Governance. One of the original documents is on file at ESC Headquarters.

What did we give up? Not much. CUP will determine subscription rates for non-ESC members.

What did we get? Quite a bit. In addition to a 7-year commitment from CUP to publish *TCE*, the ESC has received a respectable signing bonus, and will receive an annual royalty payment during the life of the contract. The ESC retains ownership of *TCE*, copyright for material published in *TCE*, and membership lists. The ESC retains jurisdiction over the Editorial Board makeup and editorial jurisdiction over content. *TCE* receives CUP support for online submission of manuscripts and copy-editing services, a dedicated CUP marketing budget to promote *TCE* internationally, and increased subscriptions that include the packaging of *TCE* for sale with other CUP journals. ESC members retain free access to *TCE* online, no longer have to pay page charges for text or colour plates, receive a 20% discount on selected books published by CUP, and receive a 20% discount on selected journals published by CUP.

Stability has been achieved for the Entomological Society of Canada and our flagship journal, *The Canadian Entomologist*. The future is bright for Canadian entomology!

# From "Dracula" to "Alien": An essay on the strange and wonderful insects found in bird nests

**Simon P. Daoust**

I am a science fiction and horror enthusiast. I was reared on a diet of Star Wars, Star Trek and monster movies; anything that involved strange looking aliens from planets in galaxies far, far away. Such a statement might not surprise anyone given the title of this article. The reason why I am sharing this and exposing my true "geeky" self is that through my studies, I discovered that one does not have to travel onboard a spaceship to visit strange new worlds and encounter truly "alien" creatures. Our beautiful planet is simply bursting with strange and exotic life forms that live and thrive in the most inhospitable places imaginable. It is within such a place that we will continue our journey. Brace yourselves, as we enter the dark and gritty microhabitat found within cavity nesting bird nests (Fig. 1).

Bird nests represent a veritable Fort Knox for entomologists. In fact, other than the developing nestlings, a typical altricial bird nest can be home to various species of lice (Dobroscky 1925; Woodroffe and Southgate 1951; Clayton and Tompkins 1995; Gwinner et al. 2000), fleas (Moller 1991; Heeb et al. 1996), mites (Burtt Jr et al. 1991; Merino and Potti 1995), beetle larvae (Dobroscky 1925; Woodroffe and Southgate 1951)), fly larvae (Sabrosky 1956; Sabrosky et al. 1989; Bennett and Whitworth 1992) and wasps (Whiting 1967; Darling and Werren 1990; Raychoudhury et al. 2009; Raychoudhury et al. 2010). For my PhD work, I had the privilege of working on two groups of insects that make up this most unusual community: the ectoparasitic blowflies of the genus *Protocalliphora* Hough (Diptera: Calliphoridae) (Fig. 2) and the parasitoid wasps of the genus *Nasonia* (Ashmead) (Hymenoptera: Pteromalidae) (Fig. 3).

S. Daoust

Fig. 1. Cavity nest of a tree swallow.

## *Protocalliphora* – The bird nest vampires

*The gruesome details*

Like Bram Stoker's Dracula, *Protocalliphora* larvae feed on the blood of their unsuspecting victims; in this case, nestling birds. The larvae are typically anchored to the most accessible part of the nestling (feet, legs and belly) (Fig. 4). Some species can also be found burrowing into the nestling's auditory and nasal cavities (Whitworth and Bennett 1992) (Fig. 5). And like the vampires of fiction, *Protocalliphora* larvae use specialized hooks located in the anterior portion of their mouths to cut into the chick's flesh. They even have a specialized structure known as the "prothoracic fringe" to anchor themselves into the bird as they drink their bloody meal. This is a slow process, taking up to 45 minutes to fill one third of its crop. They must take at least two to three

J. Lindsey

Fig. 2. *Protocalliphora azurea*.

G. Gibson & L. Bearss

Fig. 3. *Nasonia vitripennis* (male).

*Simon Daoust (daoust.simon@gmail.com) received his PhD from the Université de Montréal in December 2011 (see page 23). He is currently a post-doctoral fellow at Maladies Infectieuses et Vecteurs: Ecologie, Génétique, Evolution et Contrôle Centre IRD, Montpellier, France.*

blood meals to complete their development or else they mature into shriveled, sterile adults known as "runts" (Sabrosky et al. 1989). The amount of blood they are capable of ingesting varies significantly between species, reaching on average 80 mg in the large *Protocalliphora rognesi* Thompson & Pont (Whitworth and Bennett 1992). In the most extreme scenario, 5 or 6 of the largest *P. rognesi* larvae, each capable of ingesting 200 mg of blood, could exsanguinate an 18-day-old bank swallow (*Riparia riparia* [Linnaeus]) in a single day (Whitworth and Bennett 1992).


R. Dawson

Fig. 4. *Protocalliphora* larvae attached to the abdomen of a tree swallow nestling.

*How to collect and identify these intriguing flies*

After such a dramatic introductory paragraph, many of you will undoubtedly be getting your nets and insect traps out in hopes of catching one of these vampirical flies. Sadly, nets and traps have proven time and time again to be utterly useless at trapping *Protocalliphora*. Adults of this genus are notoriously difficult to catch and therefore, if you hope to ever find any, I suggest you set up some bird boxes and wait until the late spring. Indeed, the easiest way to collect *Protocalliphora* is as pupae from bird nests. Once the larvae are ready to pupate, they typically burrow down into the very base of the nest, where they pupate incrusted in a matrix of dirt, fecal matter and nest material (as seen in Fig. 6). To make our lives a little easier, pupae are actually easier to key for this group than adults, and excellent keys for pupae have been developed by Whitworth (2003)


T. Whitworth

Fig. 5. *Protocalliphora* larvae penetrating the nasal cavity of an ovenbird nestling.

*Ecology and distribution*

Remarkably, the life history has not been described for a single species of *Protocalliphora* in North America, and perhaps even worldwide. This sad state of affairs is in part due to the fact that they are notoriously hard to collect as adults as well as being very difficult to rear. However, enough information is known of the life cycle and the factors affecting it so that several inferences can be drawn. It is pretty clear now that *Protocalliphora* overwinter as adults, with both males and females surviving to the following spring. It is not known if mating occurs prior to hibernation or during the first warm days of late winter and early spring when the flies become active. Once the gravid female fly locates a bird nest containing nestlings, the fly oviposits either directly on the young or in the nest materials. Interestingly, the duration of the egg and subsequent larval stages generally reflects the length of the host nestling period; species parasitizing large birds with long nestling periods have longer egg and larval stages than species parasitizing small passerines. The number of *Protocalliphora* larvae per nest has been shown to range from as few as one to thousands of individuals. Large numbers of larvae may result primarily from large nests with suitable


T. Whitworth

Fig. 6. The underside of a tree swallow nest with *Protocalliphora* pupae embedded in the matrix.

hiding places rather than from large birds, as small or fragile nests are inadequate for very high numbers of larvae. The genus *Protocalliphora* is Holarctic and predominantly found in the Northern Hemisphere. In North America, they can be found in Alaska, throughout Canada, Greenland and in most of the contiguous states of the U.S.A. The flies seem to occur chiefly at higher altitudes in the southern extensions of their ranges (Sabrosky et al. 1989; Bennett and Whitworth 1991).

*Impact on their bird hosts*

At this point, I suppose that most of you are wondering how the poor nestlings fare after being used as a veritable blood buffet. The vast majority of studies that deal with *Protocalliphora* are interested in this very same question. If I were to express a general consensus based on the work that has been done, I would say that the survival/wellbeing of the nestling/offspring ultimately depends on the level of ectoparasitism and the amount of food provided for them by the parents. Generally, parasitized nestlings had lower hematocrit and haemoglobin levels (Whitworth and Bennett 1992; O'Brien et al. 2001; Hannam 2006), reduced growth rates (Whitworth and Bennett 1992), decreased body temperatures and metabolic rates (Simon et al. 2005), and lower fledging survival and reduced dispersal in the first days following fledging (Thomas et al. 2007; Streby et al. 2009). Conversely, others have reported no significant effects of *Protocalliphora* ectoparasitism on any of the aforementioned parameters (Johnson et al. 1991; Roby et al. 1992; Wittmann and Beason 1992; Miller and Fair 1997; Thomas and Shutler 2001).

## *Nasonia* – The killer parasitoid

*Science-fiction meets reality*

The first time I saw Ridley Scott's masterpiece "Alien" I was mesmerized. Aside from the spine-tingling plot and the excellent casting, it was the creature that truly stuck with me. Its life cycle seemed so horrific and so unbelievable that I was certain it was the product of some twisted imagination. Boy, was I wrong! Not only are there creatures with even more horrific life cycles than the one depicted in "Alien", but these creatures can be found right in your backyard. So began my love of parasitoids. Through my PhD work, I became rather intimate with one group in particular, the small chalcid wasp *Nasonia vitripennis*.

*Ecology and distribution*

*Nasonia vitripennis* is a small (<2 mm) parasitic wasp that lays its egg in the pupae of various fly species (including *Protocalliphora*!!) (Fig. 7). Female wasps can lay between 20 and 50 eggs in one pupa (they can not possibly lay more eggs in one pupa as there simply is not enough room, as seen in Fig. 8). Along with the eggs, they also inject venom, halting the fly's development (killing it), as well as a virus, which is coded in their own genome that down regulates the host's immune system. Interestingly, the males emerge first by chewing their way out of the pupa. Once out, they wait patiently on the periphery of their exit hole for the females (usually their sisters) to come out so that they can mate. Males in this species do not have a very exciting life; due to their reduced wings, they are incapable of flight and it is therefore the females that disperse in order to find a new batch of pupae (Whiting 1967).

Another interesting aspect of *Nasonia*'s biology is its haplodiploid mode of sex determination. Unlike humans, *Nasonia* do not possess sex chromosomes. Instead, females are produced from fertilized eggs (diploid) while males emerge from unfertilized eggs (haploid). What is remarkable about this form of sex determination is that it enables mothers to control the sex of their offspring (Beukeboom et al. 2007). To the casual observer this might not seem like something to make much of a fuss about, but this fact has lead to hundreds of scientific works in the field of adaptive sex ratio and evolution (Godfray 2010).

## A truly unique community

Individually, birds, *Protocalliphora* blow flies, and *Nasonia* wasps are fascinating to study, but


Fig. 7. *Nasonia vitripennis* female on a fly pupa.


Fig. 8. *Nasonia vitripennis* larvae within a fly pupa.

as a community of interacting species within an ecosystem, they are what great science is all about. This system owes its uniqueness to the fact that it allows for two important paradigm shifts in community ecology. Firstly, unlike the vast majority of ecological networks, birds within this system are not only placed at the lowest trophic level but they are placed below two insect groups. Secondly, unlike most trophic networks, the organisms within this system actually get smaller as you go up the food web. This unique system not only allows us to study intriguing organisms, but it also gives us the opportunity to test fundamental concepts in community ecology.

## References

Bennett, G.F., and Whitworth, T.L. 1991. Studies on the life history of some species of *Protocalliphora* (Diptera: Calliphoridae). Canadian Journal of Zoology **69**: 2048-2058.

Bennett, G.F., and Whitworth, T.L. 1992. Host, nest, and ecological relationships of species of *Protocalliphora* (Diptera: Calliphoridae). Canadian Journal of Zoology **70**: 51-61.

Beukeboom, L.W., Kamping, A., and van de Zande, L. 2007. Sex determination in the haplodiploid wasp *Nasonia vitripennis* (Hymenoptera: Chalcidoidea): a critical consideration of models and evidence. Seminars in Cell and Developmental Biology **18**: 371-378.

Burtt Jr, E.H., Chow, W., and Babbitt, G. 1991. Occurrence and demography of mites of tree swallow, house wren, and eastern bluebird nests. *In* Bird–parasite interactions: Ecology, evolution and behaviour. *Edited by* J.E. Loye and M. Zuk (eds) Oxford University Press, Oxford, UK. pp. 104-122.

Clayton, D.H., and Tompkins, D. 1995. Comparative effects of mites and lice on the reproductive success of rock doves (*Columba livia*). Parasitology **110**: 195-195.

Darling, D.C., and Werren, J.H. 1990. Biosystematics of *Nasonia* (Hymenoptera: Pteromalidae): Two new species reared from birds nests in north America. Annals of the Entomological Society of America **83**: 352-370.

Dobroscky, I.D. 1925. External parasites of birds and the fauna of birds' nests. Biological Bulletin **48**: 274-281.

Godfray, H. 2010. *Nasonia*: a jewel among wasps. Heredity **104**: 235-236.

Gwinner, H., Oltrogge, M., Trost, L., and Nienaber, U. 2000. Green plants in starling nests: effects on nestlings. Animal Behaviour **59**: 301-309.

Hannam, K. 2006. Ectoparasitic blow flies (*Protocalliphora* sp.) and nestling eastern bluebirds (*Sialia sialis*): direct effects and compensatory strategies. Canadian Journal of Zoology **84**: 921-930.

Heeb, P., Werner, I., Richner, H., and Kolliker, M. 1996. Horizontal transmission and reproductive rates of hen fleas in great tit nests. Journal of Animal Ecology **65**: 474-484.

Johnson, L.S., Eastman, M.D., and Kermott, L.H. 1991. Effect of ectoparasitism by larvae of the blow fly *Protocalliphora parorum* (Diptera: Calliphoridae) on nestling house wrens, *Troglodytes aedon*. Canadian Journal of Zoology **69**: 1441-1446.

Merino, S., and Potti, J. 1995. Mites and blowflies decrease growth and survival in nestling pied flycatchers. Oikos **73**: 95-103.

Miller, C.K., and Fair, J.M. 1997. Effects of blow fly (*Protocalliphora spatulata*: Diptera: Calliphoridae) parasitism on the growth of nestling savannah sparrows in Alaska. Canadian Journal of Zoology **75**: 641-644.

Moller, A. 1991. Ectoparasite loads affect optimal clutch size in swallows. Functional Ecology **5**: 351-359.

O'Brien, E.L., Morrison, B.L., and Johnson, L.S. 2001. Assessing the effects of haematophagous ectoparasites on the health of nestling birds: haematocrit vs haemoglobin levels in house wrens parasitized by blow fly larvae. Journal of Avian Biology **32**: 73-76.

Raychoudhury, R., Baldo, L., Oliveira, D.C.S.G., and Werren, J.H. 2009. Modes of acquisition of *Wolbachia*: horizontal transfer, hybrid introgression, and codivergence in the *Nasonia* species complex. Evolution **63**: 165-183.

Raychoudhury, R., Desjardins, C., Buellesbach, J., Loehlin, D., Grillenberger, B., Beukeboom, L., Schmitt, T., and Werren, J. 2010. Behavioral and genetic characteristics of a new species of *Nasonia*. Heredity **104**: 278-288.

Roby, D.D., Brink, K.L., and Wittmann, K. 1992. Effects of bird blowfly parasitism on eastern bluebird and tree swallow nestlings. The Wilson Bulletin **104**: 630-643.

Sabrosky, C.W. 1956. The nomenclature of *Protocalliphora* (Diptera: Calliphoridae). Wiley Online Library. pp. 175-179.

Sabrosky, C.W., Bennett, G.F., and Whitworth, T.L. 1989. Bird blow flies (*Protocalliphora*) in North America (Diptera: Calliphoridae), with notes on the Palearctic species. Smithsonian Institution Press, Washington, DC.

Streby, H.M., Peterson, S.M., and Kapfer, P.M. 2009. Fledging success is a poor indicator of the effects of bird blow flies on ovenbird survival. The Condor **111**: 193-197.

Thomas, D., Shipley, B., Blondel, J., Perret, P., Simon, A., and Lambrechts, M. 2007. Common paths link food abundance and ectoparasite loads to physiological performance and recruitment in nestling blue tits. Functional Ecology **21**: 947-955.

Thomas, K., and Shutler, D. 2001. Ectoparasites, nestling growth, parental feeding rates, and begging intensity of tree swallows. Canadian Journal of Zoology **79**: 346-353.

Whiting, A.R. 1967. The biology of the parasitic wasp *Mormoniella vitripennis* [= *Nasonia brevicornis*](Walker). Quarterly Review of Biology **42**: 333-406.

Whitworth, T.L. 2003. A key to the puparia of 27 species of North American *Protocalliphora* Hough (Diptera: Calliphoridae) from bird nests and two new puparial descriptions. Proceedings of the Entomological Society of Washington **105**: 995-1033.

Whitworth, T.L., and Bennett, G.F. 1992. Pathogenicity of larval *Protocalliphora* (Diptera: Calliphoridae) parasitizing nestling birds. Canadian Journal of Zoology **70**: 2184-2191.

Wittmann, K., and Beason, R.C. 1992. The effect of blowfly parasitism on nestling eastern bluebird development. Journal of Field Ornithology **63**: 286-293.

Woodroffe, G., and Southgate, B. 1951. Birds' nests as a source of domestic pests. Wiley Online Library. pp. 55-62.

# ‘Butterfly Skin’ for Wind Turbines

**Igor Kovalev**

In the course of development of animal species, flying has been “invented” several times: the first winged insects began to populate the forest of the Carboniferous period about 350 million years ago. The wing surfaces of the insects were smooth. Butterflies with scaled wings began to fly into the sky of the Jurassic period. Through natural selection, the butterflies have been experimenting with scale coverage and scale microstructure for 210 million years. Among all present day insects, butterflies and moths with scale- covered wings are the record holders of two titles: long distance travel (monarch butterfly, *Danaus plexippus L.* [Fig. 1] and flight speed (113 km/h, the black cutworm moth, *Agrotis ipsilon*) (Sappington et al. 1992).

Butterflies and moths both belong to the insect order Lepidoptera (derived from Greek words meaning “scale wing”). The surface of the wings of present day butterflies and moths is covered with millions of tiny movable appendages – scales (30-200 µm in size). The scales are arranged in highly ordered rows in the same fashion as tiles on a roof. When we handle butterflies or moths, the “dust” that comes off is composed of these very small scales.

K. Floate

Figure 1. Monarch butterfly (*Danaus plexippus L.*), weighing on average about 500 mg, covers its migration distance of 3200 km in only 3 weeks.

Investigation of the structures, forms and functions of scales began in medieval times. Theodore de Mayerne, physician to Charles I (England, late 17th century), described colors and patterns on the wings of butterflies. The development of the microscope and of scientific knowledge had a substantial impact on research into these cuticular appendages of insect wings. It was shown that the scale coverage was multifunctional. The tiny appendages create the wonderful colors on butterfly wings, influence regulation of body temperature, and increase the lift force of fixed-wings.

The microstructure of a butterfly scale is a true miracle of nature. Each butterfly scale is a long and flattened extension of cuticle and generally resembles a gathered sack consisting of lower and upper laminae (Fig. 2). These laminae are separated by an air cavity. The lower lamina is a flat plate from which trabeculae rise to join the upper lamina. The upper lamina is a complex structure consisting of ridges with an inverted V-profile and grooves with discrete openings. The inverted V-profiles of the ridges form microchannels, which are disposed between the air-

*Igor Kovalev (kovis@ashdot-m.org.il) was born in 1962 in Russia. He graduated from Kharkov Aviation Institute. During his 7 years at the Zaporozhye Engine-building Design Office, Igor took part in the development of wind turbine blades, and directed R&D studies of aviation coatings having a butterfly wing scale type of structure, intended for the wind turbine. He entered a post-graduate course at St. Petersburg State University (Department of Entomology) in 1995. Igor emigrated to Israel in 1997. Since 1998, he has studied the effect of insect flight parameters and has led research into the development of biomimicry coatings for the wind turbine. Igor has made 5 scientific discoveries and several inventions, and has written 20 scientific papers.*

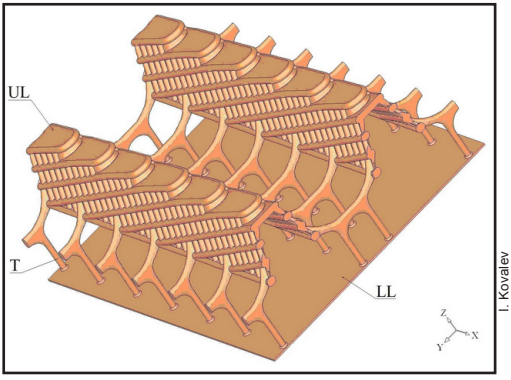


Figure 2. Vertical cross-section of *Danaus plexippus* wing scale. UL, upper lamina; LL, lower lamina; T, trabecula.

permeable upper laminae and air-proof lower laminae.

During my investigations of lepidopterans in the laboratory and in the field, I discovered three major effects of the butterfly scale coverage. The first effect was to increase the aerodynamic forces of wings in flapping flight, and to extend the wings' movement capability (maneuverability). Furthermore, the air cavity of a butterfly scale increases the lift force (Kovalev 2008). The second effect was to minimize vibration. The final effect was to decrease the noise produced by the flying insect (Kovalev 2005). These properties improve the lepidopterans' chances of avoiding predator attacks in flight.

Biomimicry is a progressive orientation in engineering work. Its main objective is to create new kinds of highly effective machines that function like living organisms. For this, biomimicry prepares the ground by systematically investigating the multiplicity of biological structures, form and processes, and ways that are functionally interrelated. For example, Otto Lilienthal (Germany, late 19th century), together with his brother Gustav, investigated the flight of birds and the airflow past a wing. He came to appreciate the importance of the arched profile.

A wind turbine, usually called a windmill, is a machine that converts the energy of the wind into more useful forms (mechanical energy or electricity) using rotating blades. A history of practical wind turbine development usually begins with mention of windmills in eastern Persia (9th century) (Ahmad et al. 1986). The initial development of the wind turbine faced two major problems (George et al. 1983). The first problem was to develop a light and strong design for turbine blades while maintaining good aerodynamic efficiency. The second problem was to minimize the vibration of wind turbine blades.

My study of the matchless multifunctional microstructure of wing scales, which have functioned flawlessly for 210 million years, led to the design of a highly effective skin which eliminated the problem associated with wind turbine blades. I devised a special design of the wing skin, called 'butterfly skin' (a metallic version of the butterfly scale), and experimentally investigated the influence of the skin on the lift force and vibration performance of a wind turbine blade (Kovalev 2010). Two different wind turbine blades were used. The skin of the first wind turbine blade was imitated from the monarch butterfly wing scale (Fig. 2). 'Butterfly skin' was composed of two layers (Fig. 3). The upper metal wall and the lower metal wall were separated by an air cavity. Both surfaces of the upper wall were covered with a large number of span wise grooves. Ridges (spacing 1 mm) with an inverted V-profile were formed between the grooves. The grooves of the external surface were provided with lines of perforations. The inverted V-profile of the ridges formed the channels, which were disposed between the upper and lower walls. The lower wall was similar to a thin sheet. The skin thickness was 1 mm.

The second turbine blade was geometrically similar to the first wing It was the principal concern of this study to qualitatively determine the effect of 'butterfly skin' on aerodynamic forces of a wing. Therefore, the skin of the second turbine blade was mono-layered, smooth and airproof. The design of the skin is traditional for modern wind turbines. The aerodynamic properties of the first turbine blade were compared with those of the second turbine blade.

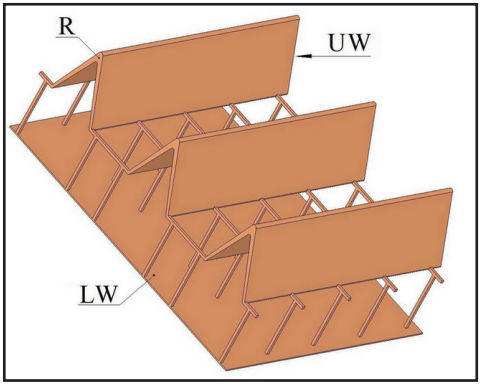


Figure 3. Vertical cross-section of the 'butterfly skin'. LW, lower wall; R, ridges; UW, upper wall.

Results of the studies indicated that the 'butterfly skin' of a wing increased the lift force by a factor of 1.15, and reduced both the aerodynamic friction and the frequency of an oscillating blade. Moreover, the aerodynamic influence on the rotor blade with the 'butterfly skin' in unsteady conditions was more lasting than on the rotor blade with the smooth skin. This result is in good agreement with the experimental data of the lift given by Nachtigall (1965) for a moth wing with scales, and with the data of the drag reduction given by Becher et al. (1985) for shark skin.

The modification of the aerodynamic effects and of the vibration performances on the turbine blade was due to an increase in the volume of the air which influences the 'butterfly skin' and is set in motion together with the wing.

It is evident that the wind turbine with the 'butterfly skin' will extract more energy from the wind, and the power of the wind turbine with the 'butterfly skin' will become more economic.

## Acknowledgements

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## References

Ahmad Y. al-Hassan, and Hill, D.R.. 1986. Islamic Technology: An Illustrated History. Cambridge University Press, Cambridge.

Bechert, D.W., Hoppe, G., and Reif, W.- E. 1985. On the drag reduction of the shark skin. American Institute of Aeronautics and Astronautics. 12-14 March. Paper No 85 – 0546.

George, A.R., and Chou, S.-T. 1983. Comparison of broadband noise mechanism, analyses, and experiments on helicopters, propellers, and wind turbines, NASA Center, AIAA, *In* Aero-acoustics Conference, Atlanta, Georgia. 11-13 April 1983.

Kovalev, I. 2005. Butterflies and helicopters. Bulletin of the Entomological Society of Canada, **37**: 140 -142.

Kovalev, I.S. 2008. The functional role of the hollow region of the butterfly *Pyrameis atalanta* (L.) scale. Journal of Bionic Engineering, **5**: 224-230.

Kovalev, I.S. 2010. From butterfly to wind turbine. Wind Engineering, **34**: 351-360.

Nachtigall, W. 1965. Die aerodinamische Function der Schmetterlingsschuppen. Naturwissenschaften, **52**: 216 - 217.

Sappington, T.W., and Showers, W.B. 1992. Reproductive maturity, mating status, and long-duration flight behaviour of *Agrotis ipsilon* (Lepidoptera: Noctuidae) and the conceptual misuse of the oogenesis- flight syndrome by entomologists. Environmental Entomology, **21**: 677-688.

# Meeting announcements / Réunions futures

**45th Annual Meeting of the Society for Invertebrate Pathology and International Congress on Invertebrate Pathology and Microbial Control**
Buenos Aires, Argentina, 5-9 August 2012
http://www.sipweb.org/SIP2012/index.html

**International Congress of Entomology**
Daegu, South Korea, 19-25 August 2012
http://www.ice2012.org/

**IOBC/WPRS Pheromones and other Semiochemicals Conference**
Bursa, Turkey, 1-5 October 2012
http://www20.uludag.edu.tr/~bitkik/iobc/iobc_pheromone_2012.html

**Joint Annual Meeting of the Entomological Societies of Canada and Alberta**
Edmonton, Alberta, 4-7 November 2012

**Annual Meeting of the Entomological Society of America**
Knoxville, Tennessee, 11-14 November 2012
Entomology 2012

**ECE X (Tenth European Congress of Entomology)**
York, UK, 3-8 August 2014
www.ece2014.com

*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.*

## 62nd Annual General and Governing Board Meetings

The Annual General Meeting of the Entomological Society of Canada will be held at the Coast Edmonton Plaza Hotel on Tuesday, 6 November 2012, from 17:00 to17:45. The Governing Board Meeting will be held at the same location on Saturday, 3 November 2012 from 08:30 to 17:00. Matters for consideration at either of the above meetings should be sent to Alec McClay, Secretary of the ESC.

## Call for nominations: Second Vice-President, Director-at-Large

Nominations for the Second Vice-President and Director-at-Large must be signed by three active members of the Society and should be received by the Secretary of the Entomological Society of Canada, Alec McClay, by 30 April 2012 (see inside back cover for contact details).

## 62e assemblée générale annuelle et réunion du conseil d'administration

L'assemblée générale annuelle de la Société d'entomologie du Canada se tiendra à l'hôtel Coast Edmonton Plaza le mardi 6 novembre 2012 de 17h00 à 17h45. La réunion du conseil d'administration se tiendra au même endroit, le samedi 3 novembre 2012 de 8h30 à 17h00. Tout sujet pouvant faire l'objet de discussion pour chacune de ces réunions doit être envoyé à Alec McClay, secrétaire de la SEC.

## Appel à candidatures : Deuxième vice-président et conseiller

Les candidatures pour les postes de deuxième vice-président et conseiller doivent être signées par trois membres actifs de la Société et doivent être reçues par le secrétaire de la Société d'entomologie du Canada, Alec McClay, au plus tard le 30 avril 2012 (voir le troisième de couverture pour les coordonnées détaillées).

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**Kenneth Allan Neil**

**(1952–2011)**

Kenneth Allan Neil, of Sheffield Mills, Kings County, Nova Scotia, passed away peacefully surrounded by his loving family on 5 July 2011 in Valley Regional Hospital, Kentville, after a courageous battle with cancer. Born on 29 October 1952, in Halifax, he was the son of the late Walter and Dorothy (Flynn) Neil.

Ken's lifelong passion was entomology. As an aspiring entomologist he was actively involved with the Young Linnaeans, a youth group run by Pierre Tashereau at the Nova Scotia Museum. At the Museum he met entomologists such Douglas C. Ferguson, Barry Wright, and Philip S. Ward with whom he remained friends and corresponded throughout his career. Ken maintained a wide circle of contacts with Lepidopterists such as Don Lafontaine at the Canadian National Collection of Insects, with whom he corresponded and exchanged specimens.

He graduated from Dalhousie University in 1975 with a BSc in Biology, followed by studies at Carleton University in Ottawa, before returning to Dalhousie to obtain his PhD in 1981. This was followed by a postdoctoral fellowship at Simon Fraser University in Burnaby, British Columbia. Ken also followed his entomological interests abroad on a number of field collecting expeditions which took him to Guyana, Surinam, Trinidad, Ecuador, and Colombia.

Ken published papers on both Lepidoptera and Coleoptera and described both *Agrotis arenarius* Neil 1983 and *Orgyia leucostigma sablensis* Neil 1979. He had a particular interest in the larvae of Lepidoptera, reared many species, recorded host plant information, and published descriptions of nine species of larvae. Over the years Ken amassed a large personal collection of approximately 15 000 Lepidoptera specimens. There are plans to donate this collection in the future to the Nova Scotia Museum.

For many years Ken worked at the Kentville Research Station on various projects for fruit and vegetable growers. While there he worked particularly closely with Harold B. Specht on biocontrol studies. He also identified marine invertebrates for the Department of Fisheries and Oceans and was a part-time lecturer at St. Mary's University for several years. In later years Ken became interested in Coleoptera and worked on contracts for Acadia University helping to identify saproxylic beetles. He developed a particular interest in tiger beetles and received assistance from the Nova Scotia Museum to better document their distribution in the province, discovering two new species for the Nova Scotian fauna in the process. Ken was also a past employee of Hillaton Foods and Nova-Agri.

He is survived by his wife, Irene (Belliveau) Neil, as well as their children, David, Dartmouth, and Denise (Justin) Longley, Toronto. Also surviving are Ken's brother, William (Joan) of Lower Sackville; his sisters, Cathy (Laurie Browning) Riley, Lumby, British Columbia and Heather (Andre) Belanger, Timberlea; two nephews, two nieces, two great-nephews and one great-niece. Ken's hobby was military modeling and painting miniature figures and he spent many happy hours diligently working on his creations.

Ken continued his research on insects, and wrote online entomological articles until the final stages of his illness. Ken's long-interest in the entomology of Nova Scotia, and his particular love of Lepidoptera, have had an enduring impact on the knowledge of insects of the province. His enthusiasm for collecting moths never flagged over the many years of his activity, and he will be missed by the many entomologists with whom he collaborated and who he assisted over the years.

Christopher Majka, Halifax


## Call for Papers: Perspectives on Arctic Arthropods

*The Canadian Entomologist* has scheduled a themed issue on Perspectives on Arctic Arthropods, to appear early in 2013. *The Canadian Entomologist* has been dedicated to the advancement of research in entomology through its 144 year long history as a leading journal in its field. The journal has published classic papers related to arctic invertebrate biology. A recent partnership with Cambridge University Press is expected to further enhance this journal's visibility and wide audience and this special issue will undoubtedly be the benchmark for future research about Arctic arthropods.

### Background

Arctic and sub-Arctic ecosystems are inherently fragile and under increasing pressure due to human induced environmental changes such as climate change and resource development. It is time to benchmark a new era of research on arthropods in the Arctic and sub-Arctic. This thematic issue of *The Canadian Entomologist* will explore and highlight research on northern arthropods, with circumpolar perspectives from sub- and high-Arctic ecosystems. This thematic issue will be one of the first collections of articles on this topic. We welcome research papers on all aspects of northern arthropods, with potential topics including but not limited to:

The effects of climate change on Arctic arthropods;
The role of arthropods in Arctic food-webs;
The use of arthropods in biodiversity monitoring in northern ecosystems
Life history adaptations of Arctic arthropod species

We are pleased to have two guest editors for this special issue: Professors Toke T. Høye (Aarhus University, Denmark) and Derek Sikes (University of Alaska)

### Submission Guidelines

Original and unpublished high-quality research papers will be considered, and we also welcome ideas for larger reviews on the topic and/or forum papers. Manuscripts must be submitted to the journal at http://mc.manuscriptcentral.com/tce in accordance with our Instructions for Authors, which are available at http://journals.cambridge.org/tce/ifc. You must provide a cover letter indicating that the submission is for the issue on "Perspectives on Arctic Arthropods". If this is not supplied, or if too many/insufficient papers are accepted for a particular theme, they will be published as regular submissions in the journal. All papers will undergo a rigorous peer-review process - that they are part of a themed issue (solicited or not) does not guarantee acceptance. Please contact Editor-in-Chief Professor Christopher Buddle (McGill University) for additional details: chris.buddle@mcgill.ca

### Important Dates

Manuscript submission deadline: 1 June 2012

Publication of themed issue: February 2013 (to be confirmed)


## Appel à soumission: Perspectives sur les arthropodes arctiques

*The Canadian Entomologist* planifie un numéro thématique sur les perspectives sur les arthropodes arctiques, qui paraîtra au début de 2013. *The Canadian Entomologist* s'est dévoué à l'avancement de la recherche en entomologie tout au long de ses 144 années d'histoire en tant que revue importante dans son domaine. La revue a publié des articles classiques concernant la biologie des invertébrés arctiques. Le nouveau partenariat avec Cambridge University Press devrait augmenter davantage la visibilité de la revue et sa large audience, et ce numéro spécial sera sans aucun doute un point de référence pour la recherche future sur les arthropodes arctiques.

### Contexte

Les écosystèmes arctiques et subarctiques possèdent une fragilité inhérente et sont sous pression croissante due aux changements environnementaux causés par l'humain, tels que le changement climatique et le développement des ressources. Il est temps de marquer une nouvelle ère de recherche sur les arthropodes arctiques et subarctiques. Ce numéro thématique de *The Canadian Entomologist* explorera et mettra en valeur la recherche sur les arthropodes nordiques, avec des perspectives circumpolaires des écosystèmes subarctiques et haut-arctiques. Ce numéro thématique sera une des premières collections d'articles sur ce sujet. Nous accueillerons des articles de recherche sur tous les aspects des arthropodes nordiques, avec des sujets potentiels incluant, mais ne se limitant pas à :

Les effets des changements climatiques sur les arthropodes arctiques ;

Le rôle des arthropodes dans les chaînes alimentaires arctiques ;

L'utilisation des arthropodes dans l'évaluation de la biodiversité dans les écosystèmes nordiques ;

L'adaptation de l'histoire de vie des espèces d'arthropodes arctiques.

Nous sommes heureux d'avoir deux éditeurs invités pour ce numéro spécial : Professeurs Toke T. Høye (Université Aarhus, Danemark) et Derek Sikes (Université de l'Alaska).

### Date limite des soumissions

Les articles de recherche originaux et non-publiés de haute qualité seront considérés, et nous accueillerons également les idées de synthèses plus larges sur le sujet et/ou des articles de discussion (type forum). Les manuscrits doivent être soumis à la revue à http://mc.manuscriptcentral.com/tce en accord avec les directives aux auteurs qui sont disponibles sur http://journals.cambridge.org/tce/ifc. Vous devrez fournir une lettre de présentation indiquant que la soumission est pour le numéro sur les «Perspectives sur les arthropodes arctiques ». Si cette lettre n'est pas fournie, ou si un nombre trop grand ou insuffisant d'articles sont acceptés sur un thème particulier, ils seront publiés en tant que soumission régulière pour la revue. Tous les articles subiront un processus d'évaluation par les pairs rigoureux – qu'ils fassent partie d'un numéro thématique (sollicité ou non) n'en garantit pas l'acceptation. Merci de contacter le rédacteur en chef Professeur Christopher Buddle (Université McGill) pour plus de détails: chris.buddle@mcgill.ca

### Dates importantes

Date limite de soumission des manuscrits : 1 juin 2012

Publication du numéro thématique : février 2013 (à confirmer)

## Eighth Annual Photo Contest

The Eighth Annual Photo Contest to select images for the 2013 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*. Winning photographs, and a selection of all entries, will be exhibited on the website.

There is no cash award for the winners, but photographers will be acknowledged in each issue the photos are printed.

Submission deadline is **31 July 2012**. 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

## Huitième concours annuel de photographie

Le huitième 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 en 2013 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 et des gros plans, ainsi que des activités associées à la physiologie, au comportement, à la taxonomie ou à la lutte intégrées 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 acceptés. 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'auteurs.

Le participant conserve les droits d'auteur de la photo, mais l'utilisation libre de droits doit être accordées 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*. Les photographies gagnantes et une sélection de toutes les soumissions seront affichées sur le site Internet.

Il n'y a aucune récompense financière pour les gagnants, mais les photographes seront remerciés dans chaque numéro où les photos seront imprimées.

La date limite de soumission est le **31 juillet 2012**. Les soumissions doivent être faites en pièces jointes d'un courrier électronique. L'objet du message doit débuter par « Soumission pour le concours de photographies de la SEC ». Envoyez vos courriels à : photocontest@esc-sec.ca

## JAM 2011 – Many thanks to the volunteers!

The Entomological Society of Canada, Acadian Entomological Society, and the Organizing Committee of the 2011 Joint Annual Meeting would like to thank the many volunteers who worked very hard make JAM 2011 a success!

*Volunteers:*

Colin MacKay
Kevin Reeh
Amal De Silva
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Justin Renkema
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Lindsay May
Julien Saguez

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## MSc/PhD Fellowship available: Community ecology - Brown spruce longhorn beetle

The University of New Brunswick (UNB) in Fredericton and the Canadian Forest Service (CFS) laboratories in Fredericton and Quebec City are seeking a MSc or PhD student whose research will evaluate the impact of biotic (i.e., trophic interactions) and abiotic (i.e., climatic) factors that drive the population dynamics of exotic forest insects. Using the exotic brown spruce longhorn beetle as a model system, the student will examine the patterns and processes that explain why some alien forest insect species become invasive.

The student will pursue course work at UNB, Fredericton, New Brunswick's capital city. Fredericton is home to a large and vibrant research community at the university and in several federal research labs. Research activities will be based out of the quarantine laboratories of the Canadian Forest Service in Fredericton. Field work will be conducted in infested red spruce forests in Nova Scotia. The supervisory committee will consist of Dr Deepa Pureswaran (CFS-Quebec), Dr Steve Heard (UNB) and Dr Jon Sweeney (CFS-Fredericton).

Candidates will be chosen based on the excellence of their academic credentials.

The fellowships will be each of a minimum of $19,000 per year (before tuition and fees) for 3 years (Summer or Fall 2012 to Fall 2015). Students already holding or who are intending to hold other scholarships are encouraged to apply. Please consult the following page for admission requirements: http://www.unb.ca/fredericton/science/biology/Degree_Info/Graduate.html

Information on our research programs can be found at:
http://www.unb.ca/fredericton/science/biology/Faculty/Heard.html
http://cfs.nrcan.gc.ca/employees/read/dpureswa
http://cfs.nrcan.gc.ca/employees/read/jsweeney

For more information contact Deepa Pureswaran (dpureswa@rncan.gc.ca) or Steve Heard (stephen.heard@unb.ca).

## Graduate opportunities in agricultural entomology and chemical ecology

ACADIA UNIVERSITY

We are currently seeking motivated graduate students (MSc) to conduct research in the areas listed below.

### General Qualifications

Successful candidates will be highly motivated and have a keen interest in chemical ecology, entomology, and integrated pest management. They will be able to work well independently and with a team, and have a good suite of communication and interpersonal skills. Applicants must hold a BSc in biology or a related discipline and meet requirements for admission as a graduate student to Acadia University. Experience in entomology, chemistry or neuroscience would be an asset but not required. Please refer to the following websites for additional information:

http://www.acadiau.ca/reg/admissionsNEWSITE/gradPrograms.htm#appInformation
http://gradstudies.acadiau.ca/
http://biology.acadiau.ca/home.html

For more information, please contact Dr Kirk Hillier:

Dr Kirk Hillier
Biology, Acadia University
902-585-1314
kirk.hillier@acadiau.ca , http://www.acadiau.ca/~khillier

### Graduate assistantship in agricultural entomology and chemical ecology of *Delia* maggots

*Project Summary:* Development of products for improved monitoring and management of Delia maggots. *Delia* spp. maggots (i.e., cabbage root maggot, turnip root maggot) are some of the most devastating groups of insects on these cruciferous crops. These pests are cosmopolitan and can be found throughout the Northern Hemisphere. Larvae damage cabbage, turnip, radish, swede, and several other cruciferous crops. Because the larvae of these insects are found within the roots of plants, they can be difficult to target using insecticides or to detect using standard techniques. By using chemically-attractive lures, it may be possible to more accurately monitor for adults of these flies.

We are seeking a motivated graduate student for the development and improvement of semiochemically- based monitoring tools for managing *Delia* maggots in Atlantic Canada. The objectives of this work are to: (1) evaluate improved technology for monitoring tools for *Delia* spp. based on attractive host plant volatile compounds; (2) examine mitigation tools using combined attractant-lures with spore-delivery traps; and (3) develop a prototype trapping system to improve efficacy of monitoring and control.

Research will be conducted collaboratively between the Dixon laboratory at the Atlantic Cool Climate Crop Research Centre, St. John's, Newfoundland, and the Hillier lab at Acadia University. Ideally, field research would be conducted largely in Newfoundland between May and August, with laboratory studies conducted at Acadia University between September and April.

*Start date and stipend*:

Start date will be September 2012 or May 2013, pending funding approval. Funding will comprise a combination of research support and a teaching assistantship, and students are encouraged to apply for additional funding and scholarships.

For more information, please contact Dr Kirk Hillier (details above).

### Graduate assistantship in chemical ecology and pest management of bollworm pests

*Project Summary:* We are seeking a highly motivated MSc student to investigate "PUSH-PULL" integration of inhibitory pheromones with sentinel plants for management of Heliothine moths.

1) *The "PUSH"*: Heliothine moths represent multi-billion dollar crop pests. We will test a combination of novel male-produced inhibitory pheromones and sentinel plants to passively monitor and control these insects. Our lab's research has documented the behavioural and physiological effects of male-produced courtship pheromones which inhibit flight in bollworm moths (Heliothinae). Under natural conditions, this aids a courting male by inhibiting females from moving away during mating and also inhibits other males from approaching during a courtship encounter. We will develop this as an affordable, non-toxic mechanism for repelling insects from high value crops.

2) *The "PULL"*: Bollworms are devastating, cosmopolitan, and highly polyphagous pesta that exhibit a range of preference in their host plant species. Through oviposition host choice tests, we will identify a hierarchical series of preferred plants (i.e., sentinels) which may function as 'PULL' targets for corn earworm, *Helicoverpa zea*.

3) *Integration*: We will identify the best combination of courtship pheromone application technology (PUSH) and prospective plants to function as sentinels (PULL) which reduced crop infestation.

The successful candidate will have an opportunity to integrate elements of electrophysiology, organic chemistry, field biology, and greenhouse and laboratory studies.

*Start date and stipend*:

Start date will be May 2012, pending funding approval. Funding will comprise a combination of research support and a teaching assistantship, and students are encouraged to apply for additional funding and scholarships.

For more information, please contact Dr Kirk Hillier (details above).

## A winter wonderland (beneath the snow!)

**(continued from page 60)**

throughout the cold weather.

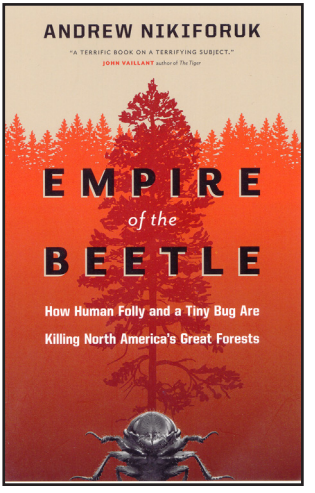
What remains unclear at this juncture, however, is just what advantages accrue to bugs that are winter-active, compared to their hibernating cousins. According to Dave Walter, populations of some mite species comprise both adults and juveniles, and food is present in the gut of individuals, indicating that they are feeding and breeding despite the near-freezing conditions. Thus, like the ESC Board, some sub-niveal arthropod societies conduct their affairs through the winter. However, I can state with confidence that, unlike these arthropods, there is no aestivation for board members when summer comes around!

## Un pays des merveilles hivernal (sous la neige!)

**(suite de la page 60)**

des juvéniles, et la nourriture est présente dans l'intestin des individus, indiquant qu'ils se nourrissent et se reproduisent malgré les conditions de presque congélation. Ainsi, tout comme le conseil d'administration de la SEC, certaines sociétés d'arthropodes subnivaux mènent leurs affaires durant l'hiver. Cependant, je peux affirmer avec confiance que, contrairement à ces arthropodes, il n'y a pas d'estivation pour les membres du conseil d'administration lorsque l'été arrive!

***Empire of the Beetle: How human folly and a tiny bug are killing North America's Great Forests.***
Nikiforuk, A. 2011. Greystone Books, D & M Publishers Inc., Vancouver/Toronto/Berkeley, co-published with the David Suzuki Foundation, 230 pp. (paperback). $19.95. ISBN 978-1-55365-510-7.




This book is about the pine beetles that have focused their formidable energies to wreak havoc in North America's vast conifer forests in recent decades. It is written by the award winning Canadian journalist Andrew Nikiforuk, noted for his writing on politically-charged environmental topics. Although the book is a critique of how human activities have missed the point in dealing with these voracious insects, it also provides an enlightening history of pine beetle cycles and a fascinating summary of the very complex biology of these beetles. It is also about climate change. Throughout, authorities are cited and their words and work are used to build a case for society to take heed.

The book begins with a prologue recounting the 1870s story of the Rocky Mountain locust, *Melanoplus spretus* Stål. Once darkening the skies and devastating the vegetation on the prairies, it suddenly disappeared from the face of the earth due to catastrophic modifications to its native grassland habitat by human agricultural activity. Fast forward 100 years to the explosion of pine beetles in the Pacific Northwest and the devastation of the highly valued conifer forests. The difference is that human manipulation of pine beetle habitats has resulted in even greater loss of our forests rather than the extinction of the causative agent.

Chapter 1 gives an historical account of the first 'modern' spruce bark beetle, *Dendroctonus rufipennis* Kirby, outbreaks in Alaska that left millions of dead trees on private and public lands. Removing the unsightly and fire hazardous trees was a priority of individuals and governments. Meanwhile, scientists were learning how these beetles were adapting to changing environmental conditions, that there had been periodic outbreaks through history, and that accepted harvesting practices improved the survival of the spruce bark beetle.

The next chapter provides details on: the diversity of bark beetles ─ "1430 species in North and Central America"; the other organisms associated with them ─ up to 10 fungal species, 6 mites and 9 bacteria are associated with the spruce bark beetle; the complex relationships between bark beetles and this baggage ─ fungi are cultivated as a food source, mites carry blue stain fungus which is beneficial to them but toxic to the bark beetles and mildly so to the tree; and the conflict between the bark beetles and their tree hosts ─ sticky resin can smother beetles and the trees release terpenes (30+ types) which can gas the beetles. A description follows of how bark beetles select hosts (weaker trees produce less resin and fewer terpenes), overwhelm a targeted tree (600 mature mountain pine beetles can kill a mature lodgepole pine, it takes >2,000 southern pine beetles to kill a loblolly pine), use chemicals to attract and regulate the numbers of attacking beetles, and how the attacked tree attempts to fight the invasions (ramping up toxicity of its chemical defences by orders of magnitude, killing tissue around invading beetles).

Chapters 3 and 4 detail the mountain pine beetle, *Dendroctonus ponderosae* Hopkins, outbreaks that started in British Columbia and have become a major crisis in Canadian forests, and the multi-billion-dollar response, learned from European experiences. Many experiments were conducted over the last 100 years to find controls for pine beetles. Efforts to save infested

trees, remove fire hazards, and clear-cut infested areas had no impact, the beetle populations just kept building. The mountain pine beetle finally breached the Rocky Mountain barrier and now threatens much of Canada's boreal forests. It is argued that politically-based rather than biologically-based decisions were the cause of this catastrophe. In the end the outbreaks ran their course, beetle populations declined, and a more diverse forest was left behind.

The aftermath is described in Chapter 5. Clear cutting has devastated regions and changed whole watersheds, but profits were good! Communities of people left behind as the mills shut down have attempted to adapt, by developing new industries such as wood pellets, although very high input costs have it struggling to survive. There is always a silver lining, however small: blue-stained beetle wood or "denim pine", worked into urns, boxes, benches, dog food trays, houses, and other "beetle-wood memorabilia". There is even the hope that a better understanding of natural cycles has been achieved.

The mountain pine beetle assault on whitebark pine, a symbol of endurance, is next. The biology of this remarkable species is described, its survival despite infection by the Asian white pine blister rust, and its importance in the web of life. Climate-change models predicted the destruction of the whitebark pine by the mountain pine beetle before it began. Sadly, all things associated with the whitebark pine are also in decline.

Pinyon pines are the subject of Chapter 7. Drought in the U.S. southwest led to the outbreak of pinyon engraver, *Ips confusus* (LeConte). During this period the use of sound by engraver beetles was uncovered as a means through which the beetles find hosts (the drying pitch 'pops') as well as a way to regulate densities within a host (beetle chirping intensity elicits different behaviours, some fatal to conspecifics).

The next chapter is all about the great diversity of beetles and how they influence life, eating our crops and moving our poop, and how they can change our society. For example, the boll weevil, *Anthonomus grandis* Boheman, outbreak in Alabama resulted in the return of crop diversity to farming in that region.

Chapter 9 is about how climate change can affect even the fungi associated with bark beetles. *Grosmannia calvigera* (Robinson-Jeffrey and Davidson) and *Ophiostoma montium* (Rumbold von Arx) are important food for bark beetles which preferentially feed on them when temperatures are lower or higher, respectively, than 22°C. Temperature changes due to climate change could result in the loss of the fungi and elimination of the bark beetles, with consequences for the natural recycling of trees. It is argued that a new approach to thinking about the natural world is needed and humans need to reconnect with it.

The book concludes with a comparison between the pine beetle and the eastern spruce budworm, *Choristoneura fumiferana* Lederer. The importance of understanding population cycles, the complexities that influence them, and the role of ecosystem robustness in resisting dramatic changes are the messages. It ends with a final warning that by ignoring the natural world humans are setting themselves up for things unforseen.

For entomologists this is a useful summary of bark beetle biology, the history of their population cycles and management attempts, and the consequences of failing to work with them to maintain the health of our forests. The climate change theme is topical and the examples treated lend strong support to the need for action. It is disappointing that the excellent research contributions over many years by some of our outstanding colleagues (Les Safranyik and John Borden are two) are not given the credit that they deserve. However, the book is still a great read at a bargain price!

Peter Mason, Research Scientist
Agriculture and Agri-Food Canada
Ottawa

## Books available for review

The ESC frequently receives unsolicited books for review. A list of these books is available online (http://www.esc-sec.ca/bulletinbooks.html) 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 (Kevin Floate, Kevin.Floate@agr.gc.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.

## Livres disponibles pour critique

La SEC reçoit fréquemment des livres non demandés pour des critiques. Une liste de ces livres est disponible en ligne (http://www.esc-sec.ca/fr/f-bulletinbooks.html) 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 (Kevin Floate, Kevin.Floate@agr.gc.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 there are no books available for review / Il n'y a présentement aucun livre disponible pour des critiques**

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http://www.entsocont.ca

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## Acadian Entomological Society

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Fredericton, NB, E3B 5P7
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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.*

## *Bulletin of the Entomological Society of Canada*

Editor: Cedric Gillott
Assistant Editor: Julia Mlynarek

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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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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**Submission deadline for the next issue: 30 April 2012**


## *Bulletin de la Société d'entomologie du Canada*

Rédacteur: Cedric Gillott
Rédactrice adjointe: Julia Mlynarek

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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**Date de tombée pour le prochain numéro: 30 avril 2012**

# The last word / Le dernier mot

**Cedric Gillott, Editor / Rédacteur**

## A winter wonderland (beneath the snow!)

In a strange twist, shortly after reading President Cusson's message that, unlike many of their research subjects, those charged with running the Society would not be entering diapause this winter, I heard of the Alberta Bugs group that is documenting the arthropods which also remain active during the Alberta winter. So far, the group has counted >130 species, including many spiders and mites, though the list contains many that are 'active by accident', for example, ladybird beetles and flies that have found their way indoors, aphids (on house plants), and mites living in the soil around potted indoor plants.

But of particular interest to the group are sub-nivean bugs, that is, those arthropods that live at the interface of the snow and soil/leaf litter and remain active through the Canadian winter. Snow is, of course, an excellent insulator. Studies done by the Saskatchewan Research Council many years ago showed that a snow depth of 10 or more centimetres resulted in sub-niveal temperatures around the freezing point, even when the ambient air temperature was many degrees below zero. Latent heat escaping from the soil melts the snow above to a depth of a few centimetres, providing an air space that enables a wide range of animals, both vertebrate and invertebrate, to be active

**(continued on page 54)**

## Un pays des merveilles hivernal (sous la neige!)

Étrangement, peu de temps après avoir lu le message du Président Cusson disant que, contrairement au sujet de recherche de plusieurs d'entre eux, les gens en charge de faire rouler la Société n'entreraient pas en diapause cet hiver, j'ai eu des nouvelles du groupe Alberta Bugs qui documente les arthropodes qui restent actifs durant l'hiver en Alberta. Jusqu'à maintenant, le groupe a compté >130 espèces, incluant plusieurs araignées et acariens, bien que la liste comporte plusieurs étant « actifs par accident », par exemple les coccinelles ou les mouches qui se sont infiltrées à l'intérieur, les pucerons (sur les plantes d'intérieur) et les acariens qui vivent dans le sol autour des plantes en pot à l'intérieur.

Mais ceux qui sont d'un intérêt particulier au groupe sont les arthropodes subnivaux, c'est-à-dire les arthropodes qui vivent à l'interface entre la neige et le sol/la litière et demeurent actifs durant l'hiver canadien. La neige est, évidemment, un excellent isolant. Des études menées par le Conseil de Recherche de Saskatchewan il y a plusieurs années ont montré qu'une épaisseur de neige de 10 cm ou plus amenait des températures subnivales autour du point de congélation, même lorsque la température ambiante était de plusieurs degrés sous zéro. La chaleur latente qui s'échappe du sol fait fondre la neige au-dessus de quelques centimètres, fournissant un espace d'air qui permet à une large gamme d'animaux, autant des vertébrés que des invertébrés, d'être actifs durant les temps froids.

Ce qui reste moins clair à cette jonction, cependant, ce sont les avantages que possèdent les arthropodes qui sont actifs l'hiver en comparaison à leurs cousins qui hibernent. Selon Dave Walter, les populations de certaines espèces d'acariens comprend des adultes et

**(suite à la page 54)**

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# Société d'entomologie du Canada, 2011-2012

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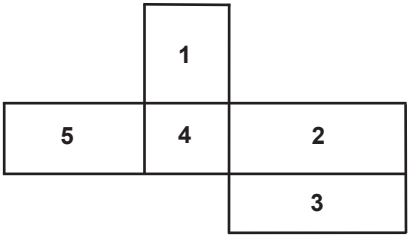


## Images

**On the spine:** A rarely observed robber fly, *Ommatius bromleyi* Pritchard (Diptera: Asilidae). Guadaloupe Canyon, Arizona. Photo: S.A. Marshall

**Beneath the title:** Larva of a human botfly, *Dermatobia hominis* (Linnaeus, Jr.) (Diptera: Oestridae), excised from under the skin of a host, Costa Rica. Photo: W.B. Strong

**1** A bee fly, *Bombylius aurifer* Osten Sacken (Diptera: Bombyliidae), wing-fanning on a leaf, Vernon, British Colombia. Photo: W.B. Strong

**2** The Manual of Nearctic Diptera coordinators with German dipterist Willi Hennig, during his visit to the Diptera Unit of the Canadian National Collection of Insects (Ottawa) in fall of 1967. Back, left to right: Frank McAlpine, Herb Teskey, Guy Shewell; front, left to right: Monty Wood, Dick Vockeroth, Bobbie Peterson, Willi Hennig. Photo: Unknown

**3** A soldier fly, *Caloparyphus decemmaculatus* (Osten Sacken) (Diptera: Stratiomyidae), New Mexico. Photo: S.A. Marshall

**4** Head of Narcissus bulb fly, *Merodon equestris* (F.) (Diptera: Syrphidae), a species introduced to North America from Europe. Vernon, British Colombia. Photo: W.B. Strong

**5** Courting/mating long-legged flies, *Dolichopus* Latreille (Diptera: Dolichopodidae), Copetown Bog, Wentworth Co., Ontario. Photo: S.A. Marshall.

**Back cover:** A soldier fly, *Odontamyia cincta* Olivier (Diptera: Stratiomyidae), near Elk Island National Park, Alberta. Photo: H.C. Proctor.

Français à l'intérieur de la couverture avant.

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