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Captions for cover photos can be found on the back cover.
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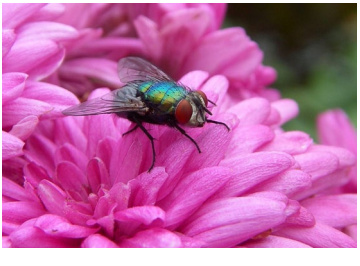


Calliphoridae (Diptera), Oyama, BC. Sitting on a bright chrysanthemum, this blow fly seems to be making up in aesthetics what it lacks in personal hygiene. Photo: Ward Strong

Calliphoridé (Diptère), Oyama, C.-B. Posée sur un chrysanthème coloré, cette mouche semble compenser ses lacunes en hygiène personnelle par l'esthétique. Photo : Ward Strong.

Up front / Avant-propos

Terry Wheeler, President of ESC / Président de la SEC

Pathways

Like many scientists, I wear a variety of labels: entomologist, taxonomist, ecologist, professor, naturalist, and more. Each of those labels has perceptions associated with it, especially, I think, "entomologist". When many people think of an entomologist, I suspect they have an image of an insect-obsessed kid, chasing down interesting beetles or butterflies to add to her collection, building a long-lasting interest in the mysteries of arthropods. That image is as often wrong as it is right.

Although many entomologists did have that childhood passion for insects, and remember fondly their first collection, many others got here by different paths. Some got here through a passion for insect natural history or photography, others because of an interest in arthropods as disease vectors, or crop pests, or pollinators, or as iconic model organisms in genetics. Other people study arthropods because they are ideal organisms for addressing questions about ecology or evolution, behavior or physiology. I, myself, had no particular interest in insects as a kid. Entomology came later for me, only after I started university and had the good fortune to take courses with some inspiring and enthusiastic entomologists. Many different paths led us here, to our common interests in

Chemins

Comme beaucoup de scientifiques, je porte plusieurs chapeaux : entomologiste, taxonomiste, écologiste, professeur, naturaliste, et plus encore. Chacun de ces chapeaux est accompagné de perceptions, particulièrement, je pense, celui d'entomologiste. Lorsque les gens pensent à un entomologiste, je suspecte qu'ils ont pour la plupart l'image d'un gamin obsédé par les insectes, chassant les scarabées ou papillons intéressants et les ajoutant à sa collection, développant un intérêt à long terme pour le mystère des arthropodes. Cette image est aussi souvent erronée que vraie.

Bien que plusieurs entomologistes aient eu une passion d'enfance pour les insectes et se rappellent leur première collection, plusieurs autres ont eu un parcours différent. Certains sont arrivés ici via une passion pour l'histoire naturelle ou la photographie d'insectes, d'autres à cause d'un intérêt pour les arthropodes en tant que vecteurs de maladies, ravageurs des cultures, pollinisateurs, ou organismes modèles pour la génétique. D'autres encore étudient les arthropodes parce qu'ils sont des organismes idéaux pour poser certaines questions sur l'écologie ou l'évolution, le comportement ou la physiologie. Personnellement, je n'avais aucun intérêt particulier pour les insectes quand j'étais enfant. L'entomologie est arrivée plus tard pour moi, seulement après avoir commencé l'université et avoir eu la chance de prendre des cours avec des entomologistes inspirants et enthousiastes. Plusieurs parcours nous mènent ici, à notre intérêt commun pour les insectes. Et tous ces parcours sont fascinants. Je pense parfois à cela lors que je suis dans une session particulièrement diversifiée de présentations dans une conférence, me demandant ce qui a mené chacun des présentateurs à leur place actuelle dans la grande communauté des entomologistes.

insects. And all those paths are fascinating ones. I sometimes think about this when I sit in on an especially diverse session of talks at a conference, wondering what led each of the speakers to their current place in the big community of entomologists.

If those speakers are students or post-docs, I also wonder where they're headed next in their careers. Because, just as many paths lead into studying entomology, many paths lead out.

As a university professor, I train undergraduate and graduate students in entomology. A few of the students who have gone through my lab are professors today. But my former students are also federal research scientists and technicians, provincial wildlife biologists, teachers, employees of private companies, and more. They're all successful, and I'm proud of all of them. It's sometimes too easy for academia to focus on the "traditional" academic progression through graduate school to postdoctoral experience and on to a tenure-track position. There is a lot of discussion now about so-called "alt-academic" careers — routes beyond graduate school that don't involve academic positions. This discussion may be happening more easily in entomology than in some disciplines; we have a tradition of promoting and valuing alt-academic careers, partly because of long-established connections between applied entomology and fundamental research that often span universities, government agencies, private companies, NGOs, and more. That history of connections is valuable, for us and for our students.

At a time when universities are training more graduate students than there are tenure-track jobs, we, in academia, have a responsibility to be aware that we aren't just training more copies of ourselves. We should be preparing students for a wide range of possible futures in entomology. Unfortunately, we don't always do that very effectively. Academia sometimes still measures success by a small set of criteria: refereed journal papers, size of grants, number of graduate students trained, how many of them went onto "good" (read: "academic")

Lorsque ces présentateurs sont étudiants ou post-docs, je me demande également où ils iront pour la suite de leur carrière. Parce que, tout comme plusieurs parcours amènent à étudier l'entomologie, plusieurs parcours s'en éloignent. En tant que professeur universitaire, je forme des étudiants au premier cycle et aux cycles supérieurs en entomologie. Quelques-uns des étudiants qui sont passés par mon labo sont aujourd'hui professeurs. Mais mes anciens étudiants sont aussi des chercheurs scientifiques et techniciens fédéraux, des biologistes provinciaux de la faune, des professeurs, employés de compagnies privées, et plus. Ils ont tous réussis, et je suis fier de chacun d'eux. Il est parfois trop facile pour les universitaires de se concentrer sur la progression académique « traditionnelle » via les études graduées puis l'expérience postdoctorale, pour ensuite aller vers un poste de titulaire. Il y a beaucoup de discussion sur les carrières non-universitaires – ces chemins après les études graduées qui n'impliquent pas de postes universitaires. Cette discussion est peut-être plus présente en entomologie que dans certaines autres disciplines : nous avons une tradition de promotion et de valorisation des carrières non-universitaires, partiellement à cause des liens de longue durée entre l'entomologie appliquée et la recherche fondamentale qui englobent souvent les universités, agences gouvernementales, compagnies privés, ONG et plus. Cette histoire de liens a une grande valeur, pour nous et nos étudiants.

À un moment où les universités forment plus d'étudiants gradués qu'il n'y a de postes titulaires, nous, à l'université, avons une responsabilité d'être conscients que nous ne formons pas simplement davantage de copies de nous-mêmes. Nous devrions préparer nos étudiants pour une vaste gamme de futurs possibles en entomologie. Malheureusement, nous ne le faisons pas toujours de façon efficace. Le monde universitaire mesure parfois le succès selon un petit nombre de critères : les articles dans des revues indexées, la taille des subventions, le nombre d'étudiants gradués formés, le nombre d'entre eux qui ont eu de

jobs. Those criteria are easy to count, but they're also extremely limiting. Many of my students don't want to be professors, and it would be unfair of me to try to steer them in that direction. Fortunately, there are many career options for those with an interest in arthropods. Part of our duty as professors, supervisors, mentors, and colleagues should be to make sure our students are aware of those options. Our connections with colleagues in government, industry, science communication and other domains are a rich source of advice about possible futures. I'm pleased to see conference organizers putting more emphasis on a wide range of job-search and career planning skills for students and early career people in recent years. We could and should do more. We should take advantage of opportunities to have our students visit labs outside the walls of academia. We should value outreach, teaching, and science communication in all its forms as highly as we value a journal paper (depending, of course, on where our students see their career heading). And we should remind each other every now and then to keep our skill sets broad and keep those options open. I didn't end up where I thought I would. Neither will many of our students.

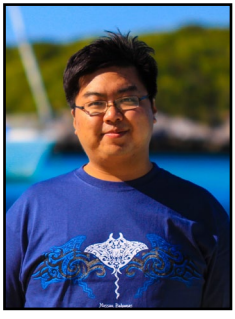
The entomological community is a lot like a big train station. Many tracks lead in, and many lead out. Although we're all milling around on the platforms, sharing stories, planning trips together, grabbing a coffee if we have time, we have to be careful not to assume that we all came in on, or are leaving on, the same train. Maybe it's those journeys that happen before and after the station that make it such a vibrant place.

« bons » (lire : « universitaires ») emplois. Ces critères sont faciles à mesurer, mais ils sont aussi extrêmement limitants. Plusieurs de mes étudiants ne veulent pas devenir professeurs, et il serait injuste de ma part d'essayer de les diriger dans cette direction. Heureusement, il y de nombreuses options de carrière pour ceux qui ont un intérêt pour les arthropodes. Une de nos tâches comme professeurs, superviseurs, mentors, et collègues, devrait être de nous assurer que nos étudiants sont conscients de ces options. Nos liens avec nos collègues au gouvernement, dans l'industrie, en communication scientifique et d'autres domaines sont une source riche de conseils pour de possibles futurs. Je suis ravi de voir que les organisateurs de conférences ont mis plus d'emphase sur les compétences en recherche d'emploi et planification de carrière pour les étudiants et les gens en début de carrière dans les dernières années. Nous pourrions et devrions faire plus. Nous devrions saisir les opportunités pour nos étudiants de visiter des labos à l'extérieur du monde universitaire. Nous devrions valoriser la diffusion, l'enseignement et la communication de la science sous toutes ses formes autant que nous valorisons un article dans une revue (dépendant, évidemment, de ce que nos étudiants voient pour leur carrière). Et nous devrions nous rappeler les uns les autres, à l'occasion, de garder nos gammes de compétences vastes et de garder ces options ouvertes. Je n'ai pas atterri là où je pensais atterrir. Et plusieurs de nos étudiants seront aussi dans cette situation.

La communauté entomologique ressemble beaucoup à une grande gare de train. Plusieurs voies s'y rendent, et plusieurs en sortent. Bien que nous fourmillions sur les quais, partagions des histoires, planifions des voyages ensemble, buvions un café quand nous avons le temps, nous devons faire attention à ne pas prendre pour acquis que nous sommes tous arrivés ou que nous repartions tous par le même train. Peut-être que ce sont les voyages qui se produisent avant et après la gare qui en font un tel endroit dynamique.

STEP Corner / Le coin de la relève

Joanna Konopka and Miles Zhang



Our new title!

With the addition of early professionals (see below) to our membership, it became necessary to change the title of our quarterly column. We have chosen 'STEP Corner' which, like its predecessor conveys the idea that this is our own bit of space, yet we remain an integral part of the whole membership body. We hope you like it!

Getting involved with SEPAC

The ESC Student Affairs Committee (SAC) has been expanded to represent early professional members and is now the Student and Early Professional Affairs Committee (SEPAC). The Early Professional membership category is open to individuals within 3 years of graduation. We invite student and early professional members to join SEPAC. Volunteering for SEPAC is a great way to get involved with the Society and promote entomology to students across Canada. If you are interested in joining or just have suggestions for new initiatives in the coming year, email us at students@esc-sec.ca

ICE Update

Early Bird Registration

Make sure to complete your **registration for ICE by 25 March 2016** to get an advanced student rate of US$350. More information about registration for ICE can be found here. http://ice2016orlando.org/registration/

Notre nouveau nom!

Avec l'ajout des jeunes professionnels (voir ci-bas) à nos membres, il devenait nécessaire de changer le titre de notre chronique trimestrielle. Nous avons choisi « Le coin de la relève » qui, comme son prédécesseur, véhicule l'idée qu'il s'agit de notre petit espace à nous, tout en étant une partie intégrale de l'ensemble des membres. Nous espérons que vous l'aimerez!

S'impliquer au sein du CAEJP

Le comité des affaires étudiantes (CAE) s'est étendu afin de représenter les membres jeunes professionnels et est maintenant le comité des affaires étudiantes et des jeunes professionnels (CAEJP). La catégorie de membre des jeunes professionnels est ouverte aux individus ayant gradué il y a au plus 3 ans. Nous invitons les membres étudiants et jeunes professionnels de joindre le CAEJP. Être bénévole pour le CAEJP est une excellente façon de s'impliquer auprès de notre Société et de promouvoir l'entomologie auprès des étudiants au Canada. Si vous êtes intéressés à joindre le comité, ou si vous avez des suggestions pour de nouvelles initiatives pour la prochaine année, écrivez-nous sur students@esc-sec.ca.

Mise à jour ICE

Inscriptions hâtives

Assurez-vous de compléter votre **inscription pour l'ICE avant le 25 mars 2016** afin de profiter du tarif étudiant hâtif de 350$US. Plus d'information concernant l'inscription est disponible ici. (http://ice2016orlando.org/registration/)

Inscription d'équipes pour les jeux linnéens globaux

Vous avez participé aux jeux linnéens durant la réunion annuelle SEC-SEQ à Montréal et

Call for Global Linnaean Games Teams

Did you participate in the Linnaean Games during the ESC-SEQ JAM in Montreal and had lots of fun? Do you have lots of entomological knowledge that you want to showcase? Regardless of your answers to the above questions, **consider putting together a team to participate in the *Global Linnaean Games* at the ICE!** Take part in an exciting question-and-answer, college bowl-style competition. Visit the ICE website for more information and to submit a team. The deadline to submit your team is **15 June 2016**. http://ice2016orlando.org/about/student-activities/linnaean-games-details/

Want to participate but don't have a team? Let us know and we will help you put your team together.

ESA STEP Travel Award Winners

Congratulations to all students and early professionals who were successful in the ESA STEP Travel Award Competition. Twenty-seven awards were given out to international student and early professional members. Six awards have been secured by students and early professionals from Canada. The successful Canadian students are Diana Catalina Fernández (University of Lethbridge), Melanie Lalonde (University of Manitoba), Chandra Moffat (University of New Brunswick), Holly Caravan (Memorial University), and Joanna Konopka (Western University), while early professional Joel Gibson (University of Guelph) also received an award.

You can see all the winners and their countries here. http://www.entsoc.org/press-releases/esa-ice-2016-travel-award-winners

Book reviews

This issue's Last Word (p. 30) is a request from the Editor for Society members to become more active in reviewing books. His message is aimed at all members, including students and early professionals. We strongly encourage you to take a look at the list of books available (p. 19) and if something takes your fancy offer to review it! Remember, you get to keep the book (and if you don't want it, you can always put it

vous avez eu beaucoup de plaisir? Avez-vous de grandes connaissances en entomologie que vous voudriez mettre en valeur? Peu importe vos réponses à ces questions, **considérez de réunir une équipe afin de participer aux *Jeux linnéens globaux* à l'ICE**! Prenez part à une compétition de type questions-réponses. Visitez le site Internet de l'ICE pour plus d'information et pour inscrire une équipe. La date limite pour inscrire une équipe est le **15 juin 2016**. http://ice2016orlando.org/about/student-activities/linnaean-games-details/

Gagnants des prix de voyage ESA STEP

Félicitations à tous les étudiants et jeunes professionnels qui ont obtenu les prix de voyage ESA STEP. Vingt-sept prix ont été donnés à des membres internationaux étudiants et jeunes professionnels. Six prix ont été obtenus par des étudiants et jeunes professionnels du Canada. Les étudiants canadiens sont Diana Catalina Fernández (Université de Lethbridge), Melanie Lalonde (Université Memorial), et Joanna Konopka (Université Western), et Joel Gibson (Université de Guelph), jeune professionnel, a aussi obtenu le prix.

Vous pouvez consulter le nom de tous les gagnants et leur pays ici. (http://ice2016orlando.org/about/student-activities/linnaean-games-details/)

Critique de livres

Le Dernier mot de ce numéro (p. 30) est une demande du rédacteur à ce que les membres de la Société soient plus actifs dans la critique de livres. Son message s'adresse à tous les membres, incluant les étudiants et les jeunes professionnels. Nous vous encourageons fortement à regarder la liste de livres disponibles (p. 19) et si quelque chose vous intéresse, critiquez-le! Rappelez-vous que vous pouvez conserver le livre (et si vous ne le voulez pas, vous pourrez toujours le donner pour les enchères silencieuses, collectant ainsi de l'argent pour les bourses étudiantes!).

into the Silent Auction, thereby raising funds for student scholarships!).

Research Roundup

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

We look forward to hearing from you,
Joanna and Miles

Aperçu de la recherche

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

Au plaisir de vous lire,
Joanna et Miles

Thesis Roundup / Foisonnement de thèses

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

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

Hamilton, Phineas. PhD, 2015. Defensive symbiosis in *Drosophila*: from multiple infections to mechanism of defense. Supervisor: Steve Perlman, University of Victoria.

Hanson, Mark. MSc, 2015. Immune evolution in the *immigrans-tripunctata* clade of *Drosophila.* Supervisor: Steve Perlman, University of Victoria.

Hodson, Christina. MSc, 2015. Genomic conflict over reproduction in a booklouse (Psocodea: *Liposcelis*): consequences of a maternally transmitted reproductive manipulator on host ecology and genetics. Supervisor: Steve Perlman, University of Victoria.

What is that water boatman doing on my car?
Insects and polarized light

Adam Blake

A.Blake

Fig. 1. A dead water boatman (*Cenocorixa* sp., Corixidae) photographed on a vehicle roof. This surface reflects highly polarized light. 9 March 2014. Iona Beach Regional Park, Richmond, British Columbia (49°13'6" N, 123°12'49" W).

You might be wondering where Figure 1 was taken and what it has to do with polarized light. The picture shows an unfortunate water boatman that landed on the roof of my car and quickly succumbed to the high temperatures of the sun baked metal. Why would this aquatic insect be landing on a car in the first place? The answer has to do with polarized light.

Just as every ray of light has a specific wavelength, each ray also oscillates in a particular direction perpendicular to its direction of travel (Fig. 2). This direction is known as the axis of polarization and is measured as an angle between 0 and 180°. When the rays of light from a light source are oscillating in different directions, light is said to be unpolarized. Sunlight and the light from most

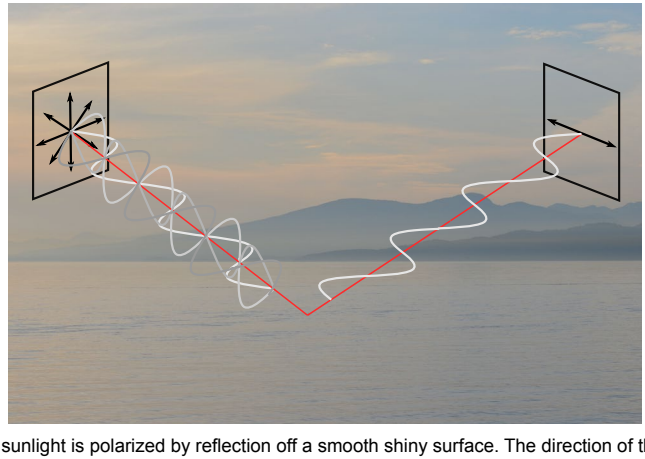


Fig. 2. Unpolarized sunlight is polarized by reflection off a smooth shiny surface. The direction of this polarization is parallel to the reflecting surface. In this case the horizontal surface of the water produces horizontally polarized light. "Figure 2" is a derivative of "Wire-grid-polarizer" (https://en.wikipedia.org/wiki/Polarizer#/media/File:Wire-grid-polarizer.svg) by Bob Mellish (https://en.wikipedia.org/wiki/User:DrBob), used under CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0/). "Polarization by Reflection" is licensed under CC BY-SA 3.0 by Adam Blake.

Adam Blake (adam@ajblake.info) is a PhD candidate at Simon Fraser University studying with Professor Gerhard Gries. His research interests include insect communication, sensory ecology, spatial ecology and plant-insect interactions. The material presented here was part of his talk in the special Lloyd Dosdall Memorial Symposium at the Montreal Joint Annual Meeting (November 2015). He is also an avid (and excellent) photographer (see Bulletin of the Entomological Society of Canada ***47****: 137, or www.ajblake.info for additional examples).*

artificial light sources are unpolarized, at least initially (Johnsen 2012). Polarized light oscillates in only one direction (Fig 2). Most light is a mixture of polarized and unpolarized light and the ratio of the two is measured as a percentage known as the degree of polarization. So how does unpolarized light from the sun and other light sources become polarized? This polarization occurs through two main processes. The first of these is scattering by molecules in air or water (Johnsen 2012). This is the same type of scattering that produces the blue sky. This scattering produces a band of polarized skylight at a 90° angle from the sun. This will become important when we talk about insect navigation. The other mechanism that produces polarized light is mirror-like reflection from smooth shiny surfaces like those on water, glass or leaves (Johnsen 2012; and Fig. 2). After being reflected, this light has an axis of polarization parallel to the reflecting surface.

You can directly observe both of these phenomena using a pair of polarized sunglasses and twisting your head back and forth. These sunglasses and most other polarizing filters work by using parallel sheets of long polymers that better absorb light oscillating parallel to the long axis of the polymers (Johnsen 2012). In sunglasses these polymers are oriented so that they will block horizontally polarized light (axis of polarization of 90°). You can roughly estimate the axis of polarization (Fig. 3 D, H) of light by twisting a polarizing filter to minimize the observed intensity (Fig. 3 A, E). The angle of the filter at this point will be parallel to the axis of polarization. Twisting the filter by 90° should maximize the intensity transmitted (Fig. 3 B, F). By comparing the intensities you can then estimate the degree of polarization (Fig. 3 C, G) with greater differences indicating a larger degree of polarization.

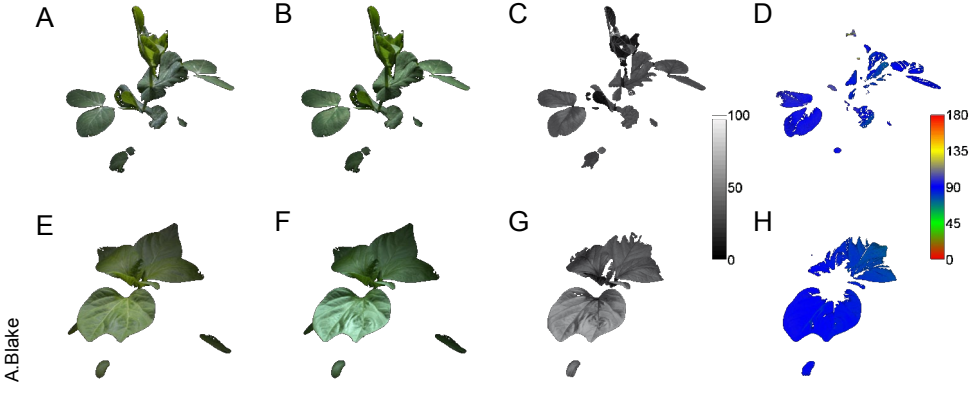


Fig. 3. Images of pea (A-D) and pepper plants (E-F) taken with a polarizing filter oriented to block (A, E; 0°) or transmit (B, F; 90°) the reflection from leaves. The degree of polarization (C, G) is calculated by comparing the intensity of the images on the left (A, B, E, F). Greater differences in intensity and greater degrees of polarization are shown with lighter shades. The axis of polarization (D, H) or the direction of oscillation of the light ray is shown with different colors. In this case horizontal polarization (90°) arises from the relatively horizontally oriented leaves.

The insect visual system, unlike that of vertebrates, is inherently sensitive to polarized light (Horváth & Varjú 2004). Like the polymers in polarized sunglasses, the visual pigments present in both vertebrate and invertebrate photoreceptors better absorb light with an axis of polarization parallel to the long axis of the pigment molecule (Johnsen 2012). What then prevents polarized light sensitivity in vertebrates? It all has to do with the organization and orientation of membranes. Because visual pigments are membrane proteins the pigment molecule can only

rotate in the plane of the membrane. The finger-like microvilli forming the rhabdom of insect photoreceptors constrain the rotation of these pigments resulting in greater absorbance of light with an axis of polarization parallel to the microvilli (Horváth & Varjú 2004). In vertebrates the rotation of pigments is not constrained within microvilli and as a consequence vertebrate photoreceptors are not generally sensitive to polarized light. The predisposition of insect receptors to sensitivity to polarized light may result in impaired color sensitivity as both spectral and polarization sensitivities can affect the response of a photoreceptor, resulting in what is known as polarization induced false colors (Horváth & Varjú 2004). To avoid this, many insects have a gradual twist along their photoreceptor that reduces the overall sensitivity to polarized light (Horváth & Varjú 2004).

How then do insects utilize this sensitivity to polarized light? The most well studied example is navigation using the pattern of polarization in the sky. Many insects have a specialized region at the very top of the compound eye known as the dorsal rim (Labhart & Meyer 1999). This area has photoreceptors that are particularly sensitive to polarized light. By comparing the response both among photoreceptors in the same ommatidium and between adjacent ommatidia, the insect is able to determine direction through the use of a polarization compass (Horváth & Varjú 2004). This has been best studied in honeybees (*Apis mellifera*), desert ants (*Cataglyphis bicolor*), and desert locusts (*Schistocerca gregaria*).

What has been relatively less well studied is the use of polarized sensitivity outside of the dorsal rim. One common use for this sensitivity is the use of horizontally polarized light by a wide variety of aquatic insects as a cue to identify water (Horváth & Varjú 2004). This brings us back to the unfortunate water boatman (Fig. 1). This aquatic insect like many others was attracted to one of many anthropogenic surfaces like vehicles, wet asphalt, glass, black plastic or oil slicks that strongly reflect horizontally polarized light (Horváth et al. 2009). In addition to the direct mortality from landing on hot vehicle surfaces (Fig. 4) or in oil pools, anthropogenic sources of polarized light can have further negative consequences when aquatic insects oviposit on these surfaces (Horváth et al. 2009).

Fig. 4. Insects attracted to the polarized reflection from vehicle surfaces. (C) The hot surface of the vehicle resulted in a substantial mortality of aquatic insects over the course of 1 h. (A) Backswimmer (*Notonecta kirbyi*, Notonectidae). (B & C) Diving beetles (*Dytiscus* sp., Dytiscidae). Nighthawk Road, British Columbia (49°0'4" N, 119°40'16" W).

This brings me to the topic of my PhD thesis, where I am investigating the use of polarized light as an oviposition or foraging cue in phytophagous insects. The idea that phytophagous insects utilize differences in the degree of polarization as a cue to recognize their host plants has been hypothesized (Kelber et al. 2001) but remains untested. If this is in fact the case we expect that (1) there will be variation among plants in their reflection of polarized light, (2) insects will be able to perceive these differences, and finally (3) these differences will affect their host choice. Different plant species have leaf surfaces with different characteristics (e.g., wax, hairs) and these characters create differences in the amount of polarized light they reflect (Grant et al. 1993; and Fig. 2). As mentioned previously, insect visual systems are inherently sensitive to polarized light and for this reason it's possible that a great many insects might be sensitive to polarized light from plants. My current experiments are investigating the third prediction using behavioral bioassays where we manipulate the polarized reflection from plants in an attempt to influence host-plant choice.

In conclusion sources of polarized light are common in both natural and anthropogenic settings and sensitivity to this polarized light seems to be equally common among insects. Something worth considering when pondering navigation, habitation selection, or host selection in insects.

Further Reading

For a more thorough introduction to polarized light I would recommend the chapter on polarization in Johnsen (2012) while Horváth & Varjú (2004) offer an extensive review of polarized light in animal vision.

Acknowledgements

I would like to thank the invaluable contribution of my undergraduate research assistants Samuel Couture & Matthew C. Go; Gerhard Gries, my supervisor; and, as always, my wife Sara who provided both moral and editorial support. The Natural Sciences and Engineering Research Council of Canada (NSERC) - Industrial Research Chair, with Scotts Miracle-Gro Canada as industrial sponsor, supported this research.

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Adaptive egg colouration: not just for the birds

Paul K. Abram

There is a stunning variety in the appearance of animal eggs in terms of their size, shape, external structure, and colouration. Colouration, which can be conferred by pigment molecules or physical structure, is particularly interesting because of the wide range of adaptive roles that it could play during egg development. Most of what is known about the ecological roles of animal egg colouration comes from studies of birds (Figure 1). Functions of bird egg colouration include camouflage, thermoregulation, mimicry of host egg colour by brood parasites, and signaling of mate quality (reviewed in Kilner 2006). Usually, egg colouration is fixed within the lifetime of individual birds, although subtle variations can occur to due nutritional condition or age (Siefferman et al. 2006). Some birds have even been shown to select their laying site based on their eggs' appearance (Lovell et al. 2013); however, there are no known cases of birds that can actually select the colouration of their eggs based on real-time variation in environmental conditions.

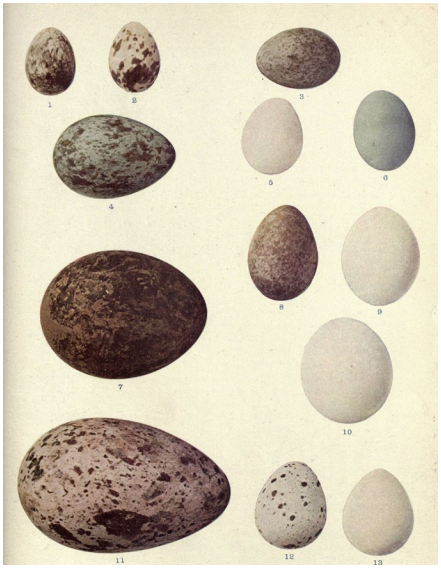

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Figure 1. Examples of egg colour and pattern variation among bird species: 1. Great crested fly-catcher. 2. King bird. 3. Night hawk. 4. Crow. 5. Red-headed woodpecker. 6. Yellow-billed cuckoo. 7. Audubon's caracara. 8. Black-billed magpie. 9. Common kingfisher. 10. Screech owl. 11. Turkey vulture. 12. Gamble's partridge. 13. Bob white quail.

So, we know quite a lot about the ecological functions of egg coloration in birds, but what about insects, the most numerous and diverse group of egg-laying animals? It turns out that not very much is known at all. There are some reports of differently coloured eggs in some species of butterflies (e.g., Daniels et al. 1994), but whether it might serve an adaptive function remains untested. It been suggested that variations in pigment concentrations inside ladybird beetle eggs, which are correlated with concentrations of toxic alkaloid compounds, might serve as an honest warning signal to predators (Winters et al. 2014). It is also known that advancing embryonic development darkens egg contents (Javahery 1994), and that egg colour can change towards the end of the laying sequence of some insects (Wickman and Karlsson 1987); however, it is hard to imagine how these kinds of changes could serve an adaptive function. Clearly, there is a lot of unexplored diversity in the form and function of insect egg colouration ripe for ecological and evolutionary study.

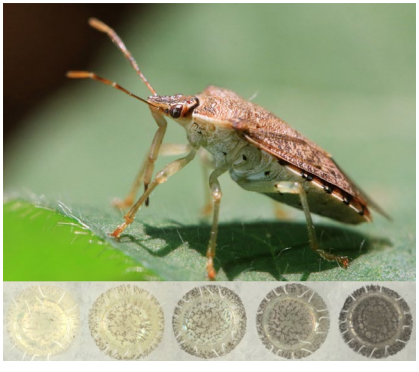
My own interest in insect egg colouration came from a curious observation during my PhD research project, when I was working with *Podisus maculiventris* Say (Hemiptera: Pentatomidae),

Paul Abram (paul-abram@hotmail.com) is a postdoctoral researcher at the Université de Montréal, where he studies the behavioural ecology of stink bugs and their egg parasitoids. *The material presented here was part of his recently completed PhD thesis work, and his Graduate Student Showcase talk at the Montreal Joint Annual Meeting (2015). For more details, see Abram et al. (2015), and the subsequent "dispatch" commentary article, Stevens (2015).*

a predatory stink bug that feeds on a wide variety of insect prey (Figure 2). While collecting eggs from rearing cages, I noticed that their colour ranged from pale yellow to almost black (Figure 3). Egg colour appeared to be determined by different amounts of a dark pigment contained in the outermost layer of the eggshell, with eggshell colour becoming fixed within about 15 minutes after laying and then remaining unchanged over the course of egg development. I began to notice an intriguing correspondence between the darkness of the eggs and the darkness of the substrate where eggs were laid. I wondered: could egg colouration be flexible within individual stink bugs? And, what is the function of the egg pigment? These relatively simple questions ended up leading myself and my colleagues down a twisting, branching path, with a lot of surprises along the way.

A. Brauner

Figure 2. Three *Podisus maculiventris* females feeding on a mealworm (*Telebrio molitor* L.), the prey used to feed our laboratory stink bug colony.



L.Abram, E.Guerra-Grenier, P.Abram

Figure 3. A *Podisus maculiventris* female with the range of egg colours she is capable of laying.

First, we wanted to confirm our informal observations that individual stink bugs could lay different colours of eggs, and that darker-coloured eggs were laid on darker substrates. To test this, we placed individual females in Petri dishes painted white, black, or white on one side and black on the other, and observed what colours of eggs they laid over the course of their lives. It was immediately obvious that individual females could lay the whole range of egg colours. Also, our suspicion that egg colour was correlated with substrate darkness was confirmed; eggs were overall more pigmented in black Petri dishes than in white Petri dishes. The same trend held for individual females laying on the white side *versus* the black side of the half black/half white dishes. There was a surprise, though: far more important than the painting of the Petri dish was where the eggs were laid. Eggs tended to be much more pigmented when laid on the bottom surface of the dish than on the underside of the lid, this being true for individual females as well as at the population level. This result reminded us that the way light passes through materials influencing how dark they appear (in this case, light passing through the petri dish lids from above increasing their reflectance) could be a major factor, leading us to the question: how does this dynamic play itself out on natural laying surfaces?

In the field, *P. maculiventris* females lay their eggs on plant leaves. While leaf surfaces aren't black and white like our Petri dishes, transmitted and reflected light can greatly influence how bright leaf surfaces appear. When light is passing through a leaf from above, the lower leaf surface appears brighter, relative to the amount of light coming up from below. The reverse is

Leslie Abram

Figure 4. To an egg-laying *Podisus maculiventris*, the undersides of leaf surfaces would appear brighter when lit from light passing through from above (left); the tops of leaves would appear darker in relative terms (right)

L. Abram

Figure 5. A dark-coloured *Podisus maculiventris* egg cluster laid on the top of a leaf (top), and a light coloured egg mass laid on the underside of a leaf (bottom) (Photos: Leslie Abram).

true on the tops of leaves (Figure 4). If egg colouration is related to surface brightness, we might expect egg colour to vary with where eggs are laid on leaves. Indeed, when we placed *P. maculiventris* females in cages with soybean plants, eggs laid on leaf tops (about 50% of all eggs laid) were twice as dark as eggs laid on leaf undersides (Figure 5).

Why would eggs need to be more pigmented when laid on leaf tops? We reasoned that it might be to protect developing stink bug embryos against damaging ultraviolet radiation that would otherwise give them a "lethal sunburn". In support of this hypothesis, we found that the more pigmented eggs were, the more likely they were to successfully develop and emerge when developing in the presence of wavelengths and intensities of UV radiation that mimicked the spectral output of the sun. This was an exciting result, since we had convincingly demonstrated a likely ecological function of insect egg colouration. But, as often happens, this only led us to more questions.

First we asked whether eggs themselves were responding to UV radiation (or other, correlated wavelengths of light) by accumulating pigment, as is the case in human skin, for example. We tested this by having female *P. maculiventris* lay on the underside of a white surface, where we knew they would typically lay light-coloured eggs, and then exposing them to different kinds of light from below. Whether we exposed egg-laying females to UV light, filtered UV light, or no light at all from below, we were unable to make them lay dark-coloured eggs. In fact, the only way to produce dark-coloured eggs on the underside of the white surface was to place the whole setup in the dark! So clearly eggs are not simply accumulating pigment in response to light

exposure. Rather, all our results together indicate that female stink bugs are probably controlling the colour of the eggs they lay, based on their visual perception of the ratio of incident light (hitting their dorsal surface) to reflected/transmitted light (coming from the substrate) (Figure 4). This would be a reasonably reliable indirect cue of their eggs' risk of UV radiation exposure during their development (even more so than using ambient UV intensity directly, which would fluctuate widely in time). Right now we can only speculate as to how this might be carried out at a physiological level, but we hypothesize that there is some kind of accessory gland in the stink bugs' reproductive tract that applies pigment precursors to the outside of eggs, and responds in real time to input from the stink bug's visual system.

We also wanted to know what pigment was giving eggs their dark colour and conferring the resulting UV protection. The obvious candidate was melanin, which is responsible for much of the dark pigmentation observed across the animal kingdom, from insects to humans. We did an internet search for melanin biochemists, and found that the two world experts, Drs Shosuke Ito and Kazumasa Wakamatsu, were in Japan. We sent them an out-of-the-blue email asking if they would run biochemical tests on our stink bug eggs to confirm that the pigment was melanin. To our delight, they enthusiastically accepted, and within a few weeks of them receiving the eggs they informed us of a very surprising result: the egg pigment was clearly not melanin. Neither they nor anyone else that we have consulted has any idea what this mystery pigment might be.

In addition to the remaining biochemical and physiological mysteries, we have a lot left to learn about the ecology and evolution of egg colouration in *P. maculiventris*. For example, why would stink bugs lay so many of their eggs on the tops of leaves in the first place, in contrast to most insects, which lay on leaf undersides? If there is indeed some advantage to laying dark-coloured eggs on leaf tops, why continue to lay light-coloured eggs on leaf undersides about half of the time? Do related species of predatory stink bugs have a similar adaptation, or variations on this theme? What are the consequences of egg pigmentation for parasitoids that lay their own eggs inside the stink bug eggs? We have begun to answer some of these questions in field and laboratory experiments, and the story gets even more intriguing as we continue to learn more.

Aside from being a fascinating case of animal adaptation, I think that the still-unfolding story of *P. maculiventris* egg colouration illustrates how relatively simple natural history questions ("Why are that bug's eggs different colours?") can quickly become quite complicated – and a lot of fun to study as a result. I hope that our work will inspire others to look at the functions of egg colouration in other insect species. I think it is likely that the ecological functions of egg colouration in insects, and the evolutionary stories behind them, will turn out to be just as diverse as those in birds. But as entomologists, we have a lot of work to do if we want to catch up – so let's get to it!

Acknowledgements

This work was conducted in collaboration with two fantastic undergraduate researchers, Eric Guerra-Grenier and Marie-Lyne Deprés-Einspenner (Université de Montréal), and a visiting PhD student, Inma Torres-Campos (Instituto de Hortofruticultura Subtropical y Mediterránea "La Mayora", Spain). Josée Doyon provided assistance in the laboratory. My PhD supervisors, Jacques Brodeur (Université de Montréal) and Guy Boivin (Agriculture and Agri-Food Canada), contributed ideas and unconditional support all along the way. Throughout my PhD project, I was supported by an NSERC postgraduate scholarship.

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H. Glenn Wylie (1927 – 2015)

H. Glenn Wylie was born on 15 October 1927 in Wingham, Ontario, and died on 1 December 2015 in Winnipeg, Manitoba. Glenn had a long and productive career specializing in parasitoid biology and the biological control of insect pests. His interest in biology began on the family farm in southwestern Ontario, and in insects as a student assistant at the Canada Department of Agriculture laboratory at Belleville, Ontario, in the summer of 1948. He graduated from the University of Toronto, Honours Zoology, in 1949, and was immediately hired by the Canada Department of Agriculture as a Technical Officer in the Entomology Laboratory at Belleville. From April 1950 Glenn was seconded to the Commonwealth Institute of Biological Control, Feldmeilen, Switzerland, to collaborate in efforts to find biological control agents against the balsam woolly aphid in the Atlantic Provinces. In addition to 6 months at Feldmeilen, Glenn was stationed in the Vosges Mountains of France for the summers of 1950 and 1951. The result of these efforts was "…a list of European predators and detailed information on the biology and life history of each species" (Bulletin of the Entomological Society of Canada **19** [1988]: 91–92). Six aphid predators that he identified were imported to eastern Canada, four of which established successfully.

Instead of the expected return to Canada in fall 1951, Glenn was encouraged to enrol in graduate studies at the University of Oxford. His doctoral thesis, under the guidance of Professor George Varley, described host-finding by the house fly parasitoid, *Nasonia vitripennis* (Walker). Professor Niko Tinbergen had recently arrived at Oxford, and stimulated Glenn's interest in animal behaviour. A condition of Glenn's Department of Agriculture support during his doctoral studies was that he be involved in Varley's research on the winter moth, *Operophtera brumata* (L.). This insect had become a major pest of broad-leafed trees in Nova Scotia, and Glenn was required to spend about 6 weeks each summer in 1952 and 1953 on studies that might lead to its biological control. Because of the workload, Glenn was initially reluctant to take on both thesis research and the winter moth project. Nevertheless, he successfully juggled these two responsibilities and additionally found time to court Jean Mary Hodges. Jean typed Glenn's DPhil thesis, which was submitted in May 1953, and in September 1953 they were married and moved to Belleville. So, from 1950–1953, by his 26th birthday, Glenn completed a major study of the biological control of balsam woolly aphid, completed a DPhil on the behaviour of a housefly parasitoid in 22 months, met and married Jean Hodges, and laid the ground work for biological control of winter moth.

Biological control of the winter moth was Glenn's full-time project from 1954–57. Between 1952 and 1956 over 182,000 winter moth were shipped to Belleville for parasitoid rearing and other studies. Although Glenn made some of the first collections, most were done by European collaborators with visiting entomologists from Belleville to coordinate: Harold Welch in 1954,

This article is also published in the Proceedings of the Entomological Society of Manitoba in an expanded form with citations and bibliography.

Harold and Glenn in 1955, and James McLeod in 1956. Glenn's thorough knowledge of the European literature, and the work at Belleville, resulted in a catalogue of 63 parasitoids of the moth in its native range, and improved understanding of geographic variation in the moth's phenology and population ecology. As early as 1953, Glenn concluded that the tachinid *Cyzenis albicans* (Fallen) and the ichneumonid *Agrypon flaveolatum* (Gravenhorst) were promising candidate biological control agents, and Glenn and Jean, along with Glenn's assistant Leon Chivers, made the first releases of *C. albicans* in Nova Scotia in 1954. Glenn was always quick to acknowledge the assistance of colleagues in Europe and North America, but without Glenn's efforts, the declines in the population of winter moth would not have happened. The two parasitoids recommended by Glenn established quickly and went on to control the damage of winter moth in Nova Scotia and Prince Edward Island. Douglas Embree later documented that the total cost of the research leading to this result was $160,000 and saved, in Nova Scotia alone, a forest resource valued at $12,000,000 (current value $75,000,000). When winter moth was introduced to Victoria, British Columbia, Embree repeated the process, collecting parasites in Nova Scotia, and sending them to Victoria with similar rapid success (Bulletin of the Entomological Society of Canada **45** [2013]: 175–176).

After completion of the winter moth project, Glenn returned to the study of pteromalid parasitoids of muscid flies. First, he published his thesis research on *N. vitripennis*, and followed this with studies of the effect of host age, size and density on this parasitoid. He also investigated the effects of intraspecific and interspecific interactions of pteromalid parasitoids within the same host. An early benefit of this research was its utilization "…by the USDA in developing mass rearing procedures for parasites released in inundative control programmes against house fly and other pest fly species" (Bulletin of the Entomological Society of Canada **19** [1988]: 91). From 1958 to 1979, Glenn published 21 papers reporting on his studies of pteromalid parasitoids and these have been cited more than 700 times. They continue to be important in the field of host-parasitoid interactions, with more than 50 citations since 2009, some 30–60 years after their publication dates.

In 1972, Agriculture Canada transferred Glenn and many of his colleagues at the Belleville laboratory to the Integrated Pest Management Section of the Winnipeg Research Station. In Winnipeg, Glenn quickly developed a research program on the parasites of key pests of oilseed rape or canola, then a rapidly expanding crop in Western Canada with many little known insect pests. With Gordon Bucher, Glenn used field surveys to assess the role of pathogens and parasitoids in the population dynamics of bertha armyworm, *Mamestra configurata* Walker. Glenn went on to document the prevalence and biology of armyworm parasitoids in a series of six papers produced from 1977 to 1979. By 1979 he had begun work on the life history of flea beetles in canola, in preparation for investigating opportunities for their biological control. He initially focussed on the biology of an already active parasitoid *Microctonus vittatae* Muesbeck, and later studied other euphorine braconids including the European *Microctonus bicolor* Wesmael. This work resulted in a series of 10 papers from 1980 to 1985. From 1978 to 1983, the European parasitoid, *Townselitus bicolor* Wesmael was released for biological control of flea beetles, but this species apparently did not establish. By 1985, Glenn was working with his technician and graduate student, Frank Matheson, on the parasitoids of aphids that infest alfalfa and field peas. As part of this program, over 100,000 *Aphidius smithi* Sharma et Subba Rao were released against pea aphid, *Acyrthosiphon pisum* (Harris), between 1983 and 1987; assessments in 2001 indicated that this parasitoid had become established.

Besides his many contributions to biological control of insect pests, Glenn contributed in other ways to entomology. He was a quiet man, not given to self-promotion, but was a valued and willing reviewer and source of expertise and advice for his colleagues. He was Secretary of the Entomological Society of Canada (1982–1984), and chaired the ESC's By-Laws Committee.

For the Entomological Society of Manitoba, Glenn chaired the Annual Meeting Committee and Publicity Committee at various times, and was President of the Society in 1976–1977. Glenn was an Adjunct Professor in the Department of Entomology, University of Manitoba from 1982 to 1988. Reflecting the respect he was given by the entomological community in Canada, he was named an Honorary Member of the Entomological Societies of Canada (1988) and Manitoba (1987).

Glenn retired in January 1987 after 37 years working at Agriculture and Agri-Food Canada. He was an active retiree. He volunteered his time at the Fort Whyte Alive Environmental Education Centre, and was a member of the Friends of the Delta Marsh Research Station. He continued to take an interest in entomologists and entomology and, until shortly before his death, encounters with Glenn and his dog were welcome punctuations for some of his former colleagues on their walk home.

Neil Holliday and Robert Lamb
Winnipeg

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Vane-Wright, D. 2015. Butterflies: A Complete Guide to their Biology and Behavior (2nd Edition). 128 pp.; colour photographs. Cornell University Press. ISBN 9781501700170 [soft cover]

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Williams, P., Thorp, R., Richardson, L., & S. Colla. 2014. Bumble Bees of North America. 208 pp.; 150 colour illus. Princeton University Press. ISBN 9780691152226 [paperback, e-book]

66th Annual Meeting of Members and Board of Directors Meetings

The Annual Meeting of Members of the Entomological Society of Canada will be held at the Orange County Convention Center, Orlando, Florida, at 2:30 pm on Tuesday, 27 September 2016. The Board of Directors Meeting will be held at the Rosen Plaza Hotel, Orlando, Florida, on Saturday, 24 September 2016, from 8:30 to 17:00. The incoming Board of Directors will also meet immediately following the Annual Meeting of Members. Matters for consideration at any of the above meetings should be sent to Alec McClay, Secretary of the ESC (see inside back cover for contact details).

66e assemblée annuelle et réunions du conseil d'administration

L'assemblée annuelle de la société d'entomologie du Canada se tiendra au Orange County Convention Center, Orlando, Floride, à 14:30 le mardi 27 septembre 2016. La réunion du conseil d'administration se tiendra à l'hôtel Rosen Plaza, Orlando, Floride, le samedi 24 septembre 2016 de 8:30 à 17:00. Le nouveau conseil d'administration se réunira également immédiatement après l'assemblée annuelle. Les sujets à aborder pour n'importe laquelle de ces réunions doivent être envoyés à Alec McClay, secrétaire de la SEC (voir le troisième de couverture pour les coordonnées détaillées).

Call for nominations: Societal Director (Second Vice-President), Director at Large

The Society will hold an online ballot to select candidates for a Societal Director and Director at Large. The selected candidates will then be presented as a slate for formal election by members at the Annual Meeting in Orlando in September. Nominations for these positions must be signed by three active members of the Society and be received by the Secretary of the Entomological Society of Canada, Alec McClay, by 30 April 2016 (see inside back cover for contact details).

Appel à candidatures : Directeur sociétal (second vice-président), conseiller

La Société tiendra un vote en ligne afin de sélectionner des candidats pour les postes de directeur sociétal et conseiller. Les candidats sélectionnés seront ensuite présentés comme liste de candidats pour une élection formelle par les membres à la réunion annuelle à Orlando en septembre. Les nominations pour ces postes doivent être signées par trois membres actifs de la Société et être reçues par le secrétaire de la Société d'entomologie du Canada, Alec McClay, au plus tard le 30 avril 2016 (voir le troisième de couverture pour les informations de contact)

ESC Scholarship Fund can now accept donations of capital property

In addition to ESC accepting cash donations to its Scholarship Fund by means of cheque, money order, credit card or PayPal, the Fund is now set up to accept in-kind donations of capital property (such as securities). Simply put, on top of the normal tax credit from the Canada Revenue Agency, the donor also benefits in not having to pay capital gains tax on donated capital property. It should be noted the foregoing information is not tax advice and ESC encourages potential donors to consult a qualified tax advisor to identify income tax considerations that are specific to their situation. For more information please feel free to contact the ESC Treasurer at: christopher.p.dufault(at)gmail.com

Le Fonds pour les bourses de la SEC accepte maintenant des dons d'immobilisations

En plus d'accepter les dons en argent pour son Fonds pour les bourses étudiantes de la SEC par chèque, mandat-poste, carte de crédit ou PayPal, le Fonds est maintenant prêt à recevoir des dons en nature de biens en immobilisation (telles que des valeurs mobilières). Plus simplement, en plus du formulaire régulier d'impôts de l'Agence de revenue du Canada, le donateur bénéficie également en n'ayant pas à payer de l'impôt sur les gains en capital sur le bien en immobilisation donné. Notez que cette dernière information n'est pas un conseil sur les impôts et la SEC encourage les donateurs potentiels à consulter un conseiller en impôt qualifié afin d'identifier les considérations spécifiques à leur situation. Pour plus d'information, n'hésitez pas à contacter le trésorier de la SEC à : christopher.p.dufault(at)gmail.com

Twelfth Annual Photo Contest

The Twelfth Annual Photo Contest to select images for the 2017 covers of *The Canadian Entomologist* and the *Bulletin of the Entomological Society of Canada* is underway. The cover images are intended to represent the breadth of entomology covered by the Society's publications. Insects and non-insects in forestry, urban or agriculture; landscapes, field, laboratory or close-ups; or activities associated with physiology, behaviour, taxonomy or IPM are all desirable. A couple of 'Featured Insects' (for the spine and under the title) are also needed. If selected, your photo will grace the cover of both publications for the entire year. In addition, winning photos and a selection of all submitted photos will be shown on the ESC website.

Contest rules:

- Photos of insects and other arthropods in all stages, activities, and habitats are accepted. To represent the scope of entomological research, we also encourage photos of field plots, laboratory experiments, insect impacts, research activities, sampling equipment, etc. Photos should, however, have a clear entomological focus.
- Digital images must be submitted in unbordered, high-quality JPG format, with the long side (width or height) a minimum of 1500 pixels.
- Entrants may submit up to five photographs. A caption must be provided with each photo submitted; photos without captions will not be accepted. Captions should include the locality, subject identification as closely as is known, description of activity if the main subject is other than an insect, and any interesting or relevant information. Captions should be a maximum of 40 words.
- The entrant must be a member in good standing of the Entomological Society of Canada. Photos must be taken by the entrant, and the entrant must own the copyright.
- The copyright of the photo remains with the entrant, but royalty-free use must be granted to the ESC for inclusion on the cover of one volume (6 issues) of *The Canadian Entomologist*, one volume (4 issues) of the *Bulletin*, and on the ESC website.
- The judging committee will be chosen by the Chair of the Publications Committee of the ESC and will include a member of the Web Content Committee.
- The Photo Contest winners will be announced on the ESC website, and may be announced at the Annual Meeting of the ESC or in the *Bulletin*. There is no cash award for the winners, but photographers will be acknowledged in each issue the photos are printed.
- Submission deadline is 15 August 2016. 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.

D.Giberson

Douzième concours annuel de photographie

Le douzième concours annuel de photographie visant à sélectionner des images pour les couvertures de *The Canadian Entomologist* et du *Bulletin de la Société* d'entomologie du Canada pour 2017 est en cours. Les images sur la couverture doivent représenter l'étendue entomologique couverte par les publications de la Société. Des photos représentant des insectes ou autres arthropodes forestiers, urbains ou agricoles, des paysages, du travail de terrain ou de laboratoire, des gros plans, ainsi que montrant des activités associées à la physiologie, au comportement, à la taxonomie ou à la lutte intégrée seraient souhaitées. Deux « insectes vedettes » (pour le dos et sous le titre) sont également recherchés. Si elle est sélectionnée, votre photo ornera la couverture des deux publications pour l'année entière. De plus, vos photos gagnantes et une sélection de photos soumises seront montrées sur le site Internet de la SEC.

Règlements du concours :

- Les photos d'insectes et autres arthropodes à n'importe quel stade, effectuant n'importe quelle activité et dans n'importe quel habitat sont acceptées. Afin de représenter les sujets de la recherche entomologique, nous encourageons également les photos de parcelles de terrain, expériences de laboratoire, impacts des insectes, activités de recherche, équipement d'échantillonnage, etc. Les photos doivent, cependant, avoir un intérêt entomologique clair.
- Les images numériques doivent être soumises sans bordure, en format JPG de haute qualité, avec le plus grand côté (largeur ou hauteur) d'un minimum de 1500 pixels.
- Chaque participant peut soumettre jusqu'à cinq photographies. Une légende doit être fournie pour chaque photo soumise : les photos sans légendes ne seront pas acceptées. La légende doit inclure la localisation, l'identification du sujet le plus précisément possible, la description de l'activité si le sujet n'est pas un insecte, et toute information intéressante ou pertinente. Les légendes doivent avoir une longueur maximale de 40 mots.
- Les participants doivent être membres en bonne et due forme de la Société d'entomologie du Canada. Les photos doivent avoir été prises par le participant, et le participant doit en posséder les droits d'auteur.
- Le participant conserve les droits d'auteur de la photo, mais l'utilisation libre de droits doit être accordée à la SEC afin de l'inclure sur la couverture d'un volume (6 numéros) de *The Canadian Entomologist*, un volume (4 numéros) du *Bulletin*, et sur le site Internet de la SEC.
- Le comité d'évaluation sera choisi par le président du comité des publications de la SEC et inclura un membre du comité du contenu du site Internet.
- Les gagnants du concours de photographie seront annoncés sur le site Internet de la SEC et pourront être annoncés à la réunion annuelle de la SEC ou dans le *Bulletin*. Il n'y a pas de prix en argent pour les gagnants, mais les photographes seront remerciés dans chaque numéro où les photos seront imprimées.
- La date limite de soumission est le 15 août 2016. Les soumissions doivent être faites en pièces jointes d'un courrier électronique. L'objet du message doit débuter par « Soumission pour le concours de photographie de la SEC ». Envoyez vos courriels à : photocontest@esc-sec.ca.

Letters from Ministers of the new Federal Government

In November 2015 the Society sent a letter to the new Prime Minister and several Ministers of the newly elected Federal Government, expressing concerns about the management of science in the public service (see the December 2015 *Bulletin*, page 175). We have so far received four replies from Ministers, which are reproduced below.

Lettres des Ministres du nouveau gouvernement fédéral

En novembre 2015, la Société a envoyé une lettre au nouveau Premier Ministre et à plusieurs Ministres du gouvernement fédéral nouvellement élu, afin d'exprimer ses inquiétudes concernant la gestion de la science dans la fonction publique (voir le Bulletin de décembre 2015, page 175). Nous avons jusqu'à présent reçu quatre réponses de Ministres, qui sont reproduites ci-bas.

Minister of Natural Resources/ Ministre des Ressources naturelles
Ottawa, Canada K1A OE4

Jan 14 2016

Dear Dr. Wheeler:

Thank you for your letter of November 10, 2015, regarding science in the government. As you are aware, the Government of Canada has strongly signaled the value we place on our scientists and on ensuring that science and empirical evidence play a central role in decision-making. Science, both fundamental and applied, delivers economic, environmental, health and social benefits. Canada needs robust science for the public good.

Certainly the importance of science is critical to my own portfolio, natural resources, and I am proud to be leading a department with such a rich tradition of scientific excellence. I will be working with my colleague, the Honourable Kirsty Duncan, Minister of Science, in supporting scientific research and the integration of scientific considerations in our investment and policy decisions across government.

I should note that Minister Duncan has also announced that she will be working closely with Canada's scientific community to ensure that there is open communications about science, now and in the future. Today, science matters more than ever before, and the Government will ensure it plays a central role in decision-making.

Sincerely,

The Honourable Jim Carr, P.C., M.P.

Minister of the Environment / Ministre de l'Environnement
Ottawa, Canada K1A OH3

Dear Dr. Wheeler:

Thank you for your letter of November 10, 2015, and enclosure, concerning federal scientific capacity and funding, as well as working conditions and media access for scientists.

While I recognize that most of the Entomological Society of Canada's members are with Agriculture and Agri-Food Canada, Fisheries and Oceans Canada, and Natural Resources Canada, and that some of the issues raised in your correspondence are specific to these departments, I am pleased that you brought your concerns to my attention.

Along with my other colleagues responsible for federal science-based departments and agencies, I am committed to a high standard for openness and transparency in government. We will be working together to deliver on the Government of Canada's commitment to make government science available to the public. As well, I share your enthusiasm for enabling scientists to do their work and speak publically about it.

Integrating scientific considerations in its investment and policy choices will be an important goal for the Government. It was a proud moment for me in November when, for the first time, scientists briefed the Prime Minister, the cabinet, and premiers on the science of climate change (http://ec.gc.ca/sccs/Default.asp?lang=En&n=A5F83C26-1). Evidence and information from Environment and Climate Change Canada scientists across the country will also be integral to delivering on other important elements of my mandate, including the completion of robust species-at-risk recovery plans and the review of Canada's environmental assessment processes.

Please be assured that the Government of Canada will listen to the scientific knowledge developed by the Entomological Society of Canada's membership and the many other areas of science relevant to its work as the Government moves forward in delivering on its positive, optimistic, and hopeful vision for Canada.

Sincerely,

The Honourable Catherine McKenna, P.C., M.P.
Minister of Environment and Climate Change

[handwritten postscript: *"Thank you for your thoughtful letter - our government believes in the importance of science in public policy decision making."*]

c.c.: The Honourable James Gordon Carr, P.C., M.P.
The Honourable Kirsty Duncan, P.C., M.P.
The Honourable Lawrence MacAulay, P.C., M.P.
The Honourable Hunter Tootoo, P.C., M.P.

Minister of Agriculture and Agri-Food / Ministre de l'Agriculture et de l'Agroalimentaire
Ottawa, Canada K1A 0C5

Feb 5 2016

Dear Dr. Wheeler:

Thank you for your email regarding public science. I appreciate your taking the time to write.

Agriculture and Agri-Food Canada (AAFC) is the largest single provider of agricultural research in Canada. The Department has the infrastructure, expertise, and financial stability that allow for long-term projects and research that target results for the sector. AAFC in-house research enables our scientists to focus on core research where government has a clear role and adds value, while not duplicating work being done by industry and research partners.

AAFC is proud of the world-class research conducted by its scientists and scientific support staff, working in a national network of 20 research and development centres across Canada. In order to maintain this scientific capacity and ensure continued support for a competitive and sustainable agricultural sector, AAFC continually recruits new scientific personnel and works on strong succession plans.

As stated in my mandate letter from the Prime Minister, AAFC will work with provinces, territories and other willing partners to help the agriculture and agri-food sector adjust to climate change, and to better address water and soil conservation and development issues. The work of entomologists will be key in addressing issues relating to pest management and the study of insects interacting with their environment, including invasive and alien species.

With respect to your comments about the opportunity for scientists to speak about their work, I refer to the statement by the Minister of Innovation, Science and Economic Development, the Honourable Navdeep Bains: "Our government values science and will treat scientists with respect. That is why government scientists and experts will be able to speak freely about their work to the media and the public."

Our government is committed to investing further in agricultural research to support discovery science and innovation, building new collaborations and clusters of scientific expertise to work on solutions for farmers, and creating new opportunities for the sector.

I trust that this information will be of assistance to you. Again, thank you for writing to me on this matter.
Sincerely,

Lawrence MacAulay, PC, MP

Minister of Science / Ministre des Sciences
Ottawa, Canada K1A OH5

Dec 23 2015

Dear Dr. Wheeler:

Thank you for your letter of November 10, 2015, expressing your views regarding support for federal science and scientists.

As Minister of Science, my goal is to support scientific research and other science-based departments, and ensure government science is available to Canadians. With respect to the issue you raise about the Experimental Lakes Area, I have taken the liberty of forwarding your correspondence to my colleague, the Honorable Hunter Tootoo, Minister of Fisheries, Oceans and the Canadian Coast Guard, for consideration.

In reference to concerns stated in your letter, I will work closely with Canada's scientific community to ensure that there is open communication about science now and in the future. As part of this commitment, I will be creating a Chief Science Officer mandated to ensure that government science is fully available to the public, that scientists are able to speak freely about their work, and that scientific analyses are considered when the government makes decisions.

Canadians expect us to fulfill our commitments, including a more transparent and open government, and I am confident that we will fulfill these commitments.

Once again, thank you for writing and please accept my best wishes.

Sincerely,

The Honourable Kirsty Duncan, P.C., M.P.

c.c. The Honorable Hunter Tootoo, P.C., M.P.

Meeting announcements / Réunions futures

The 13th Arbovirus Surveillance and Mosquito Control Workshop
St. Augustine, Florida, 29-31 March 2016
http://www.amcdsjc.org/

Integrated Tick Management Symposium: Solving America's Tick-Borne Disease Problem
Washington, D.C., 16-17 May 2016
http://entsoc.org/ITMS

The 2016 National Conference on Urban Entomology
Albuquerque, New Mexico, 22-25 May
http://ncue.tamu.edu/

The 11th International Symposium on Adjuvants for Agrochemicals
Monterey, California, 20-24 June 2016
http://events.isaa-online.org/page/269/welcome-to-isaa-2016.html

The IX International Symposium On Phlebotomine Sandflies
Reims, France, 28 June-1 July 2016
http://www.univ-reims.eu/site/event/isops-ix,18817.html

Ecology of Aphidophaga XIII
Freising, Germany, 29 August-2 September 2016
http://aphidophaga.de/

Entomological Society of Canada Annual Meeting 2016
Orlando, Florida, 25-30 September 2016
The meeting will be held in conjunction with the 2016 International Congress of Entomology.
http://www.esc-sec.ca/annmeet.php

XXV International Congress of Entomology (Entomology without Borders)
Orlando, Florida, 25-30 September 2016
www.ice2016orlando.org

12th International Congress of Orthopterology (Orthoptera in a Changing World)
Ilhéus, Bahia, Brazil, 30 October-3 November 2016
http://www.ico2016.com.br/

The Third Hemipteran-Plant Interactions Symposium
Madrid, Spain, 4-8 June 2017
http://www.hpis2017.csic.es/

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

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

Bulletin of the Entomological Society of Canada

Editor: Cedric Gillott
Assistant Editor: Donna Giberson

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

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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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Bulletin de la Société d'entomologie du Canada

Rédacteur: Cedric Gillott
Rédactrice adjointe: Donna Giberson

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

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

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ISSN: 0071-0741

Date de tombée pour le prochain numéro: 30 avril 2016

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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.*

The last word / Le dernier mot

Cedric Gillott, Editor / Rédacteur

A plea for help

A society such as ours thrives on the volunteer efforts of a large number of its members. Mostly, these efforts go unnoticed as, for example, the work of members of the Society's many committees. Typically, this behind-the-scenes work never comes to the attention of members, except in the form of resolutions to be voted on by those in attendance at annual general meetings.

An important area of volunteerism in our Society, currently lacking participants, is book reviews, hence my 'plea for help'. Readers may have noticed an unusual feature of this issue of the Bulletin – it contains no book reviews! Personally, I find it both surprising and disappointing that so few members jump at the chance to obtain (for free!) a newly published book in an area of interest, in return for which they are asked to produce a review of its contents for publication in the Bulletin. A glance at Page 19 reveals that a dozen books currently are seeking a partner willing to take them in their arms, longingly gaze at them, and assess whether a lifetime together is in order! The titles of some of these literary gems suggest that they ought to have wide appeal within the Society, while others are clearly very specialized in their partner requirements (surely there's at least one 'frog-loving entomologist' in our membership!).

Thus, I urge readers to take another look at what's available for review, and if something takes your fancy, please contact the Chair of the Publications Committee (tom.lowery@agr.gc.ca) who will be delighted to arrange for you to get the book. Remember, if after reading it (and writing the review), you decide to end the relationship, you can always send the book to the Silent Auction at the next JAM!

Appel à l'aide

Une société telle que la nôtre prospère grâce à l'effort bénévole d'un grand nombre de ses membres. La plupart de ces efforts, comme le travail des membres des nombreux comités de la Société, passent inaperçus. Ce travail en coulisse n'est généralement jamais porté à l'attention des membres, sauf sous la forme de résolutions à voter par ceux qui assistent aux assemblées générales annuelles.

Une partie importante du bénévolat de notre Société qui manque présentement de participants est la critique de livres, d'où mon « appel à l'aide ». Les lecteurs ont peut-être remarqué une particularité de ce numéro du *Bulletin* – il ne contient pas de critiques de livres! Personnellement, je trouve cela à la fois surprenant et décevant que si peu de membres sautent sur l'occasion d'obtenir (gratuitement!) un livre publié récemment dans un domaine d'intérêt, en échange de la production d'une revue et critique de son contenu pour publication dans le *Bulletin*. Un coup d'œil à la page 19 révèle qu'une douzaine de livres cherchent un partenaire prêt à les prendre dans leurs bras, à les dévorer des yeux, et évaluer si une vie ensemble est possible! Le titre de certains de ces bijoux suggère qu'ils devraient avoir un intérêt assez vaste au sein de la Société, alors que d'autres sont clairement très spécialisés dans leurs exigences pour un partenaire (il doit probablement y avoir au moins un entomologiste qui aime les grenouilles parmi nos membres!).

J'encourage donc fortement les lecteurs à jeter un œil sur les livres disponibles pour critique, et si quelque chose vous plaît, contactez le président du comité des publications (tom.lowery@agr.gc.ca) qui sera ravi de s'assurer que vous obteniez le livre. Rappelez-vous, après l'avoir lu (et avoir écrit la critique), si vous décidez d'arrêter la relation, vous pouvez toujours envoyer le livre aux enchères silencieuses à la prochaine réunion annuelle!

Entomological Society of Canada, 2015-2016
Société d'entomologie du Canada, 2015-2016

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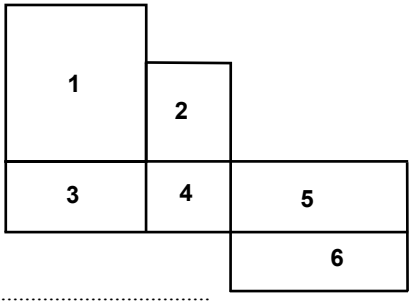

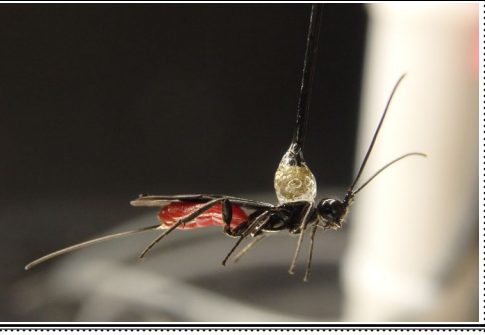

Front cover/Plate supérieur:

1.Graduate students collect at a light trap late at night (Vernon, BC). The bright lights are powered by the car's battery.
Des étudiants gradués capturent des insectes dans un piège lumineux tard dans la nuit (Vernon, C.-B.). Les lumières vives sont alimentées par une batterie de voiture. [Photo : Ward Strong]

2.Predator versus parasitoid: *Rhinocoris annulatus* feeding on an ichneumonid (Delémont, Switzerland).
Prédateur contre parasitoïde : *Rhinocoris annulatus* se nourrissant d'un ichneumon (Delémont, Suisse). [Photo : Tim Haye]

3.A spruce budworm (*Choristoneura fumiferana*) pupa on a balsam fir branch. The spruce budworm is a major native defoliator in Eastern Canada. Near Baie-Comeau, QC.
Une chrysalide de tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana*) sur une branche de sapin baumier. La tordeuse des bourgeons de l'épinette est un défoliateur indigène dans l'est du Canada. Près de Baie-comeau, Qc. [Photo : Véronique Martel]

4.The longhorned beetle *Bellamira scalaris* preparing for takeoff in Denver, NS.
Le longicorne *Bellamira scalaris* se préparant à s'envoler à Denver, NS. [Photo : Colin MacKay]

5. Cecropia moth, *Hyalophora cecropia*, just after molting to third instar. This lab-reared caterpillar is from the F2 generation of a gravid female collected in 2014 from Black Donald Lake near Calabogie, ON.
Un saturnie cécropia, *Hyalophora cecropia*, après la mue vers le troisième stade. Cette chenille élevée en labo est de la génération F2 d'une femelle féconde capturée en 2014 au lac Black Donald près de Calabogie, Ont. [Photo : Andrea Brauner]

6. *Megachile* Latreille, 1802 (Megachilidae) leafcutter bees are important pollinators widely used in alfalfa growing areas. Their reproductive biology is quite interesting. This specimen was excavating its nest in an old wood retaining wall in our garden. Prince George, BC.
Megachile Latreille, 1802 (Megachilidae). Les abeilles découpeuses sont d'importants pollinisateurs largement utilisés dans les aires de cultures de Luzerne. Leur biologie reproductive est plutôt intéressante. Ce spécimen creusait son nid dans un vieux mur de soutènement en bois dans notre jardin. Prince George, C.-B. [Photo : Staffan Lindgren]

Back cover/Plate inférieur:

Female *Atanycolus* sp., a North American parasitoid of emerald ash borer, tethered to a flight mill in a laboratory at the Canadian Forest Service, Great Lakes Forestry Centre (Sault Ste. Marie, ON) to study factors affecting flight.
Une femelle *Atanycolus* sp., un parasitoïde nord-américain de l'agrile du frêne, attachée à un moulin de vol dans un laboratoire du Service canadien des forêts, au Centre de foresterie des Grands-Lacs (Sault-Ste-Marie, Ont.), afin d'étudier les facteurs qui affectent le vol. Photo : Justin Gaudon.

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