Entomological Society of Ontario

Newsletter

Inside:
AGM 2014 News
Bug Day 2014
New website launch
President's address
The fate of JESO
Election and nominations

New Features:
Coleopterist's corner
MED ENT
Hopper Hot Wire!
Diptera Diary
Butterfly Focus

...And so much more!

Volume 19; Issue II
July 21, 2014

Entomological Society of Ontario

FOUNDED 1863

The ESO Newsletter

July 11, 2014 • Volume 19 • Issue II

JESO

Featured Research

Society News

Announcements

This issue was inspired by

Dr. Jim O'Hara's

The Tachinid Times

http://www.nadsdiptera.org/Tach/home.html

For Subscriptions to t.T.T contact Jim at

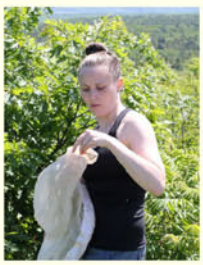
James.O'Hara@agr.gc.ca

2014 Officers of the ESO

President: Jeremy McNeil

Western University
jmcneil2@uwo.ca

Past President
Jeff Skevington
AAFI, CNC
Carleton University
Jhskevington@gmail.com



Secretary
Michelle Locke
AAFI, CNC
Michellemlocke@gmail.com

JESO Editor
John Huber
AAFI, CNC
John.huber@agr.gc.ca

JESO Tech. Editor
Jess Vickruck
Brock University
Jvickruck@gmail.com

Treasurer
Shiyou Li
AAFI
sli@nrcam.gc.ca

Librarian & ESO Archivist
Jim Brett
Guelph University
jimbrett@uoguelph.ca

ESC Rep. to ESO
Pat Bouchard
AAFI, CNC
Patrice.bouchard@agr.gc.ca

Student Rep
Lauren Des Marteaux
Guelph University
ldesmart@uwo.ca

Webmaster
Newsletter Co-Editor
Trevor Burt
Carleton University, CNC
trevburt@gmail.com

Newsletter Co-editor
Amanda Lindeman
Carleton University
amanda.lindeman
@gmail.com

Director 2013-15
Brent Sinclair
Western University
bsincla7@uwo.ca

Director 2013-15
Sophie Cardinal
AAFI, CNC
sophie.cardinal
@agr.gc.ca

President Elect
Ian Scott

ian.scott@agr.gc.ca

Director 2014-16
Antonia Guidotti
Royal Ontario Museum
Antoniag@rom.on.ca

Director 2014-16
Wayne Knee
AAFI, CNC
Whknee@gmail.com

Director 2012-14
Joel Gibson
Guelph University
Jfgibson@uoguelph.ca

Director 2012-14
Christine Bahlai
Michigan State U
cbahlai@msu.edu

Become an ESO Member

Do you often forget to pay your yearly ESO membership dues (hint, hint, the start of 2015 and a new membership season will soon be upon us)? Are you a long-time devoted member of the ESO? Based on member feedback, we've created a NEW membership dues option that has been available since 2013:

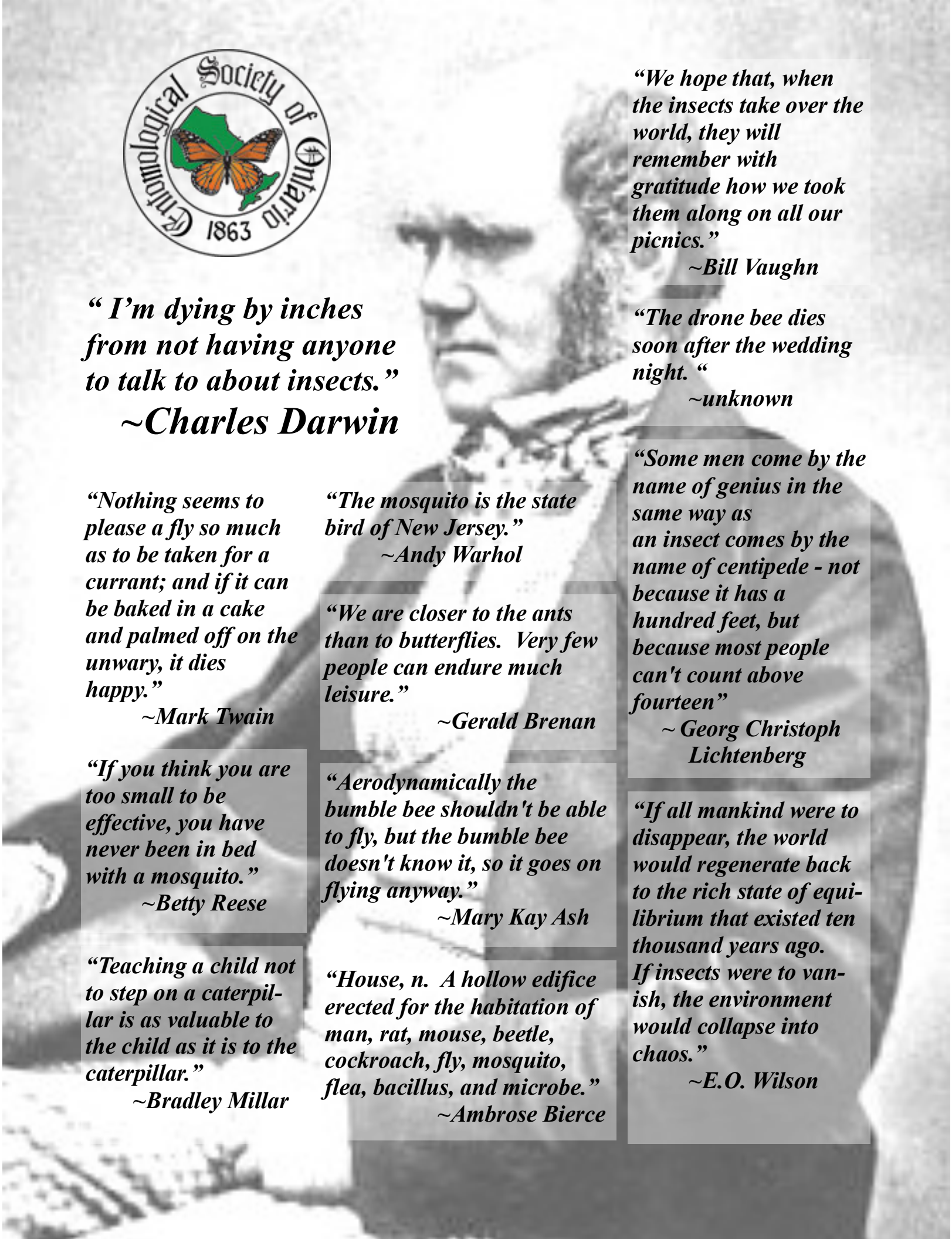
A one-time payment of $150 to secure a 5 year membership!

The ESO registration form is available on the **ESO website: *entsocont.ca***

For all membership and payment options, including to pay via ***PayPal,*** please visit **www.entsocont.ca , or** mail your invoice and payment to:

Michelle Locke (ESO Secretary)
Vista Centre
1830 Bank St.
PO Box 83025
Ottawa, ON K1V 1A3
Telephone: (613) 759-1727

Student, amateur and retired memberships in Canada are free but **must be renewed each year**! Free memberships may be renewed electronically by sending an email to **Michelle** at:
entsocont.membership@gmail.com



Entomological Society of Ontario 1863

" I'm dying by inches from not having anyone to talk to about insects."

~Charles Darwin

"We hope that, when the insects take over the world, they will remember with gratitude how we took them along on all our picnics."

~Bill Vaughn

"The drone bee dies soon after the wedding night. "

~unknown

"Some men come by the name of genius in the same way as an insect comes by the name of centipede - not because it has a hundred feet, but because most people can't count above fourteen"

~ Georg Christoph Lichtenberg

"Nothing seems to please a fly so much as to be taken for a currant; and if it can be baked in a cake and palmed off on the unwary, it dies happy."

~Mark Twain

"The mosquito is the state bird of New Jersey."

~Andy Warhol

"We are closer to the ants than to butterflies. Very few people can endure much leisure."

~Gerald Brenan

"If you think you are too small to be effective, you have never been in bed with a mosquito."

~Betty Reese

"Aerodynamically the bumble bee shouldn't be able to fly, but the bumble bee doesn't know it, so it goes on flying anyway."

~Mary Kay Ash

"If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos."

~E.O. Wilson

"Teaching a child not to step on a caterpillar is as valuable to the child as it is to the caterpillar."

~Bradley Millar

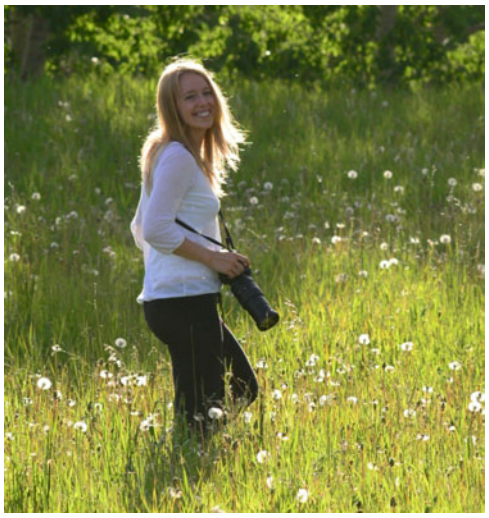
"House, n. A hollow edifice erected for the habitation of man, rat, mouse, beetle, cockroach, fly, mosquito, flea, bacillus, and microbe."

~Ambrose Bierce

Newsletter Editors

Trevor Burt
MSc Candidate
Carleton University
Canadian National Collection of Insects, Arachnids and Nematodes (CNC)
Ottawa

trevburt@gmail.com



Amanda Lindeman
PhD Candidate
Carleton University
Ottawa

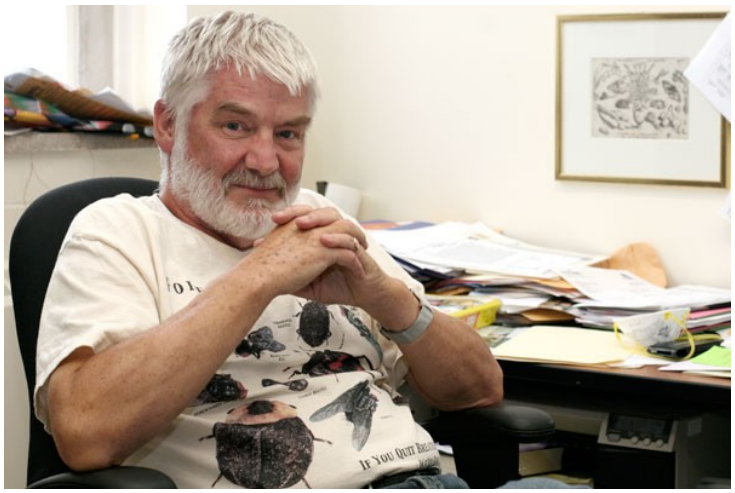
amanda.lindeman@gmail.com

Trevor studies the Family Conopidae (Diptera) of the Nearctic region and is attempting to revise the group by identifying unique characteristics to develop strong species concepts. He works under Jeff Skevington (CU & AAFI/CNC Diptera Unit) and Jeff Dawson (CU Biology Dept.) at the Diptera Unit of the CNC.

Trevor has been a **Student Member** of the **ESO** since 2008, and along with Amanda, took over as **Newsletter Editor** in the fall of 2013. In the spring of 2014 he replaced **Morgan Jackson** as **Webmaster**.

Amanda studies all aspects of acoustic communication in a highly destructive group of bark beetles – *Dendroctonus* – from the acoustic properties of the signals, how they are produced, and what information they convey, to how these signals are "heard" (neuroanatomy/physiology of potential ears) and how individuals respond to them. She works under Jayne Yack at Carleton University.

Amanda has been a **Student Member** of the **ESO** since 2012, and, along with Trevor took over as **Newsletter Editor** in the fall of 2013.



President's Address

Dear Colleagues

I trust that you are having an enjoyable summer and that your research is going well.

At the upcoming annual meeting in Toronto there will be two important issues that we need to resolve. I am, therefore, taking this opportunity to provide the background information for each one, so that everyone will be in a position to participate in the debate.

The first relates to an amendment to extend the Presidential term from one to two years, which has been proposed by Trevor Burt and seconded by Jeff Skevington. The complete details and rationale are listed on page 65 of this newsletter. If this amendment is approved at the next Annual meeting it could come into effect immediately, should President Elect Scott agree to serve a two-year term. If not then it would take effect in 2015. I personally think that this is a positive initiative, and would support the proposed amendment.

The second issue is the future of the Journal of the Entomological Society of Ontario. Despite the stellar efforts of the Editor, John Huber, it has become increasingly more difficult to obtain enough manuscripts to sustain the journal. There are a number of reasons for this, including the significant increase in the number of scientific journals and the pressure on authors to publish their work in ones with a high impact factor.

One option is to terminate the journal, as the la Société d'entomologie du Québec did with the Annales de la Société entomologique du Québec. It should be noted that the SEQ started Antennae, a magazine that has been published three times a year since 1994, and has proved a successful venue for the entomological community in the province (seq.qc.ca/antennae/antennae.asp).

The alternate is to try and revitalize the JESO, including a suggestion that it be dedicated to a specific subject area of entomology. Regardless of format, the steps necessary to turn things around have been outlined in a report prepared by Brent Sinclair, with input from several members of the Board (page 9). As noted it will take a very dedicated team, working over several years, if there is any hope to raise the profile of the journal to the point where it is competitive with other available publication venues. Consequently, from a very pragmatic perspective it comes down to determining whether the considerable effort required (that is certain) is reasonable given the probability of success (which is far from assured).

I would ask you all to give thought to these two issues and be prepared for discussions at the upcoming annual meeting to be held 3-5 October in Toronto. If you are unable to attend feel free to send your thoughts and suggestions to me at jmcneil2@uwo.ca

Jeremy McNeil
President of the ESO

A Brief History of the *Journal of the Entomological Society of Ontario*

The Entomological Society of Canada (ESC) was founded in 1863 and changed its name to the **Entomological Society of Ontario** (ESO) in 1871, as explained in Timms (2009). Volume 1 of **The Canadian Entomologist** was published in 1869. The first volume of ESO was published in 1871 and entitled "**First Annual Report on the Noxious Insects of the Province of Ontario**" and subtitled "**Prepared for the Agricultural and Arts, and Fruit Growers' Associations of Ontario**, on behalf of the Entomological Society of Canada." Most subsequent volumes, published once a year, usually in the next calendar year from that stated on the front cover, were entitled "xxth **Annual Report of the Entomological Society of Ontario**", but it is clear from their numbering that the first volume was the one mentioned above. The latter title continued until the Eighty-fifth Annual Report of the ESO 1954 (published in 1955) after which the name changed to "Annual Report of the ES0 Volume Eighty-six 1955" (published in 1956). The name then changed to "**Proceedings of the ESO**" for vol. 90 1959 Annual Report" (published in 1960). The phrase "annual report" was dropped from volumes 91 on. The final change in title occurred with volume 133 2002 (published 2003) when it became "**Journal of the Entomological Society of Ontario**." Despite the name changes, the 144 volumes were published without a break since 1871 making **JESO** the second oldest entomological journal in North America after The Canadian Entomologist. Back issues have been scanned and are available on **Biodiversity Heritage Library** and the **Entomological Society of Ontario** websites.

"JESO [is] the second oldest entomological journal in North America . . ."

As of 2014, hard copy publication through a commercial printer will cease and any manuscripts submitted to the Editor that pass the referee process (two external referees review all submitted mss) and are accepted for publication will appear in electronic format only. They will be posted for immediate open access on the ESO website. Even though articles will henceforth be published electronically only the format will remain unchanged for the foreseeable future and technical editing will ensure that the front and back cover style will remain. If needed, a few copies containing all the mss published electronically over the calendar year will be compiled and published as hard copy in-house for placement in the **ESO Archives.**

References

Timms L. 2009. Growing pains: how the birth of the Entomological Society of Canada affected the identity of the Entomological Society of Ontario. *Journal of the Entomological Society of Ontario* **140**: 46–53.

Dr. John Huber

Journal of the Entomological Society of Ontario Editor-in-Chief

john.huber@agr.gc.ca

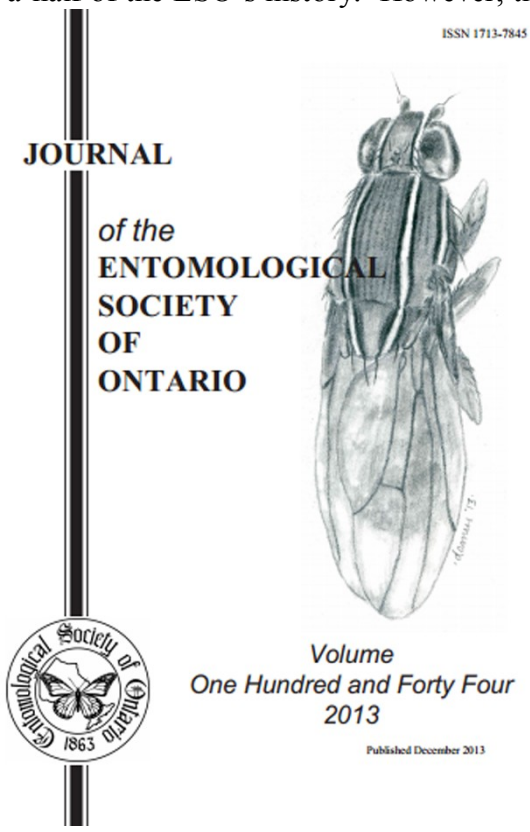
The future of the *Journal of the Entomological Society of Ontario*

Preamble

Currently in its 144th year, *JESO* is one of the oldest entomological journals in the world, and the second oldest in North America. Although the journal has been well served by volunteer editors, and has a proud history, submissions have been declining, and over the past 14 years, the number of subscriptions has declined from c. 150 (1999-2001) to 83 (2013), suggesting that there is reduced interest from subscribers. An attempt to reverse this by abolishing page charges has not increased the submission rate, but has served to make the journal a financial liability to the society.

The publishing landscape is changing

Publishing a journal has been a core activity of the society, and provides continuity over the century-and-a-half of the ESO's history. However, the purpose of the journal as a vehicle for communication among the members was obsolete over a century ago, and the competitive nature of science means that publishing in invisible, low-tier journals like JESO is not a strategy that we can recommend to HQP or to any researcher whose performance is reviewed. Thus, one of the key challenges that JESO faces is attracting submissions.



However, there is a market for publication in good-quality journals. There has been a proliferation of open-access journals (some of which are sadly predatory), which indicates that publishing in journals in the English Language is as appealing as it ever has been. Attracting some of these papers, in a context that allows the journal to break even, could allow the journal to survive – and possibly even thrive – in this new environment. The purpose of this document is to suggest the changes that can be affected to facilitate this shift, should the ESO decide to continue publishing JESO.

An immediate priority: keeping the journal and society solvent

An immediate priority is to get the journal into a state where it is not a financial drain on the society. A shift to electronic publication (as .pdfs) with additional charges for bound paper copies that reflect this cost (perhaps via print-on-demand service or via a University's graphic services – at Western this will run to $10-20 per copy). Existing electronic versions should be findable by Google, and broken into individual papers, perhaps with an html table of contents. The digitisation of the back catalogue by the Biodiversity Heritage Library will also assist with this endeavour.

Moving to electronic publication would reduce the journal costs to the technical costs (copy editing, typesetting etc.), approximately $2800/year (down

from $8500 in 2012), including the no-charge copies printed, and some copies (perhaps rather fewer than last year's 50 copies) sent to Guelph for the ESO archives. At $30/subscription, this cost would be largely covered by existing subscriptions. Such a cost could be additionally offset via a nominal per-article charge (say $20-40), which would return the journal to full solvency. Such a change will also increase the immediacy of availability. It is likely that no significant changes to the production/upload process will be necessary, except for the removal of most of the mailing/printing processes, and the addition of an appropriate paywall to encouraging subscription. The on-demand printers will likely mail the copies for us.

An alternative approach would be to move to an open access model, and charge the full cost of publication (perhaps $500/ article), which would give the editor a target of 6 papers/year – within the bounds of the number published in recent years (2011: 7, 2012: 5, 2013: 4 + 4 in review), however, it is likely that a $500 charge would make the journal unpalatable. The introduction of an open access option could partially defray some publication expenses.

"It is clear that JESO is at a critical point in its history"

A medium-term goal: Get the journal represented in ISI, SCOPUS, and Google Scholar

JESO has a low impact, which will certainly dissuade submissions (and reviewers). In order to improve the attractiveness of JESO, we need to get it listed with the main databases. This will facilitate the acquisition of a (likely small) impact factor, and ultimately prime the journal for future endeavours. Given that the journal has over 140 years of history, this should be possible, although there may be some work involved in acquiring and providing the appropriate meta-data (although the biodiversity heritage Library may be able to help with that).

Getting a journal listed by ISI is not trivial. Among their criteria is the timeliness and regularity of *current* issue publication (an issue as the current model has no set publication date), assessed over a three issue period, which means that the initial issue of journal sustainability must be resolved while this process occurs. It is plausible that the long history of JESO might mean that it can be fast-tracked (ultimately, ISI is interested in access to information – and we have plenty of that to offer already), but I suspect that ISI does not make exceptions. Details on the ISI process for having a journal listed are here: http://wokinfo.com/essays/journal-selection-process/, and the (friendly) policy toward regional journals is here: http://wokinfo.com/essays/globalization-of-web-of-science/. It is possible that JESO could leverage its history to be considered among the 'best' regional journals, but it could be equally argued that the quality of submissions is already far below that of TCE, and that TCE may have already taken whatever informal slot available to a Canadian regional Entomology journal.

Listing by Google Scholar is more simple (don't call them... they'll find us!) provided we follow some basic formatting guidelines, which can be found here http://www.google.ca/intl/en/scholar/inclusion.html#overview. SCOPUS has some specific requirements, which may require some subtle changes to the aims, scope, and editorial policies, but these should be achievable http://www.elsevier.com/online-tools/scopus/content-overview#content-policy-and-selection.

It is important to note that getting JESO listed by these databases will take some work, and will be a project encompassing several years. This will be in addition to the Editorial duties, and has no guarantee of success. However, the rewards will be many, and the improved visibility and accessibility of the journal will be essential to its long term survival, affecting both citation and submission.

Long-term goals

The decline in submissions to JESO perhaps indicate that its role as a regional journal is limited – and perhaps that regional journals in general are no

longer necessary (for example, the Quebec equivalent was folded several years ago). During a discussion at the ESO Board meeting in October 2013, several possibilities were mooted. Note that these are not mutually exclusive. All will require a change in the aims and scope, and may require a significant change in direction for the journal. Any (and all) such changes should be debated vigorously among the board and the membership before any action is taken.

- The journal editor could move to a policy of actively soliciting submissions, for example by the ESO sesquicentennial scholarship winners.
- We could change the regional focus of the journal. By shifting to receive submissions from a wider geographical base, it is possible that the journal could be revitalised. On the other hand, this has the potential to open ourselves to an influx of poor-quality submissions from the developing world, making editorship a misery.
- We may be able to partner with some other journals. For example, JESO could become a destination for pieces that are slightly too small for *The Canadian Entomologist*, or slightly too substantial for *Ontario Insects* (the newsletter of the Toronto Entomologists Association). Such a shift will be a fine line to walk – politically and editorially – but could yield high-quality submissions that need a home somewhere in the recognised scientific literature. Similarly, there may be work currently being published in the 'gray literature', e.g. in-house publications at CFIA, that would be better suited to the peer-reviewed literature, and perhaps JESO could aim to pick up those articles. The latter strategy could be effected via networking on the part of board members.

JESO could change focus entirely to become a first choice journal for something that currently slips between the cracks. For example, although publishing only distribution notes might seem like a low bar to set, perhaps it is possible for JESO to become the 'journal of record' for such notes – again ensuring its long term sustainability? Alternatively, we could focus on entomological outreach and education.

Another 143 years of JESO?

It is clear that JESO is at a critical point in its history, and that concerted action must be taken over the next five years if the journal is to survive. The short-, medium-, and long-term goals above are suggestions only, but are intended to start an open and vigorous discussion about the future of the journal. Because of the tenuous financial position that the journal's current operations put the society in, I suggest that these discussions are urgent.

Recommendations

It is possible that JESO may be saved, however doing so will be a lot of work, and that effort may be for nothing. Even the immediate goal of shifting to electronic publication will be a challenge, and the existing editor has made it clear that he has no skills in that area. If an editorial team were to step forward and be willing to invest the hundreds of hours necessary, then I suggest that the society should consider supporting them. However, ESO is not a large society, and it could well be argued that said effort would be better invested in outreach and other activities. I believe that this issue needs to be carefully considered by both the Board and the Membership. Upon reflection, my recommendation will be to close JESO, and re-focus the Society's efforts on the annual meeting, as well as on outreach and educational activities.

Acknowledgements
Thanks to John Huber, Jess Vickruck, Patrice Bouchard, Jeremy McNeil, Antonia Guidotti, Jeff Skevington, Joel Gibson and Shiyou Li for providing facts, figures and discussion.

Dr. Brent Sinclair
Western University
bsincla7@uwo.ca

Butterfly Focus

Written by
Dr. Chris Grinter

Chris Grinter is an entomologist at the Denver Museum of Nature & Science. He is currently working with the Southwest Collections of Arthropods Network (SCAN) to database and photograph the spectacular insects of the American SW.

He is the author of the blog *The Skeptical Moth: Entomology as a Candle in the Dark*

Follow him on his website:
http://www.theskepticalmoth.com/
Or on twitter @skepticalmoth

Butterfly focus
Photographing Microlepidoptera

Photographing small moths, whether alive in the field or a specimen in a lab, can require a lot of patience but be extremely rewarding. Expensive gear isn't usually required; a high quality image can be obtained with a fairly simple setup and a bit of DIY. In this article I will share a few of the best techniques I've picked up over time and will hopefully help you the reader and photographer take better images of small moths. I'll focus mostly on specimen photography in the lab and end on a few tips for live specimens in the field.

Cameras & Lenses

Photography can be a slippery slope of exponentially expensive equipment. For a basic high-resolution image a DSLR is the best option. Canon makes gear that in my opinion syncs best to a computer and offers the most flexibility in lens choice. The all-powerful MP-E 65mm 1x – 5x macro lens helps make Canon the default choice for many macrophotographers. My standard setup is a Canon 5d mark 3, MP-E 65mm and MT-24EX twin flash. But any older digital Canon will still get the job done, having a better lens is more important than an expensive body. Additionally, acquiring images greater than 1:1 is possible with extension tubes on any camera with any lens. A good 60 or 100mm lens with a few tubes will help increase magnification on the sensor. The two standard lenses I recommend is the MP-E 65mm (or a 60mm with extension tubes) for tiny insects, and a 100mm for butterfly-sized animals. If you're shooting large Saturniidae than perhaps a 50mm macro would be required, but I almost never need it.

Lighting

The most important factor in creating a good image is always lighting. The very bright yet diffuse light required to eliminate shadows takes some rigging and can be done on a budget. Flash is usually required for live subject photography, but is not required in the studio. Directing a steady source of light on the specimen (avoiding incandescent) can take the place of a flash. Ikea has a few LED and Xenon options that provide cheap and bright light sources. For light diffusion in the lab I use a Styrofoam soup bowl by cutting out the bottom out and shooting down through the center (Fig. 1). Styrofoam in general is one of my go-to diffuser materials, but similar foam and tracing papers can create comparable effects. One of the most critical things I have found is the diffuser be round, corners and edges create odd light shadows. Thinking outside the box, USDA photographer and entomologist

(Fig. 1) Styrofoam bowl acting as light diffuser. Visionary Digital Passport II setup.

Sam Droege shoots entirely within a foam cooler, bouncing the flash light off of the walls and onto his specimen for spectacular results. In the field I use a twin macro flash by Canon, which also requires a significant amount of diffusion to reduce glare while providing enough illumination. I have a large array of foam and plastic cups that are taped to the end of my lens that create a dome over the subject. Again, a curved surface always seems to produce the best effect. While there are many expensive diffuser options on the market I often find building your own setup and experimenting with materials will give you the best results.

Composition

Lepidoptera are fairly easy to photograph because of their two-dimensional nature. One exposure is all that is required for most well-spread moths, as long as the wings or abdomen aren't distorted or drooping. If you're imaging a specimen at greater than 1x or need to focus on a three dimensional aspect of the animal then focus-stacking will be necessary. Increasing the aperture for a greater depth of field is not an ideal solution for obtaining sharper focus as quality is drastically lost with high aperture values. To retain a perfectly sharp image you want to try and shoot at the lowest possible aperture (f/4, ISO 100 is my standard when stacking). But at ~f/4 the depth of field is so narrow that a dozen or so images are necessary to complete a stack. Shooting stacks doesn't have to be overly complicated and can even be done by hand (see Piotr Naskrecki) but for complex three dimensional objects some type of automation improves image quality drastically.

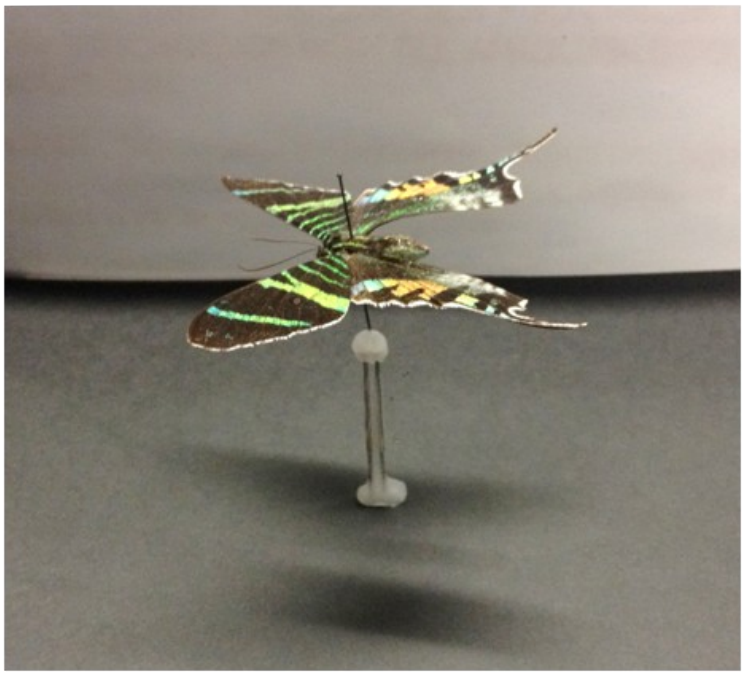
If only a small part of the specimen is out of focus in your final image then taking one or two additional photos can be done by simply manipulating your focus on the lens or moving the camera up or down very slightly. At an aperture of ~f/8 you should be able to capture most of the range of a moth's wings in 2-3 images. A program like Zerene Stacker is affordable and very powerful, often rendering hairs and scales better than more expensive competitors. Helicon Focus excels at shiny and smooth objects, and Photoshop can stack a handful of images with decent results. Auto-montage software, while a leader in the field years ago, seems too expensive to be considered for any budget-conscious lab and I am not personally aware of benefits of their program.

If capturing more than 4 images for a single composition using an automated system makes life easy (and expensive), the best equipment I have used is manufactured by Visionary Digital. Their lower-end setup (Fig. 1) comes in at a stiff ~$20,000, but includes the camera and high end computer for crunching large images. But many of these components can be assembled for a lower price tag. Picking up a photography copy stand can usually be done for less than $100 and on that stand you can mount the StackShot automated rail manufactured by Cognisys ($550). A stacking program like Zerene has built in tools to control this rail system. Any camera can be mounted to the copy stand and lights of your choice can be easily added.

(Fig. 2) *Acrocercops sp.* undescribed (Gracillariidae). Canon 5d ii, MP-E 65mm @ 2x. ISO100. f/9, 1/200. flash fired

Composition and the requirements of an image are some of the first things to consider. I prefer the specimen on a simple black, white or neutral grey background. Black often provides the best contrast for delicate fringe and can make a specimen look very impressive (Fig.2). White and grey are preferred by many journals because it is cheaper to print, but white can

wash-out the margins of wings by the time you adequately adjust the lighting on the rest of the moth. Because of this I prefer a light neutral gray to white. Colored backgrounds of any kind should always be avoided. Color gives a false illusion of a middle ground where both fringe and wing pattern is illuminated. However, it is impossible to correct for color reflections, and the moth will have a false-color hue that can be very misleading.



(Fig. 3) *Urania sloanus*, illustrating elevated pinning

Arriving at the quality of the previous image (Fig. 2) is not as difficult as it might seem. First the specimen is inspected under a scope for cleaning – stray dust and hairs can be gently removed with a minuten or a fine paintbrush. This cleaning step is much more important when working at higher magnification or with non-lepidoptera. The finished image is a moth floating on a pure black background, ideally without using Photoshop to cut out the moth or drastically alter the background color. To achieve this effect I use a trick of moving the specimen further off the background than the standard distance of a pin will allow. Keeping the final image to a single-shot means shooting at an aperture of > f/8, allowing for the entire wing surface to be in focus. But if the specimen isn't moved the background begins to come into focus, which creates distracting distortions, and a poor quality image.

To raise the specimen higher off the pinning surface I use a combination of pins and wax. A black enamel pin with a tiny ball of wax is sufficient to hold a minuten. Given the tiny size of the specimen relative to how far it now is off the backdrop you can greatly increase aperture without losing the floating effect. For larger or heavier specimens I have taped together two pins and braced them with a larger dollop of wax. A small wooden dowel or any object that will remain hidden under the specimen can be used. On the pin heads more wax is used to adhere the specimen. This method is stable enough that I have used it to photograph very rare and fragile specimens, including this extinct *Urania sloanus* female. (Fig. 3).

Having the flash only hit the top of the specimen and not seep in from below drastically helps highlight only the moth and not the background. I cut a ring of black paper that is equal to the height of the wings, thereby insulating the bottom of the specimen from light reflected horizontally. The flash heads are then pulled close to the Styrofoam cup and shot at a significantly reduced power. All of these tricks help to create a very well lit specimen above a solid, out-of-focus, background.

Post Processing

I shoot my images in RAW format which allows for greater manipulation of white balance and shadows with Photoshop and Lightroom. With the Canon EOS Utility (free software with Canon DSLRs) I set images to be automatically imported into Lightroom. There I tend to apply a standard processing: reduce shadows, increase highlights, nudge up the clarity and vibrance a tiny amount. Then I export the photo as a 16bit TIF for final editing in Photoshop. With the aid of the spot healing brush tool you can magically repair wing holes, tears, and missing scales. As a last effort to drop out the black background into a perfectly solid color I adjust the levels. Pulling in the highlights from the right will brighten your moth and pulling in the shadows from the left will only darken the background, leaving your specimen floating perfectly on black. Importantly, I only adjust the

(Fig. 4) *Coptotriche mediostriata* (Tischeriidae) MP-E65mm @ 2x, ISO100, f/14, 1/80. Twin flash, fired.

physical appearance of specimens that are not going into a scientific publication, where the true appearance of the moth is paramount. Holotypes are especially valuable and no adjustments beyond exposure and levels should ever really be applied.

In the Field

Live microlepidoptera can be difficult to track down and photograph in the field. Some of the easiest images come from reared specimens (Fig. 4). Charley Eiseman has many beautiful examples of reared micros shot in a studio setting. Here the trick is getting the moth to stand still for a moment, and in the past I have used a refrigerator to chill the animal until it's lethargic. I refrigerated this Tischeriidae until it had flipped itself over and looked dead. 30 seconds of room temp had warmed it up enough to flip over and act normal, before flying off and having to be chased down in the lab.

Capturing a micro in a natural setting is harder yet and usually involves scaring up a moth from the brush and chasing after it until it settles, only to fly away the instant you pull the trigger on the camera. Or, worse yet, you crawl up to a moth on your belly only to realize you just discovered a small cactus right under you.

Again, lighting is critical. Natural light can be used but is often not ideal for small subjects. In the following image I captured an *Ethmia* in natural light at 100mm, but you can tell that some "fill flash" would have improved the quality of this image by reducing the shadows from the direct sunlight, and shooting it with a higher magnification would have made the moth more central in the photograph (Fig. 5). By removing the flash from the camera and holding a distance away from the subject a little bit of light can perfectly adjust the lighting.

Digital cameras have made learning photography on your own infinitely easier because you can always just keep deleting images you aren't satisfied with. The most important thing is shooting as many photographs as you can, thinking of what you'd like the image to look like in the end, and experimenting.

Dr. Chris Grinter
Denver Museum of Nature & Science.

[Fig. 5] *Ethmia arctostaphylella* at 100mm.

Coleopterist's Corner

Written by

Heath Blackmon

Ph.D. candidate

University of Texas at Arlington

Heath Blackmon has been an amateur naturalist and coleopterist for years, and he is currently a PhD candidate in Quantitative Biology at the University of Texas at Arlington. His research interests include sex chromosomes, evolution of sexual systems, and applied phylogenetics.

Heath can be found all over the web by the name "Coleoguy" (google, skype, instagram, etc).

He is the author of the blog *Coleopterist's Corner: Using Coleoptera to Understand Evolution* and co-author of the Coleoptera Karyotype Database with Dr. Jeffery Demuth (http://www.uta.edu/karyodb/)

Follow Heath on his website:
http://coleoguy.blogspot.ca/
Or on twitter @coleoguy

Coleopterist's Corner
Coleoptera Karyotypes: The evolution of sex chromosomes and chromosome number.

Coleoptera karyotypes have a long history of use by taxonomists and evolutionary biologists. In 1905, Nettie Stevens discovered the first empirical support for the role of chromosomes in sex determination through karyotype analysis of the yellow mealworm beetle, *Tenebrio molitor*. Stevens eventually identified what she called heterochromosomes in an additional 44 species of beetles. We now know that these heterochromosomes were the X and Y chromosome, and that as she inferred are indeed the key to sex determination.

Despite this early beginning, Coleoptera cytogenetics did not begin to flourish until the second half of the twentieth century. Beginning in the 1950s an increasing number of researchers such as Smith, Suomalainen, Takenouchi, Virkki, and Lanier turned their attention to the field of Coleoptera karyotype evolution and cytotaxonomy. By 1975, these and other workers had documented the karyotypes of thousands of species. It was at this time that the last synthesis of Coleoptera cytogenetics was completed, largely by Stanley G. Smith who was part of the Canadian Forestry Service. However, he passed away in 1976 and was unable to see its publication. His collaborator Nilo Virkki was responsible for the inclusion of much of Smith's previously unpublished work and its eventual publication in 1978 as a volume in the Animal Cytogenetics series. This synthesis contains a list of 2160 karyotypes documented in beetles prior to 1976.

Beetle karyotypes are typically produced through testes squashes, but the karyotype is reported in a way that is unique to the group. For example, a common karyotype is "9+Xy_p". This is called a meioformula and reveals that there are 9 autosomes, an XY sex determination system, and that a small Y chromosome remains at a distance from the X during meiosis. In most organisms, the segregation of chromosomes into the gametes requires that matching paternal and maternal chromosomes pair with one another and recombine, exchanging genetic information between them. This process increases genetic diversity and holds the chromosomes in place until they can be pulled to the two daughter cells.

A large body of empirical and theoretical research predicts that Y chromosomes should degenerate and eventually be lost. Briefly, the presence of genes that have alleles that differ in their fitness in males and females will lead to a reduction and eventual cessation of recombination between most of the X and Y chromosome. Since most of the Y chromosome cannot recombine, that portion begins to degenerate due to forces like Muller's ratchet (the stochastic loss of high fitness chromosomes) and background selection (reduction in variation due to positive selection). Over time, this is expected to lead to the loss of genes on the portion of the Y chromosome that does not recombine and perhaps even the complete loss of the Y chromosome creating an XO sex determination system. However, in one suborder of beetles (Polyphaga) most species have sex chromosomes that pair at a distance and do not recombine. In table 1 the most common sex chromosome systems documented in beetles are described.

In addition to variation in sex chromosomes Coleoptera karyotypes also reveal variation in chromosome number. The lowest documented diploid chromosome number, 4, is found in the elaterid *Chalcolepidius zonatus*. The highest is found in the adephagan *Dixus capito obscuroides*, which has

Table 1: Common Sex Chromosome Systems (SCS)

SCS	Explanation
XY	The X and Y have some region(s) that recombine during meiosis.
Xy	The X and Y have some region(s) that recombine during meiosis, and the Y is distinctly smaller than the X.
NeoXY	The X and Y have some region(s) that recombine during meiosis, and the sex chromosomes are much larger than closely related species. Authors use this annotation when they believe the sex chromosomes have fused with an autosomal chromosome.
Xy_p, Xy_r, Xy_c	Indicate that the X and Y chromosome do not recombine during meiosis, and instead are distinctly separated from one another. The subscript indicates the orientation of the sex chromosomes during meiosis.
XO	Indicate that the Y chromosome has been lost and males have an unpaired X.

a diploid complement of 70 chromosomes. However, the amount of variation in chromosome numbers among clades is highly heterogeneous. Some families such as Scarabaeidae exhibit remarkably little variation, the number of autosomes in this group ranges from 3 to 17 with a mode of 9; 73% of 430 species that have been examined exhibit this number. Meanwhile, other groups like Chrysomelidae exhibit far greater lability, with autosome numbers ranging from 3 to 31 with a mode of 11, but only 16% of the 886 species studied exhibit this mode.

Explanations for this variation among clades has focused on the relationship between the fitness effects of karyotype rearrangements and effective population sizes. Karyotypic rearrangements such as the fusion of chromosomes or translocations of portions of a chromosome are normally associated with a fitness cost. This means that they should be more common in species with smaller effective population sizes (natural selection will be weaker in small populations so they can fix through drift). Several papers beginning in the 1970s attempted to relate the variation in chromosome number to traits that might be important in determining effective population size. One study by Eduard Petitpierre focused on beetles, and showed a tentative relationship between variation in chromosome number and specialized feeding or winglessness.

Since Smith and Virkki's 1978 compilation cytogenetic data for beetles has continued to accumulate, but these records are largely scattered in papers with either narrow taxonomic or geographic focus. This has hampered any attempt to understand large-scale patterns of sex chromosome and chromosome number evolution across Coleoptera. To eliminate this barrier my advisor, Jeffery Demuth, and I created the Coleoptera karyotype database (http://www.uta.edu/karyodb/). This resource now contains 4,797 beetle karyotypes, and we envision it as a long-term repository allowing immediate access to information that was previously scattered among hundreds of journal articles in several languages. Our database allows users to 1) quickly create and download karyotype datasets for analysis with comparative methods, 2) identify organisms that may be interesting targets for future sequencing projects, 3) discover what lineages have been neglected and may be fruitful targets for future cytogenetic and cytotaxonomic research. We have begun using this database to explore the evolution of sex chromosomes and chromosome number in Coleoptera.

Sex Chromosome Evolution:

The variation in sex chromosomes and meiotic behavior that beetles exhibit offer an opportunity to explore the evolution of sex chromosomes across unprecedented time and taxonomic scales. In particular, sex chromosome systems where the X and Y do not recombine offer an opportunity to test the hypothesis that Y chromosomes are lost more frequently in clades that lack recombining sex chromosomes than in clades where the sex chromosomes do recombine. In the first published use of

the karyodb database, we test this hypothesis. We first built a molecular phylogeny for over 1,000 taxa in the karyotype database, and then used comparative methods to model the evolution of sex chromosomes. Our results showed that this widely accepted explanation for the source of XO species did not fit the pattern we observe in beetles. In fact, we observed quite the opposite. Transitions where the Y is lost occur much more frequently from recombining sex chromosomes (XY to XO transitions) than do transitions from non-recombining sex chromosomes (Xyp to XO; figure 1).

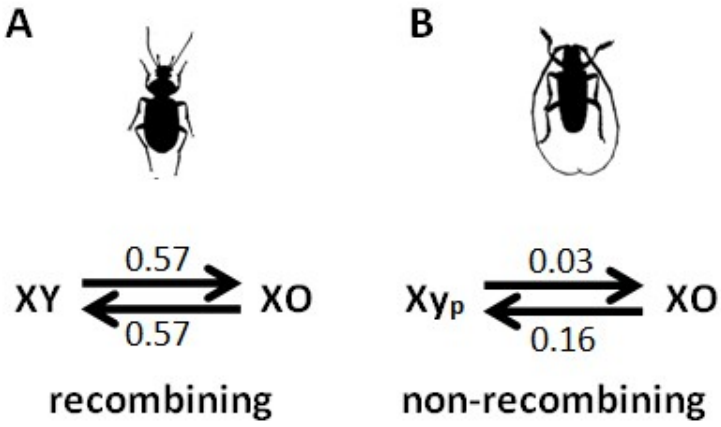


Figure 1: Rates of transition between sex chromosome systems. Rates are probabilities of a transition per 100 MY, in clades with recombining sex chromosomes (A) and those without recombination (B).

This finding led us to reexamine the literature of not only beetle sex chromosome behavior but also behavior of sex chromosomes during meiosis in mammals. Our conclusion from this research is that Y chromosomes that require recombination are fragile. More specifically, our "Fragile Y" hypothesis states that as selection leads to Y chromosomes with a very small recombining region, it increases the opportunity for generation of XO offspring through aneuploidy events. The full description of this research is available in the June 2014 issue of Genetics.

Chromosome Number Evolution:

We built on previous efforts to understand chromosome number evolution by modeling the evolution of chromosome number across beetles using time calibrated molecular phylogenies. This approach is producing the first robust estimates of the rate of karyotype evolution in beetles. We have combined these estimates with natural history data to better understand the driving forces in karyotype evolution in beetles. Preliminary results indicate that the variation in rates of karyotype evolution observed in beetles is strongly correlated with a number of traits that we expect to have large impacts on effective population size. For example, in genera where many species likely have very small effective population size, the rate of karyotype evolution is faster than closely related genera where the effective population size is expected to be larger.

Conclusions:

Despite our ability to now sequence whole genomes karyotypes remain valuable sources of data. Karyotypes are a highly variable and complex trait that offers an opportunity to detect changes in genome organization, uncover phylogenetic history, and distinguish cryptic species. Our initial analyses show that karyotype evolution can be successfully modeled and reveal important insights into the evolution of beetles. Additionally, the variation that we are uncovering in the rates of karyotype evolution may have important implications for understanding the forces responsible for the astounding diversity of some beetle groups. Finally, even in cases where whole genome sequencing is being done, karyotypes offer a quick and inexpensive form of preliminary data. This information can provide important guidance in choosing species that will be most informative in answering specific biological questions. While we continue to make every effort to include all published beetle karyotypes in our database, we also welcome contributions and corrections. You may contact us or submit data at coleochromosomes@gmail.com.

Heath Blackmon
Ph.D. Candidate
University of Texas at Arlington

Diptera Digest

Written by

Eric Eaton

Eric Eaton is a professional writer and entomologist and the principal writer of the *Kaufman Field Guide to Insects of North America.* His focus is mainly on natural history.

He is known around the web as “Bug Eric” and is the author of two blogs: *Bug Eric* and *Sense of Misplaced*

Follow his blogs at
http://bugeric.blogspot.ca/
http://senseofmisplaced.blogspot.ca/

Diptera Digest
The News Bee

”Extra, extra, read all about it. Fly mimics wasp in convincing fashion, creates local buzz.” Such might be the cry from a streetcorner vendor describing the “News Bee,” a type of large syrphid fly found over most of eastern North America. Last week, while vacationing near Atlanta, Georgia, USA, my wife and I were treated to several encounters with this amazing insect.

The scientific name of this fly is *Milesia virginiensis*, and indeed the fly seems to be more common the farther south you go on the continent. The species ranges from Kansas and Minnesota to Ontario, south to Texas and Florida. This is a large insect, measuring 18-28.5 millimeters as an adult.

These flies look for all the world like a large wasp, and could easily be mistaken for a European Hornet (*Vespa crabro*), or queen yellowjacket. Some speculate that this species mimics the Southern Yellowjacket, *Vespula squamosa*, but the workers of that species are substantially smaller than this fly. The queens, on the other hand, make for a better “model” in both size and color pattern. The ominous droning buzz it makes while hovering only heightens the visual mimicry.

Most of the images shown here depict a specimen we encountered last year, on August 23, while hiking the trail to Buzzardroost Rock, a preserve maintained by The Nature Conservancy in Adams County, Ohio. Near the top of the ridge we heard a loud buzzing and saw a large insect hovering in the sun near a large log. Periodically it would perch on

a 

leaf or the ground and only then was it apparent that it was a fly.

Milesia virginiensis figures prominently in American folklore and superstition. It is still known in many hamlets as the "News Bee" or "Good News Bee," for it will sometimes hover in front of a person, as if it were "giving them the news." It is also considered to be good luck if one of these flies alights on your finger. I was surprised that the Ohio specimen allowed me a very close approach, so maybe it is not out of the realm of possibility than one of these insects could perch on a patient person.

Perhaps the idea of these flies broadcasting the local gossip stems from confusion with *real* bees. Another old wives' tale suggests that a bee buzzing in one's ear means that important news will arrive shortly.

Larvae of the News Bee apparently feed in the wet, rotting heartwood of stumps and logs, which might explain why this adult fly showed so much interest in the log. Males might recognize a log as a potential resource for females to lay eggs in, and guard a territory around it.

Two other species in the genus, *M. bella* and *M. sctutellata* range in the southwest U.S. and southeastern U.S. (southeast Oklahoma to North Carolina), respectively.

Milesia virginiensis is also known as the Yellowjacket Hover Fly and the Virginia Flower Fly. While there are numerous records of them visiting flowers like Queen Anne's Lace, Rattlesnake Master, Common Goldenrod, Creeping Thistle, Tall Thoroughwort, Rough Sunflower, Cup-plant, Hairy White Oldfield Aster, Indiancurrant Coralberry, and other wildflowers, I rarely see them nectaring. We did see one on Buttonbush in Georgia, and another on a composite, but the fly was so heavy that the flower sagged under its weight. You are most apt to find the flies hovering in sunny spots in the understory of hardwood forests, or along forest edges. Look for them from May to October, later in the season the farther north you are.

One last bit of trivia: if you are a philatelist, then you might also spot *Milesia virginiensis* on an old (33 cents!) postage stamp issued by the U.S. Postal Service in October of 1999. It was one of a series of twenty commemorative stamps depicting insects and spiders, rendered in exquisite detail by artist Steve Buchanan. How wonderful would it be to receive a "good news" greeting card or letter, delivered courtesy of a News Bee postage stamp?

Eric Eaton

References:

Coin, Patrick, et al. 2012. "Species *Milesia virginiensis* - Yellowjacket Hover Fly," Bugguide.net (http://bugguide.net/node/view/2837)

Eaton, Eric R. and Kenn Kaufman. 2007. *Kaufman Field Guide to Insects of North America*. Boston: Houghton Mifflin Company. 392 pp.

Hilty, J. (editor). 2014. Insect Visitors of Illinois Wildflowers. (http://www.illinoiswildflowers.info/flower_insects/)

Skevington, Jeff H. 2012. "Field Guide to the Syrphidae of Northeastern North America," Canadian National Collection of Insects, Arachnids, and Nematodes (http://www.canacoll.org/Diptera/Staff/Skevington/Syrphidae/Milesia_Rhingia/Milesia_Rhingia.jpg).

MED ENT

Written by

Richard Levine

Communications Program Manager at the **Entomological Society of America** (ESA) and *Entomology Today* editor

Richard Levine is the Communications Program Manager (eNews, job opportunities, datebook, media relations, journal production) at the Entomological Society of America, which involves handling public affairs at the ESA. He is also the editor of the blog *Entomology Today*, a website devoted to the latest news about entomology, produced by the ESA. The mission statement of Entomology Today is to report interesting discoveries in the world of insect science, news and events from entomological societies,.

Check out the Entomology Today Blog at http://entomologytoday.org/

MED ENT
An Interview with Dr. Fiona Hunter, Medical Entomologist

I recently had an email discussion with Trevor Burt, co-editor of the newsletter for the Entomological Society of Ontario, about the field of medical entomology.

"I feel that medical entomology is not featured enough or discussed enough in the society meetings and conferences," he wrote. "It has been overlooked in favor of taxonomy and physiology, and I think it's time to broaden our scope and introduce a fresh perspective."

This was news to me, and I volunteered to help out. As we've written before, diseases vectored by insects have historically killed more people than bombs or bullets, (http://entomologytoday.org/2014/05/26/this-memorial-day-we-salute-the-military-entomologists/) and medical entomologists are trying to do something about it.

Dr. Fiona Hunter, a medical and veterinary entomologist at Brock University was nice enough to answer my questions about medical entomology, especially about how it is practiced in Ontario, Canada. My interview with her follows.

Richard Levine: *How does a medical entomologist differ from others as far as education is concerned?*

Fiona Hunter: A medical and veterinary entomologist is someone who studies insects (and arachnids) that can potentially harm or transmit diseases to humans and animals. This includes both domestic and wild animals. In Canada, where there are very few remaining entomology departments, it is exceedingly difficult to get formal training in medical entomology. In the U.S., one can actually get a degree in medical Entomology!

Dr. Fiona Hunter. Photo by Brock University

I was fortunate to have studied at a variety of different universities in order to gain all of the training that I needed, but it took many years. My BSc was in zoology from the University of Toronto, where I got a solid grounding in whole organism biology, invertebrate biology, entomology, evolution, and ecology.

I also did an MSc at their Botany Department so that I could work on black fly cytotaxonomy and systematics under the late Dr. Klaus Rothfels. He was a terrific mentor and arranged for me to spend a year at the Tropical Medicine Institute at the University of Tübingen in Germany, where I took parasitology and worked in a lab with a World Health Organization black fly research group that studied the role of black flies in the transmission of onchocerciasis (also known as river blindness).
I completed my PhD in biology at Queen's University under the co-supervision of Dr. Jim Sutcliffe, a black fly physiologist, and the late Dr. A. E. R.

Downe, a mosquito physiologist. Essentially, I had to cobble together my own credentials. Today, it is even more difficult for aspiring medical and veterinary entomologists to get the training they need without traveling to the U.S. for their studies.

RL: *So a degree in medicine is not required?*

FH: No, it's absolutely unnecessary. We collaborate with medical experts, but I really find it far more challenging to study the insects and the diseases they transmit from the insect's perspective.

RL: *You wrote to me that "taxonomy is still the cornerstone of our research — morphological, chromosomal and/or molecular." That surprised me a bit because I pictured medical entomologists as being more involved with actual medicine. Can you tell us a bit more about this?*

FH: Often people — including many medical doctors — think that a mosquito is just a mosquito, but that is the farthest from the truth! In Canada, for instance, there are 82 different mosquito species, and each one has its own life history traits. One species never takes a bloodmeal and spends its entire life associated with pitcher plants. Another species preferentially feeds on amphibians, and although it may have enormous larval populations, would never harass humans, nor present a danger of disease transmission to humans.

Because there are so many different species of biting insects, it is essential that we are able to identify them correctly to determine whether they present a threat or not. That is why taxonomy is the cornerstone of our research. My preference is for good, old-fashioned methods of identification based on structural traits. However, the number of trained taxonomists is also dwindling in Canada — there used to be several entomologists in Ottawa at the National Collection who were experts in biting flies, but as these people retired, they were not replaced. Therefore, we participate in establishing molecular tools for identifying the insects so that other researchers can ensure that their identifications are correct.

Canadian edition of *Biology*, co-authored by Dr. Fiona Hunter.

RL: *To be called a medical entomologist, must you work on insect-borne diseases, or is it enough to simply conduct research on insects that are considered to be medically important, like mosquitoes and flies?*

FH: For many years I worked in Algonquin Park and did not really concentrate on any important diseases, except a bird malaria that is transmitted to waterfowl by bird-biting black flies. My students and I were able to study nematodes that infect black flies and even cause feminization of behaviors in infected male black flies. We also studied sugar-feeding preferences of mosquitoes, deer flies, horse flies, no-see-ums (to determine where they get their flight energy from), and so forth. In the lab, we studied rodent malaria transmitted by a species of *Anopheles* mosquito that isn't even found in Canada.

All of this research is what I would call "baseline" research. It wasn't until West Nile virus hit Ontario that we swung into full gear looking at a disease that was actually affecting people here in Canada. Without all of the previous baseline research that my lab had been doing, it would have been impossible to do the "applied" research to determine which species of mosquitoes were carrying West Nile virus.

RL: *I read that you have a level 3 containment lab in order to study mosquitoes infected with West Nile virus. Was it difficult to build such a facility, and what's it like to work in it?*

FH: I asked Brock University if it would be possible to build a level 3 lab back in 2002, and it took just over a decade to get the funding in place and to get the facility built, certified, and up and running.

We are the only CL3 with an insectary outside of the National Microbiology Lab in Winnipeg, so we are very fortunate to have this facility. I currently have five students who work in the CL3 on West Nile virus. The really exciting thing is that we are now prepared to tackle the next emerging vector-borne disease to hit Ontario — and, of course, it is just a matter of time before that happens!

RL: *You mentioned that one of your students is "barcoding" an invasive ceratopogonid species. What does that entail exactly, and how is it useful?*

FH: Another graduate student of mine has the skills (and patience) required to do morphological taxonomy on Ceratopogonidae (or "no-see-ums"). In the first year of his studies, he discovered that there was a species in Ontario that is of veterinary importance. This species was not supposed to be as far north as Ontario, so he is working on a number of different molecular tools to be able to differentiate it from local ceratopogonids so that others can use his toolkit to conduct surveillance for this species.

RL: *You also mentioned working on malaria in Ecuador. Were you in a lab or out in the field, and what kind of things were you researching?*

FH: I had a graduate student (now graduated) who did three summers' worth of field research in Ecuador to determine the distribution of malaria mosquitoes in that country. Again, morphological and molecular tools were used, and she was also a whiz at GIS, so she was able to map everything beautifully.

RL: *I read an article that said you were "one of the few remaining medical entomologists in Canada." Is that true, and if so, why are there so few?*

FH: I think it's because we don't really have training in Canada, and as old medical entomologists at universities retired or died, they were not replaced. Also, the CNC did not replace its experts in biting flies. There used to be a Biting Fly Centre in Winnipeg, but its doors were closed decades ago. It's as if the "powers-that-be" decided that Canada no longer had a biting fly problem, or that there was nothing new to learn about them. That was very short-sighted.

RL: *Is medical entomology in Canada (or in Ontario in particular) in any way different than in the United States?*

FH: I think there actually are quite substantial differences in Ontario vs. the U.S. For instance, we do not really have public support here for using adulticides to kill vector mosquitoes. In the U.S., it has been quite a common practice over the years to use aerial insecticides to kill nuisance mosquitoes, and there are many mosquito control districts in the U.S. Thus, when there are West Nile virus scares, it doesn't take much for aerial insecticides to be used. In Canada — the exception being in Winnipeg, where they've had nuisance mosquito control for decades — the public is not used to aerial insecticides being used. As a result, even in the 2002 and 2012 West Nile epidemics in Ontario, no adulticiding was done.

Overall, medical entomologists in the U.S. are far more involved in making mosquito control recommendations than we are here in Canada. For the record, I don't think the Canadian situation is a bad thing. Let people with proper training and research experience in pest control make those recommendations!

This interview can be found online at *Entomology Today* by visiting:
http://entomologytoday.org/2014/06/19/an-interview-with-dr-fiona-hunter-medical-entomologist/

Richard Levine

Hopper Hot Wire!

Carly Brooke is an animal lover who graduated from the University of California, Los Angeles. She is the author of the blog *The Featured Creature*, where she showcases unique animals The mission statement of the Featured Creature is to introduce you to the rarest, weirdest, and just plain coolest creatures on the planet. Prepare to be amazed!

Follow Carly on her website:
http://www.thefeaturedcreature.com
Or on twitter @ftcreature

Written by
Carly Brooke

Hopper Hot Wire!
Featured Creatures with Carly Brooke

Toothpick Grasshopper
Milkweed Locust
Leichhardt's Grasshopper

Toothpick Grasshopper: Not recommended by most dentists

The Long-headed Toothpick Grasshopper (*Achurum carinatum*). It's probably one of the most fitting names for an animal I've ever come across.

With its elongated and slanted face, sword-like antennae and stick-like body this guy really does look like a living tooth-pick! It even looks like it's handcrafted from wood. Of course, this aids in its ability to perfectly camouflage itself amongst the twigs and branches of the Southeastern United States. It's hard to even spot it at all. Plus, these Toothpick Grasshoppers are tiny – only reaching a length of between 24-40 mm. Check size off the toothpick-lookalike list, too.

Photo credit: **Michael Drummond**

Great job evolution, great job.

Photo credit: **Gonçalo M. Rosa**

Rainbow Milkweed Locust: A real toxic beauty

Meet the Rainbow Milkweed Locust (*Phymateus saxosus*). These absolutely stunning creatures, which reach about 10 cm or so, feature every color of the rainbow; and for good reason. They want to alarm predators (bright colors are bad remember?) by alerting them that they've got a whole lotta toxin flowin' through those grasshopper veins and they should probably keep their hungry appetites looking elsewhere. That's because, like its common name suggests, it feeds on the Milkweed plant, in addition to other toxic vegetation.

Photo credit: **Gonçalo M. Rosa**

The Fanciest Grasshopper You Ever Did See: Leichhardt's Grasshopper

In the Northern territory of Australia is the rugged area of Kakadu. This is where the flamboyantly colored grasshopper, Leichhardt's Grasshopper (*Petasida ephippigera*), resides. It's named after the explorer Ludwig Leichhardt, who first discovered and wrote about this species in 1845. It's a standout from most other grasshopper species with its bright orange body highlighted by deep blues and reds. It does have wings, but rarely uses them to fly more than a few inches of its home.

These hoppers feed on only one type of plant, the pityrodia. An adult will spend most of its life on one plant alone, living first at the base and then journeying up the plant as it grows older. Most of its day is spent basking in the hot Australian sun and feeding. Tough life.

Photo credit: **Jon Clark**

ENT EVO

Ryan Chlebak is a postdoctoral fellow in the Dawson Insect Flight Lab at Carleton University.

His PhD dissertation was on the evolution of insect flight.

Written by

Dr. Ryan Chlebak

Postdoctoral Fellow

Carleton University

ENT EVO
Airing it out through evolution

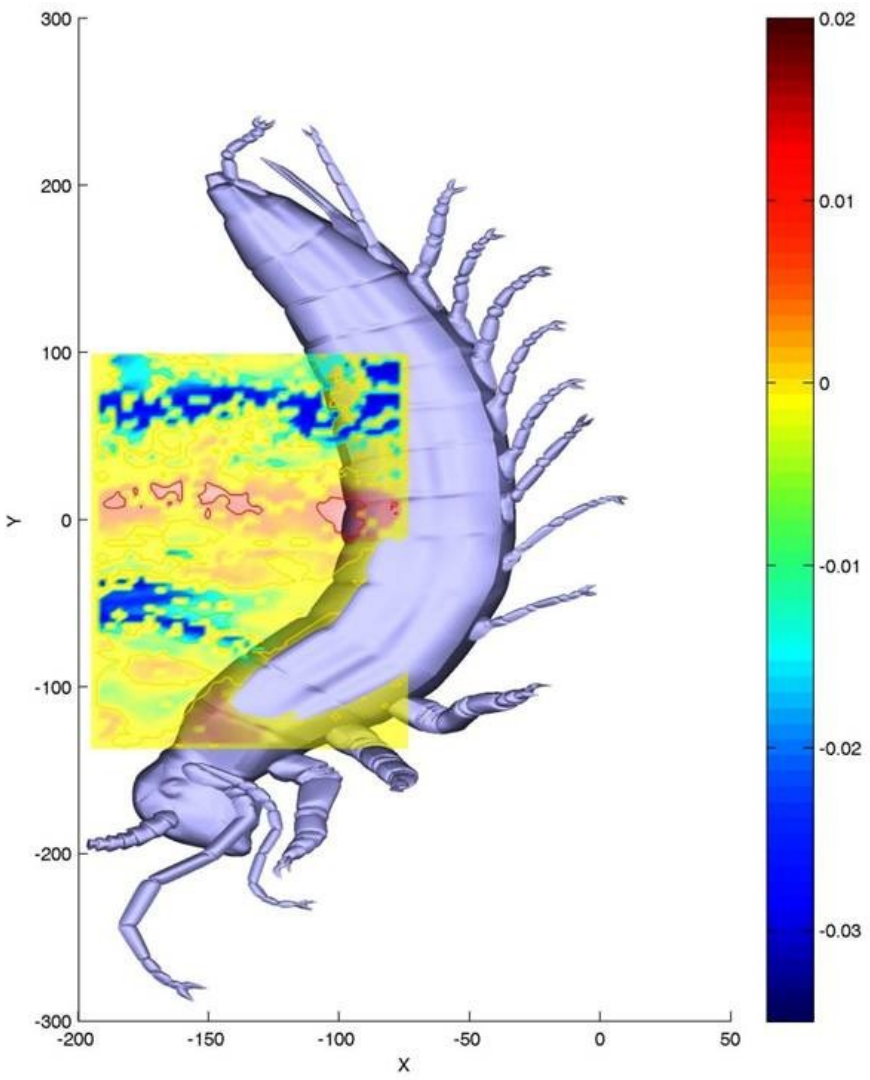
Among the curiosities in nature, how a single lineage of flightless insects diversified into the variety of fliers we see today is nothing short of remarkable. The transition from terrestrial to aerial forms and the possibility that insights about this complex evolutionary story could be gained by using extant 'living fossils', 3D imaging, computer reconstructions and modern flow visualization techniques captivated my interests as a Ph.D. student at Carleton University in the Insect Flight Group, led by Dr. Jeff Dawson. Clearly, the evolutionary progression from flightless to flight capable had to take advantage of incremental benefits to an increasingly aerial lifestyle. This is where I started – by focusing on potential pathways a basal, terrestrial ancestor may have taken into the skies, including the environmental and morphological resources available.

Several suggestions have been made about how the first insect may have taken to the air - gliding from tall structures or "flapping" wing-like structures until airborne from the ground have been investigated as important starting points. More recent focus has suggested "directed aerial descent" leading to gliding as a possibility. The Archaeognatha (jumping bristletails) is the most basal extant insect group and exhibits a body form that is not too divergent from that which is hypothesized to be the ancestral, protopterygote insect. I started my explorations by simply looking at how non-arboreal species of Archaeognatha behave while falling through the air from heights typical of vegetation in the Late Silurian (c. 410 MYA). I found that these 'living fossils' adopted a characteristic dorsoventrally curved body posture while falling that is likely due to specialized abdominal musculature used for jumping and occasionally referred to as 'rope muscles'. I suggest that the earliest "preflight lineage" of insects also equipped with this musculature may have been adopting the same posture while falling.

The Silurian and early Devonian periods exhibited an abundance of semi-aquatic, swamp-like environments and it is not unreasonable that the early protopterygote insects were abundant in these types of environments. Surviving water-landings and traversing water pools may have been an important selective pressure that contributed to an increased aerial existence. I looked at how Archaeognatha behaved when they fell onto still water and when they were 'islanded' on a rock surrounded by water. These observations were remarkable in that they showed Archaeognatha were able to propel themselves along the surface of water and were able to actively jump over or walk onto the water without any external cue. The jumping ability of Archaeognatha has been extensively observed on forest litter and rocky landscapes, so these experiments with water have opened a new door into our understanding of these animals as well as early insect behaviours.

The curved body posture is inherently stable due to the positioning of the centre of mass of the insect while falling and immediately suggests an ideal position for wing-like structures. In this context, wing-like structures would not serve a purpose in correcting or righting orientation while falling but rather, if present, would delay the descent or could alter the descent path. Thus these structures would be drag inducing and there would be a selective advantage for larger structures over time. Benefits of 'slowing down' and 'directing descent' include avoiding landing on water and exposing oneself to predators, and, having to expend considerable energy extricating oneself from the water.

Many important questions now must be considered. What did this protopterygote insect look like? How big was it? Were these wing-like structures



simply fixed or were they able to move? If they moved, would those movements have had aerodynamic consequences? The second half of my doctoral studies looked at these questions.

In collaboration with Dr. Jarmila Kukalová-Peck at Carleton University, a reconstruction of a likely protopterygote insect was developed based upon the closest known flightless lineage to the protopterygote insect, the †Cercopoda. From this sketch, I then used CAD and animation software to create a 3D model that was then rapid-prototyped (i.e. 'printed') in ABS plastic. The 3D model and our ability to print the model in different configurations allowed me to create multiple models in various positions so that I could perform aerodynamic testing. These tests included visualizing fluid flow over the body and limbs as well as force measurements while the model was subjected to flows identical to those of a falling insect.

I found that the splayed limbs and curved body posture seen in falling Archaeognatha, and presumably the protopterygote insect, produced significantly more drag than models without the curved posture or lacking limbs. Further, the curved posture created a region of low pressure above the thorax-abdomen boundary of the model. This low pressure region, which was increased with the splayed limbs, likely explains the increased descent time observed in falling tests with Archaeognatha.

An important question remained regarding the na-

ture of the proto-wings. Several lines of evidence clearly suggest that these structures were articulated and musculated, this leads to an overarching and important factor - they were mobile. With this we built an additional model for aerodynamic testing – one with protowings that could move. Many questions about how protowings flapped (i.e. the wing-tip path, wing beat frequency, and the flexibility or camber of the wings during flapping) but the likely shape of the wing is fairly certain. Our model therefore employed a basic sinusoidal flapping motion without wing twist or camber and we flapped our model wings at a frequency based on observations of wing movements from skimming mayflies.

The model produced higher drag forces with winglets than without, as expected, but more interesting was that when the winglets were flapping the model produced more drag than when the winglets were held stationary and outstretched. This is despite the admittedly 'basic' flapping pattern and lack of wing camber and angle of attack during the stroke; a hallmark of all modern powered fliers. These experiments lead me to believe that an array of small flapping winglets, as was likely present on the protopterygote insect, may have been useful in a variety of ways when considering the environmental challenges and body posture during a jump and fall from a low height. Based on the evidence at hand, one thing is certain in my mind – that gliding is not a precursor step in the evolution of flapping insect flight. The earliest wings were most likely articulated and musculated and my studies have shown that even a crude flapping motion has significant effects on the aerodynamic forces generated during descent. My studies have also shown that whether insects got into the air from a short fall or from jumping, the posture they adopted was likely key to their ability to stabilize and would set the stage for the employment of flapping winglets to alter their fall.

The adoption of powered flight within the insects is truly one of nature's great accomplishments and continues to inspire and tantalize those who choose to investigate its nuances. I genuinely hope my work stimulates great discussion and further questions to investigate how flapping winglets became the incredible wing structures they are in the insects today.

Dr. Ryan Chlebak
Postdoctoral Fellow
Carleton University

Field Season Fix

Written by

Trevor Burt

MSc Candidate
Carleton Univerrsity
Canadian National Collection of Insects, Arachnids and Nematodes

Trevor Burt is a masters candidate at Carleton University. He works under Jeff Skevington (CU & AAFI/CNC Diptera Unit) and Jeff Dawson (CU Biology Dept.) at the Diptera Unit of the CNC.

He studies studies the Family Conopidae (Diptera) of the Nearctic

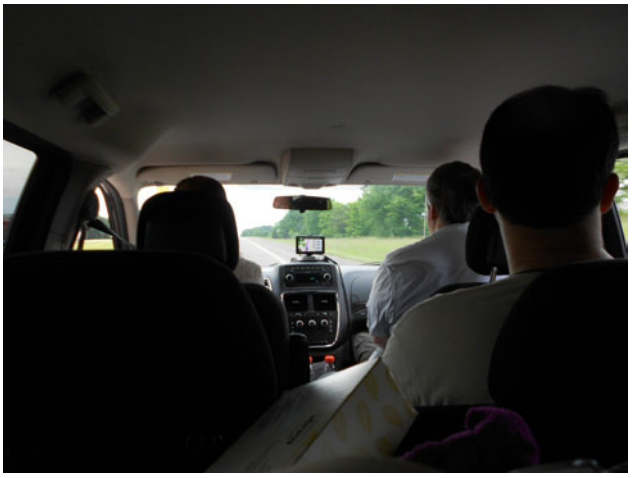
Field Season Fix
Intense Malaise in Tennessee

This is not so much an account of a field season gone awry as it is a tale of precaution set against the backdrop of a "Collection Excursion."

In May, 2013 we found ourselves zipping through Tennessee in a packed Canadian Government van on our way to the North American Dipterist Society Conference (NADS) in Starkville, Mississippi. Our party included: Dr. Jeff Skevington, my graduate supervisor, fearless leader, and birder extraordinaire; Scott Kelso, knowledgebase of all things DNA, and all around cool customer; Leonardo Rocha, a Brazilian PhD comic, and speed-walking enthusiast; and myself, an MSc student, ATM user, and noted after dinner raconteur. I was very excited as this constituted my first trip outside of Canada.

Leonardo Rocha, Scott Kelso, and *Jeff Skevington*, the dapper dipterists.

Suddenly, Jeff veered down a side road having spotted a sign for Cherokee National Forest which covers about 2600 Km^2 (about 655 000 acres!). The thinking was, we might find a couple of decent spots somewhere in this rather dense forest to throw up a few Malaise traps, as Leo and myself had never had the pleasure of setting one up. We travelled along the narrow paved road looking for a good spot to pull off, but none constituted the "sweet spot." After 10 or 15 minutes and several twists and turns we landed on a much narrower road, which was dirt-gravel. Finally we rolled up on a clearing that seemed to resonate with Jeff.



I should note here that we all of us were eager to get into the field and catch whatever we could. The trip thus far felt like a foggy mix of cramped seating, too much candy, an endless montage of Cracker Barrel stops (My God, the Cracker Barrel) and good conversation. Here is an example of what I mean.

We were excited to get to Mississippi and see all the wildlife that we were never exposed to in Canada. I was especially eager to see an alligator, or a

Leonardo Rocha just after setting up his first Malaise Trap. Cherokee National Forest, Tennessee.

tree frog. Scott was just keen to get some entomological field experience. We all wanted to see a Bobcat. Jeff, naturally had a list of birds as long as his arm, and also wanted to see an Armadillo. This prompted Leo to supply us with his musings on Armadillos.

"Everyone thinks they're slow but they are fast," he reported.

"Is that so?" Scott said, moderately impressed.

"Yes, they run away when they see you, and then all you see in the distance is a cloud of dust and dirt as they dig, or dive into a hole." He continued, "They are very nervous."

"Kind of makes you wonder how anyone catches them for study," Jeff wondered.

Leo turned in his seat very animated and giggling to himself. "Yes, yes, they are hard to catch and they have long claws, and once they go in the hole you can grab their tails and pull and pull and you can't get them out. They are strong and dig their claws into the dirt and you can't move them."

"So what do they do?" Jeff asked innocently enough.

Leo was laughing to himself now.

"There is a *way* to get them to let go," he said pointing with his finger in the air. "You come up behind them and stick your finger *in* the asshole! They let go every time!"

To which I said, "How did you figure that out?"

I think that sufficiently indicates the state of things. Needless to say we were excited to get into the 4 PM sunshine and fresh forest air.

Jeff set to work digging out the traps and nets. Once equipped we set up a Malaise trap nearby . We then turned our attention across the clearing toward a wall of Tennessee bush. Off we marched, hurriedly, with conviction, and purpose. We were looking for a river or creek bed to set up our second trap, the idea being that flies use the open space above these waterways as a natural corridor through the heavy brush. Leaving the clearing, we instantly lost the sun to a darkened, moist and humid forest. The air was close, and what sunlight trickled through the canopy fell in strange, changing patterns. Almost immediately we descended a moderately steep slope and found a dry creek bed. What luck!

"This prompted Leo to supply us with his musings on Armadillos"

Still, this was not a great spot. Though a creek bed, it was not well lit, which is critical for Malaise traps to work properly. So we pressed on, follow-

"No, no, we came over from that way"

ing the creek bed, over fallen trees, rotted logs, through brush and webs and scratching branches, stopping here and there when we thought we had something to work with, deciding against the position and heading off. It was at this point that we all realized that we move at different paces.

Putting speed in entomological terms: if Jeff and I were insects we would likely be grasshoppers, or cockroaches, zipping this way and that, whereas Leo and Scott would likely share kinship with lady beetles, or caterpillars, sedentary yet steady.

At last we found a spot after a sharp bend in the creek bed, where the sun had forced its way through the heavy canopy like a spotlight. We could clearly see flies passing through the light. We set up our trap and were quite pleased with ourselves. Then, in unison, we all sort of looked around the forest with not so bright looks on our faces. It appeared that we might be slightly lost. I looked at my watch. It was about 5:30 PM. We had been in the bush around an hour.

"No, no, we came from over that way," Jeff explained pointing to the path of the creek bed.

Fair enough. We felt with good reason if we simply followed the creek bed to the base of the hill we could then turn left and ascend that hill and pour into the clearing from whence we came.

Skip ahead 1 hour.

"I don't get it. We followed the creek bed all the way back," I said. "It should have been right over that hill."

Jeff looked. "Yeah, it was right there."Leo and Scott were somewhere behind us in the distance. At some point we decided that it would be best to leave them behind while we searched for a way out. It was embarrassing how quickly Jeff and I agreed to this option. Now we were standing together trying to figure out how we got ourselves into this.

"I was coming down the hill and I stopped and noted that the sun was over my left shoulder," I said with some authority.

Jeff shook his head. "I couldn't tell where the sun was because it's so dark in here."

"The sun is going down. In about 45 minutes we won't be able to see anything," I said.

"I forgot everything. I never go into the field without something to eat, water, or a compass, but I thought we were just going in and out," Jeff said. "I thought we'd be fine if we just followed the creek."

We were getting worried that we were walking in circles. We kept seeing hills that looked like the hill we came down which skirted the clearing where the van was parked, but every time we ran up a hill it only led to another valley, and then another hill. To make matters worse, we realized none of us had a cell phone with us, and no one knew we were stopping in this forest, and we had completely lost sight of Leo and Scott. We hollered to them occasionally to make sure we could at least yell them out of the bush. They responded and didn't seem remotely concerned.

"If you ever find yourself in a spot like this and you get separated from your party and they don't respond to your yells, do a wolf-howl. The sound travels a greater distance." Jeff explained. "Just make sure your party knows that's what you'll do if you get lost."

"So *they* will either hear me, or a pack of wolves will?"

"So* they *will either hear me, or a pack of wolves will?"

Jeff smiled. At this, I somehow knew we would be alright.

"A group of us were in Australia," Jeff started. "There were about 5 or 6 of us. We were in some rough country, and someone spotted a bird, shut off their truck, jumped out and ran into the bush. We all followed even though we didn't know what he saw. Anyway, all the trees look exactly the same there. There's a clear area with a bit of brush and a tree. You turn around and it's the same thing."

I started looking around the forest. Everything looked like everything else.

"So we saw the bird finally and spent about an hour watching it," Jeff continued. "Then we all stopped and realized we were pretty far from the vehicles, and when that happens out there, it's really serious. I said 'okay, on three point to where the trucks are. 1, 2, 3,' and everyone pointed in a different direction. No one had a compass or a phone or anything. We just had our scopes, so one of us climbed a tree to see if we could spot the vehicles, but he couldn't see them."

"What did you do?" "We did relays, he said. "One guy stays put while the rest go off in different directions. One guy goes about 100 yards or so, and if it looks good another guy will go join him and hold his place while he scouts ahead unless he comes across something that tells him he's gone the wrong way, or he sees the truck, and then you all trace after him. You start in one direction, and if that fails you try another."

"Okay, sounds like a good idea. I will go on ahead," I said.

"I'm on a road!"

Jeff paused a moment to yell to Leo and Scott, who replied from quite a distance away. Jeff pointed in what felt like a random direction, but I took off keeping him in sight, but it was a dead end. I came back and followed another line that looked like it might have been a creek bed leading toward a hill. It was always a mirage.

We operated in this fashion for about 30-40 minutes as the Tennessee sun was dying on a horizon none of us could see. The forest was getting very murky now. I came to a very flat area, still heavily forested and thought to myself that this is nothing like where we came in . . . We *are* lost. I turned right and took 3 steps and found myself standing on a paved road.

"I'm on a road!" I yelled.

I followed it for about 300 yards and by chance came to a T and a sign I recognized. I turned right and followed that for a short time before I spotted the van in the distance. Relief washed over me. I reported that I found the van and waited at the forest edge to guide the others out. Jeff went back a bit for Leo and Scott who then tracked their way back to my occasional yelp. We were all a little worse for wear but we made it out.

Then there was the issue of collecting the traps on our way back up to Ontario a week later. That too was another adventure.

Until next time . . .

Trevor Burt
M.Sc. Candidate
Carleton University

Insect Pollinators

Written by

Tom Hotte

M.Sc. Candidate

Carleton University

Tom Hotte is an M.Sc. Candidate in the Geomatics and Landscape Ecology Lab at Carleton University, under the supervision of Dr. Pierre Mineau and Dr. Lenore Fahrig.

He is interested in the relative effects that agricultural landscape composition and configuration have on insect pollination. He is also researching the effects that the diversity and abundance of bees, syrphids and butterflies have on the same measure of insect pollination.

Insect pollinators: Effects of agricultural landscapes

We are currently witnessing an increasing trend in agricultural intensification in Eastern Ontario. Given the importance of pollination as an ecosystem service (and economic implications to pollination-aided/dependent crops), we need to understand the effect that intensifying agricultural practices can have on it. I am interested in approaching this issue from a landscape ecology perspective, examining how the structure of agricultural landscapes affects insect pollination within them. A landscapes structure has two components in this context: the **composition** (amounts of different possible cover types) and **configuration** (spatial arrangement of cover types) of the landscape. The research goal of this project is to examine the relative effects that agricultural landscape composition and configuration have on insect pollination in Eastern Ontario.

Agricultural intensification (from a landscape point of view) can have a negative effect on insect pollinators through a loss in composition and configuration of the landscape. The landscape composition is affected through the loss of habitat as natural and semi-natural areas are converted to farm field and a reduction of crop diversity as more emphasis is put on large scale production of monoculture crops such as Corn and Soybean. Landscape configuration is affected through the conversion of landscapes with small fields and high edge density to landscapes with large fields and low edge density. We had three landscape level predictors for this project. The configuration of the landscape was measured using the Mean Field Size (mean size of agricultural fields within the landscape, "MFS"). The composition of the landscape was measured with Crop Diversity (an adapted Shannon-Diversity index accounting for the amount and diversity of crop types within the landscape, "CropDiv") and the percent agricultural cover within the landscape ("%Ag"). We predicted that landscapes with larger field sizes (high MFS), more agricultural cover (high %Ag) and low crop diversity (CropDiv) would have lower levels of insect pollination due to loss in spatial complexity and beneficial habitat to pollinators.

Study transect with cereal field on the right and edge on the left

One issue in running a landscape scale study is teasing apart the relative effects of landscape configuration and composition, as without consideration they can be highly correlated. This can be avoided through careful site selection. In this case, potential landscapes were assessed during site selection for landscape composition and configuration, and classified into one of four categories; high-config/high-comp, high-config/low-comp, low-config/high-comp and low-config/low-comp. We then chose equal numbers of sites from each category, allowing us to avoid correlation between landscape configuration and composition effects. This resulted in 47 1km by 1km agricultural landscapes in Eastern Ontario. Landscape metrics were calculated at multiple scales based on a combination of remote sensing and ground level surveys.

We measured insect pollination in each landscape using a phytometer experiment. This involved selecting and rearing species of flowering plant that were dependent on insects to cross pollinate (and self-incompatible), and placing them in our landscapes for a set period of time. We used the seed set of each species as a metric the amount of insect pollination occurring within

the landscapes. Each landscape contained three transects that lay between two actively farmed fields. At each transect we placed 4 pots (one for each species) containing flowering individuals of our phytometer species at local edge vegetation height. After 4 days the plants were retrieved and allowed to develop until the seeds were ready for harvest.

Delphinium flowering in transect

Running a large scale phytometer based project to measure insect pollination is a challenge. You need to ensure that the species of plants you have chosen are self-incompatible, otherwise you will not be able to use seed set to infer the amount of pollination occurring at each site. We chose *Brassica rapa*, *Raphanus sativus* and *Delphinium grandiflorum* to represent local flowering types and colors, while remaining self-incompatible. We also used plant with a vivid red flower, *Papaver rhoeas* in order to see whether or not the pollinators would respond to an exotic differently than flower colours more commonly seen in agricultural field edges. In addition to their self-incompatibility, we chose these species because they were fast growing, and hardy enough to survive in the field. As the goal of this part of the project was to be able to infer the amount of insect pollination occurring in the field from the number of seeds produced, controlling for outside sources of pollination within the greenhouse was essential. While constant care was needed ensure pollinators could not invade the greenhouses from outside sources, we took the precaution of running tests using the phytometer species to see whether or not there was pollination occurring in the greenhouses. While results did not show that there was no insect pollination, they did show that it was minimal and likely had little effect on the project results. Our greenhouses had self-contained units, so that we were able to keep plants that had already gone out in the field and returned away from plants that were not yet ready for implementation.

The other crucial element (learned from experience) is the extent to which the phytometer plants need to be "hardened" (prepared for exposure to the field conditions) before implementation. We began by placing the plants in a fine mesh enclosure outside in direct sunlight for a small period of time, and repeating with a longer period outside each time until the plants were deemed capable of surviving 4 days in the field. In addition to the enclosure, we also made a point to bag open flowers, to make sure that no pollination occurred while the plants were outdoors. Without allowing the phytometer plants time to acclimatize to direct sunlight and outdoor conditions in this hardening phase, the chance of survival in the field was much lower. We also added a water retaining/slow release polymer ("Soil Moist") to the soil to avoid desiccation in the field.

Flowering *P. Rhoeas* with both flower buds and developing seed pods visible

Once we brought the plants back from their day period in the field, the plants were isolated from plants that had not yet gone in the field. This was

done to avoid cross contamination should the plants bring pests back from the field. Fortunately for us, the greenhouses we used were made up of several self-contained units, allowing us a level of compartmentalization in case of pest or pollinator outbreak. An example of this would be the Cabbage White caterpillars that would hatch from eggs laid on plants that had been in the field and were developing seeds. They also proved amazingly able to conceal themselves when pupating. While being greeted by numerous newly hatched butterflies in the greenhouse was pleasant, the caterpillars were a problem when defoliating plants that had returned from the field, and the hatched adults posed a risk for unwanted pollination of flowers throughout the greenhouse should they escape. Netting and constant removal of both larvae and adults were the most effective methods. We also had a large aphid outbreak caused by aphids that had unknowingly infested plants in the field that caused damage to our *R. sativus,* which we dealt with using a biocontrol (one of the most entertaining elements of this project was releasing 5000 Lady Beetles in my greenhouse). Another pest to look out for if attempting a similar project is the Two-Spotted Spider Mite. These pests can undergo rapid population growth given the right conditions, and while you may not notice a small infestation, after the population boom they will become very obvious and damaging to the plants. This pest proved a blow to the *D. grandiflorum* half way through the field season, as the plants ceased flowering to combat the infestation. The greenhouses we used were pesticide free, forcing us to hand wash hundreds of *Delphiniums* in an attempt to control the infestation. While that was not particularly successful, quarantining was the ultimate solution and we were able to complete one round of survey with uncontaminated *Delphiniums*.

The purpose of this project was to examine the relative effects that agricultural landscape composition and configuration have on insect pollination as recorded using our phytometer experiment. The results of this research should provide insight into how agricultural intensification affects insect polli-

Plants in transport

nation in agro-ecosystems of Eastern Ontario. Preliminary results actually suggest that the mean field size and percent agriculture have a positive effect on seed set within two of the 4 species. While the effects are weak, there are nonetheless present and counter-intuitive. This is suggesting that among two of the four phytometer species, seed set is higher in landscapes with larger fields and higher percent agricultural cover, which we did not expect. While I am currently examining multiple explanations for this, one I feel is most likely is that in a resource poor landscape (high MFS, high % Ag), the flowering phytometer plants are simply more attractive to the pollinators present than in a resource rich environment. This results in higher pollination activity than in a landscape with more competition with the phytometer plants. While analysis is still underway, this is a really interesting result and merits further discussion of how the structure of a landscape can affect the biological patterns and processes within it.

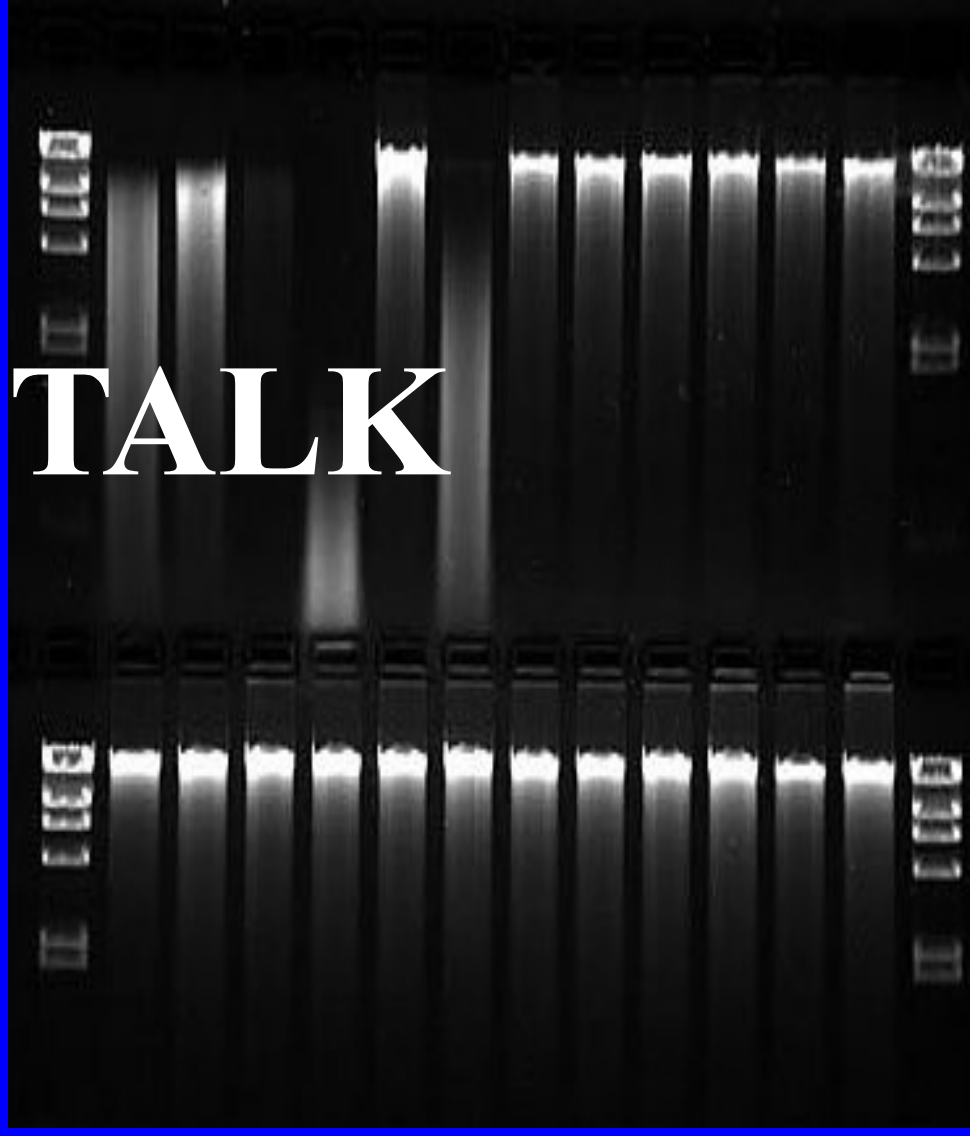
Having grown up in a farming community, I understand the necessity of certain agricultural practices that are harmful to the environment. Given the needs of a growing population, it is not reasonable to expect that this trend will cease. This is why research such as this into understanding how intensifying agricultural practices affect valuable ecosystem services such as insect pollination is so important. It is only through understanding effects like this that we can hope to mitigate them.

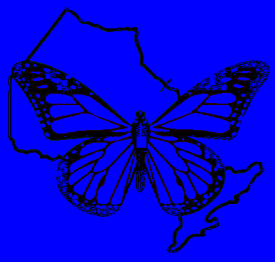
Tom Hotte
M.Sc. candidate
Carleton University

Flowering *Brassica rapa* in transect

Female Praying Mantis found on *R. sativus* when bringing plants back from field (+3 inches long!)

TECH TALK





Written by

Dr. Joel Gibson

Postdoctoral Fellow
University of Guelph

Joel Gibson is the Project Manager and post-doctoral research fellow at the University of Guelph. His research has focused on insect biodiversity and systematics.

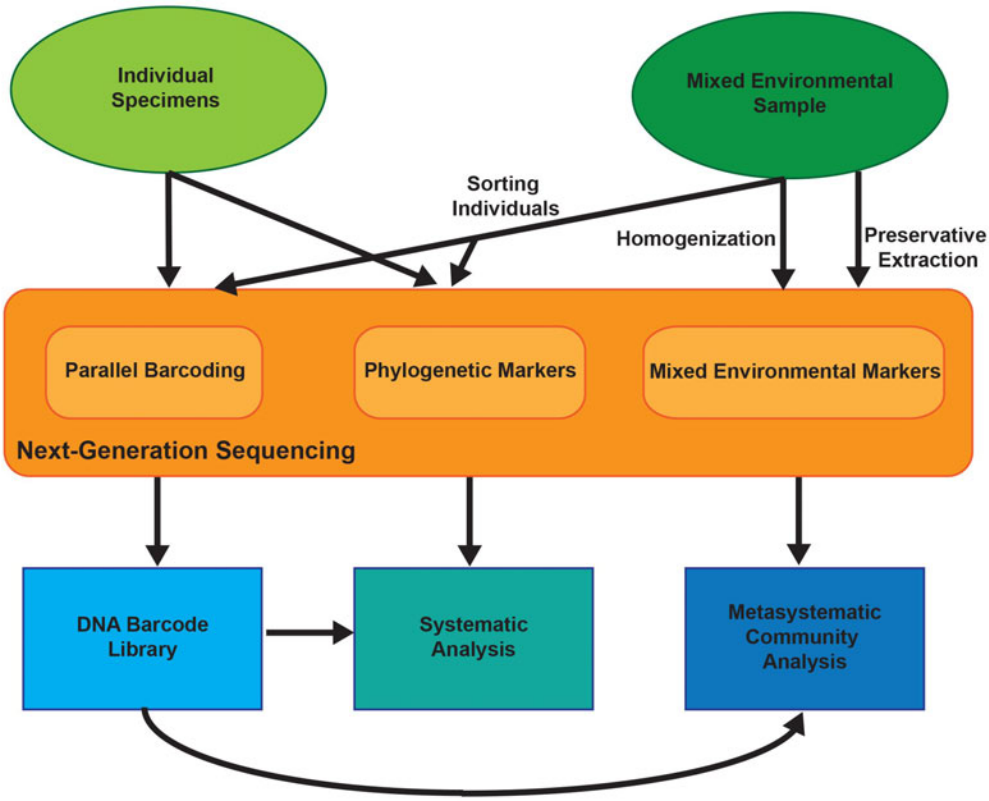
At present, he is working on using phylogenetic relationships to develop improved next-generation sequencing protocols for biodiversity analysis and on using the vast amounts of sequence data available from next-generation methods to explore phylogenetic and ecological relationships in communities of terrestrial invertebrates.

Dr. Gibson is currently running unopposed as president elect candidate of the ESO!

Tech Talk:
Cutting-Edge Genomics for Cutting-Edge Entomology

For some, lab-based research on arthropod systems can be far less stressful and far more rewarding than field studies. It is not just the uncertainty of the weather that leads to this conclusion. Lab studies include one or two known arthropod species, whereas field studies can include any number of unexpected and unidentified species. For those of us working on biodiversity studies, every environment and every sample includes dozens or hundreds of individuals from across the taxonomic spectrum. Identification of these myriad organisms requires expertise and training. Given an excess of both, incredible discoveries have been made from Malaise and sweep samples from around the world. However, when speed and efficiency are required to process numerous mixed arthropod samples, an alternative to individual morphological identification is needed.

The advent of the Sanger approach to DNA sequencing in the 1970s allowed the development of molecular approaches to both arthropod systematics and identification. The past decade has witnessed the birth and rapid development of new approaches to DNA sequencing. Often called 'next-generation sequencing (NGS)', these technologies include a number of options with varying costs and outputs (see a detailed recent review of the technology in Shokralla *et al.*, 2012). Regardless of the specific NGS platform employed, all approaches allow for the production of millions of high-quality DNA sequences from a single, or multiple, mixed samples. The cost to generate NGS sequences keeps dropping and the bioinformatic tools required to process the huge volumes of data continue to become more user-friendly. The question



remains however – what is a forward-thinking entomologist supposed to actually *do* with this new technology?

One recently developed use of NGS technology fits well with what many entomologists view as the best use for molecular data – barcoding. The ability to recover a standardized piece of DNA information for identification purposes is greatly appreciated amongst entomologists of every stripe. Recent research has shown that NGS technology can be used to generate hundreds of DNA barcodes from hundreds of specimens from a single NGS run (Shokralla *et al*., 2014). This parallel barcoding approach promises to only increase in capacity and decrease in cost in the future. The possibility also exists to adapt this approach to conventional molecular phylogenetic approaches involving many individuals and many different gene regions.

An alternate use of NGS technology is the processing of mixed samples. Homogenization (read: blending) of Malaise, benthic, or sweep samples can lead to DNA extraction of the mixture and subsequent NGS. The millions of DNA sequences produced can then be compared to standard libraries and identified to the family, genus, or species level. By using multiple amplification primers from multiple gene regions (*e.g.*, COI, 16S, ITS). This approach has been demonstrated with benthic macroinvertebrate samples (Hajibabaei *et al.*, 2011; Thomsen *et al.*, 2012). Some studies have even been able to make use of these mixtures to investigate both arthropods AND the fungi and bacteria associated with them (Ishak *et al*., 2011; Gibson *et al*., 2014). For those a little squeamish about the thought of blending potential voucher specimens, great strides have been made in the use of only the preservative ethanol from a sample for DNA sequencing (Hajibabaei *et al*., 2012).

Whether for individual identification and phylogenetic analysis or broad biodiversity analysis of arthropod communities, NGS offers a powerful tool for the forward-thinking entomologist. Top labs throughout the world have addressed many of the technological challenges of this approach. Simultaneously, costs to acquire and analyze NGS data have continued to drop. Now is the time to bring the field into the lab, metaphorically speaking, and unleash the power of NGS for entomological research.

Dr. Joel Gibson
Biodiversity Institute of Ontario and
Department of Integrative Biology,
University of Guelph

References:

Gibson JF, S Shokralla, TM Porter, I King, S vanKonynenburg, DH Janzen, W Hallwachs, M Hajibabaei. 2014. Simultaneous assessment of the microbiome and macrobiome in a bulk sample of tropical arthropods through DNA metasystematics. Proceedings of the National Academy of Science USA, 111:8007-8012.

Hajibabaei M, S Shokralla, X Zhou, GAC Singer, DJ Baird. 2011. Environmental barcoding: a next-generation sequencing approach for biomonitoring applications using river benthos. PLoS One, 6:e17497.

Hajibabaei M, JL Spall, S Shokralla, S van Konynenburg. 2012. Assessing biodiversity of a freshwater benthic macroinvertebrate community through nondestructive environmental barcoding of DNA from preservative ethanol. BMC Ecology, 12:28.

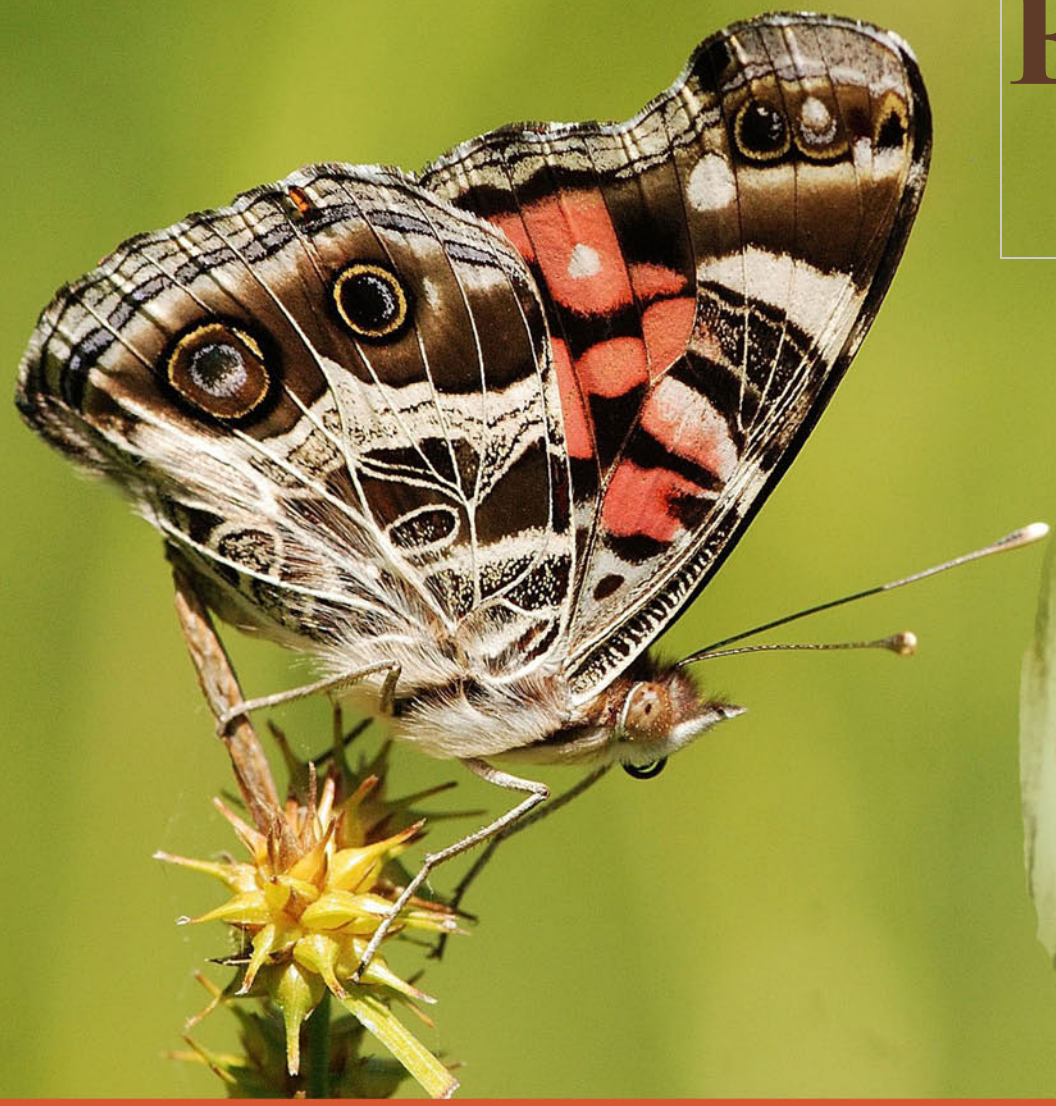
Ishak HD, JL Miller, R Sen, SE Dowd, E Meyer, UG Mueller. 2011. Microbiomes of ant castes implicate new microbial roles in the fungus-growing ant *Trachymyrmex septentrionalis*. Scientific Reports, 1:204.

Shokralla S, JL Spall, JF Gibson, M Hajibabaei. 2012. Next-generation sequencing technologies for environmental DNA research. Molecular Ecology, 21:1794-1805.

Shokralla S, JF Gibson, H Nikbakht, DH Janzen, W Hallwachs, M Hajibabaei. 2014. Next-generation DNA barcoding: using next-generation sequencing to enhance and accelerate DNA barcode capture from single specimens. Molecular Ecology Resources, DOI:10.1111/1755-0998.12236.

Thomsen PF, J Kielgast, LL Iversen, C Wiuf, M Rasmussen, MT Gilbert, L Orlando, E Willerslev. 2012. Monitoring endangered freshwater biodiversity using environmental DNA. Molecular Ecology, 21:2565-2573.

Eyespots



Thomas Hossie is a postdoctoral fellow at Trent University, recently having graduated from Carleton University where he studied the ecology and evolution of eyespots in caterpillars in the Sherratt Lab.

He is the author of the blog *Caterpillar Eyespots*.

Follow him on his website at http://caterpillar-eyespots.blogspot.ca/

Written by

Dr. Thomas Hossie

Postdoctoral Fellow
Trent University

Caterpillar eyespots: More than just spots

The caterpillars of butterflies and moths protect themselves in many spectacular ways. Some caterpillars, like the early thorn moth caterpillar (*Selenia dentaria*), so convincingly resemble pieces of their environment that seasoned entomologists still use the "squeeze test" to determine if they are holding a caterpillar or a twig. Recently I completed my doctoral dissertation studying another caterpillar different defence against predators – eyespots. Eyespots are circular, often paired, markings that to varying extents resemble vertebrate eyes. My first encounter with this defence came from a trip I took to Peru in 2007 where we unexpectedly came across a late instar *Hemeroplanes ornatus* (Sphinidade) caterpillar. This remarkable specimen convincingly resembles an arboreal viper in its late larval instars. I would learn later that Henry Walter Bates, the father of modern mimicry theory, had seen a similar caterpillar during his trip to South America and considered it one of the most impressive mimics he had ever seen (Bates 1862). In addition to Bates, caterpillar eyespots caught the attention of many eminent biologists and naturalists including August Weismann (1882), A. R. Wallace (1889), E. B. Poulton (1890), and Rev. A. M. Moss (1912) each of whom understood eyespots to be defensive features mimicking the eyes of a dangerous vertebrate and thereby intimidating would-be predators from their attack.

Far from being a one-off case of mimicry, eyespots are actually an incredibly widespread phenomenon in butterfly and moth caterpillars. There are examples occurring on every continent except Antarctica, and from numerous families across Lepidoptera, having apparently evolved numerous times. Perhaps the most familiar examples here in Canada are the late-instar tiger swallowtail caterpillars. The Canadian tiger swallowtail (*Papilio canadensis*) purportedly intimidates its attackers by adopting a defensive posture which shows off its eye-like markings, and – when necessary – everts a scented and pigmented organ (the osmeterium) from behind its head. Many naturalists will tell you that this forked structure looks like a snake's tongue and, together with the eyespots, helps to complete the ruse (see Figure 1). Note however that the osmeterium is not restricted to *Papilio* caterpillars with eyespots; other *Papilio* are aposematic (e.g., *P. polyxenes*) but still retain this organ. Of course predator intimidation is a reasonable explanation for caterpillar eyespots, but is it based on anything more substantial than our intuition?

The idea that caterpillar eyespots actually mimic vertebrate eyes as a means for protection from predators wouldn't receive serious theoretical treatment until Pough (1988), who described these caterpillars as snake mimics explicitly, and then again more recently by Janzen et al (2010) who explain that caterpillar eyespots likely mimic vertebrate eyes more generally. Both papers point out that this is probably not a one-to-one model-mimic system like so many we are familiar with. For a small insect-eating bird nearly any snake (any many other vertebrates) they encounter represents a threat, and failing to immediately flee from such a threat could be fatal. Moreover, Janzen and colleagues make the prediction that birds are genetically programmed to innately fear snakes, and to flee when they see certain eye or face-like stimuli. Certainly, it seems reasonable to think that eyespots have arisen in caterpillars by exploiting both the bird's innate fear of their own enemies and the asymmetry of the costs involved (i.e. the cost of losing a meal is far outweighed by the risk of losing their life).

These arguments are compelling, but I could not find any well-replicated studies that had tested the efficacy of eyespots as a defensive mechanism. It seemed like an empirical test was called for - not only to validate that eyespots can protect caterpil-

Final instar *Papilio canadensis* in a defensive posture and deploying osmeterium defense

lars, but also to see how the extent of protection stacks up against other defences like crypsis. Over the course of two summers I conducted field experiments using artificial caterpillars with and without eyespots which were then pinned to trees and susceptible to "predation" by wild birds (Hossie & Sherratt 2012, 2013). These experiments provided the first rigorous experimental evidence that eyespots can effectively deter insect-eating birds from their attacks, although strictly speaking it doesn't tell us *why* they work. Is it possible that the "eyes" we think are deceiving the birds might instead be deceiving us?

In recent years biologists have begun to question the assumed eye-mimicry function of eyespots. Work led primarily by Martin Stevens has shown that aversion of prey bearing eyespots might result instead from predators avoiding prey that bear conspicuous signals (e.g., Stevens, Hardman, & Stubbins, 2008; Stevens, 2007). Stevens argues that avoidance of prey bearing conspicuous signals, such as eyespots, might arise as a result of either neophobia (the fear of novel objects), or dietary conservatism (the reluctance of predators to consume uncommon or new prey). Strictly speaking, to support an eye-mimicry function for eyespots one needs to demonstrate that predators are more wary of prey that possess equally conspicuous, but more eye-like, markings (Stevens & Ruxton 2014). Point taken, but eyespots are not the only trait that has led so many biologists to suggest that these caterpillars are mimetic.

Many caterpillars that have eyespots also adopt defensive postures where the body segments with

eyespots are inflated. It is often suggested that this has the effect of making the anterior of the caterpillar look more like the head of a snake. To test this idea I collected photos of caterpillars in their resting and defensive postures (from Papilionidae, Saturniidae, and Sphingidae), and also photographed real snakes (preserved specimens from the Canadian Museum of Nature collections). This allowed me to compare the shape of the apparent "head" and position of eyespots in the caterpillars to the head shape and position of the eyes in real snakes. Importantly, I could test whether caterpillars look more like snakes in their defensive posture than when at rest. If so it would suggest that the caterpillars adopt this defensive posture as a means to enhance mimicry. All of the caterpillars I examined showed the same pattern: they were more viper-like and less caterpillar-like when in their defensive posture than when at rest (Hossie & Sherratt 2014). To me this seems like compelling support for long-held assertion that these caterpillars intimidate their attackers though snake mimicry.

Of course eyespots are not restricted to caterpillars, and are perhaps best known for their appearance on the wings of many butterflies and moths, not to mention other insects and vertebrates. A few charismatic examples in other insect groups include the eastern eyed click beetle (*Alaus oculatus*), the lantern fly, (*Fulgora lanternaria*), the peacock katydid (*Pterochroza ocellata*), and the spiny flour mantis (*Pseudocreobotra wahlbergi*). Yet, eyespots are conspicuously abundant and diverse in larval lepidopterans when compared to any other group of animals and it remains somewhat unclear why this is the case. There is much still left to learn about these markings and the animals that bear them. In the meantime, to see more examples of this amazing phenomenon, or contribute your own photos to the collection, drop by the Flickr group "Caterpillars with Eyespots" (https://www.flickr.com/groups/eyespots/). To find out more about my work on eyespots you can visit my blog Caterpillar Eyespots (http://caterpillar-eyespots.blogspot.ca/).

Dr. Thomas Hossie
Postdoctoral Fellow
Trent University

References:

Bates, H. 1862. Contributions to an insect fauna of the Amazon Valley: Lepidoptera: Heliconiae. *Transactions of the Linnean Society of London*, **23**, 495–564.

Hossie, T. J. & Sherratt, T. N. 2012. Eyespots interact with body colour to protect caterpillar-like prey from avian predators. *Animal Behaviour*, **84**, 167–173.

Hossie, T. J. & Sherratt, T. N. 2013. Defensive posture and eyespots deter avian predators from attacking caterpillar models. *Animal Behaviour*, **86**, 383–389.

Hossie, T. J. & Sherratt, T. N. 2014. Does defensive posture increase mimetic fidelity of caterpillars with eyespots to their putative snake models? *Current Zoology*, **60**, 76–89.

Janzen, D. H., Hallwachs, W. & Burns, J. M. 2010. A tropical horde of counterfeit predator eyes. *Proceedings of the National Academy of Sciences of the United States of America*, **107**, 11659–11665.

Moss, A. M. 1912. On the Sphingidae of Peru. *Transactions of the Zoological Society of London*, **20**, 73–135.

Pough, F. H. 1988. Mimicry of vertebrates: are the rules different? *The American Naturalist*, **131 Supple**, S67–S102.

Poulton, E. B. 1890. *The colours of animals: their meaning and use especially considered in the case of insects.* London: Kegan Paul, Trench, Trubner, & Co. Ltd.

Stevens, M. 2007. Predator perception and the interrelation between different forms of protective coloration. *Proceedings of the Royal Society B: Biological Sciences*, **274**, 1457–64.

Stevens, M. & Ruxton, G. D. 2014. Do animal eyespots really mimic eyes? *Current Zoology*, **60**, 26–36.

Stevens, M., Hardman, C. J. & Stubbins, C. L. 2008. Conspicuousness, not eye mimicry, makes "eyespots" effective antipredator signals. *Behavioral Ecology*, **19**, 525–531.

Wallace, A. R. 1889. *Darwinism: an exposition of the theory of natural selection with some of its applicaitons,*. London: Macmillan and Co.

Weismann, A. 1882. *Studies in the theory of descent: the origin of the markings of caterpillars.* London: Sampson Low, Marston, Searle, & Rivington.

Insect Bioacoustics

Written by
Amanda Lindeman

Amanda Lindeman is a PhD candidate at Carleton University, in the Yack Neuroethology lab.

She studies acoustic communication in bark beetles.

Insect bioacoustics

"Probably the first definite sounds made by land-animals on this earth were made by insects. Before ever birds sang or even frogs croaked"

Frank E. Lutz (1924)

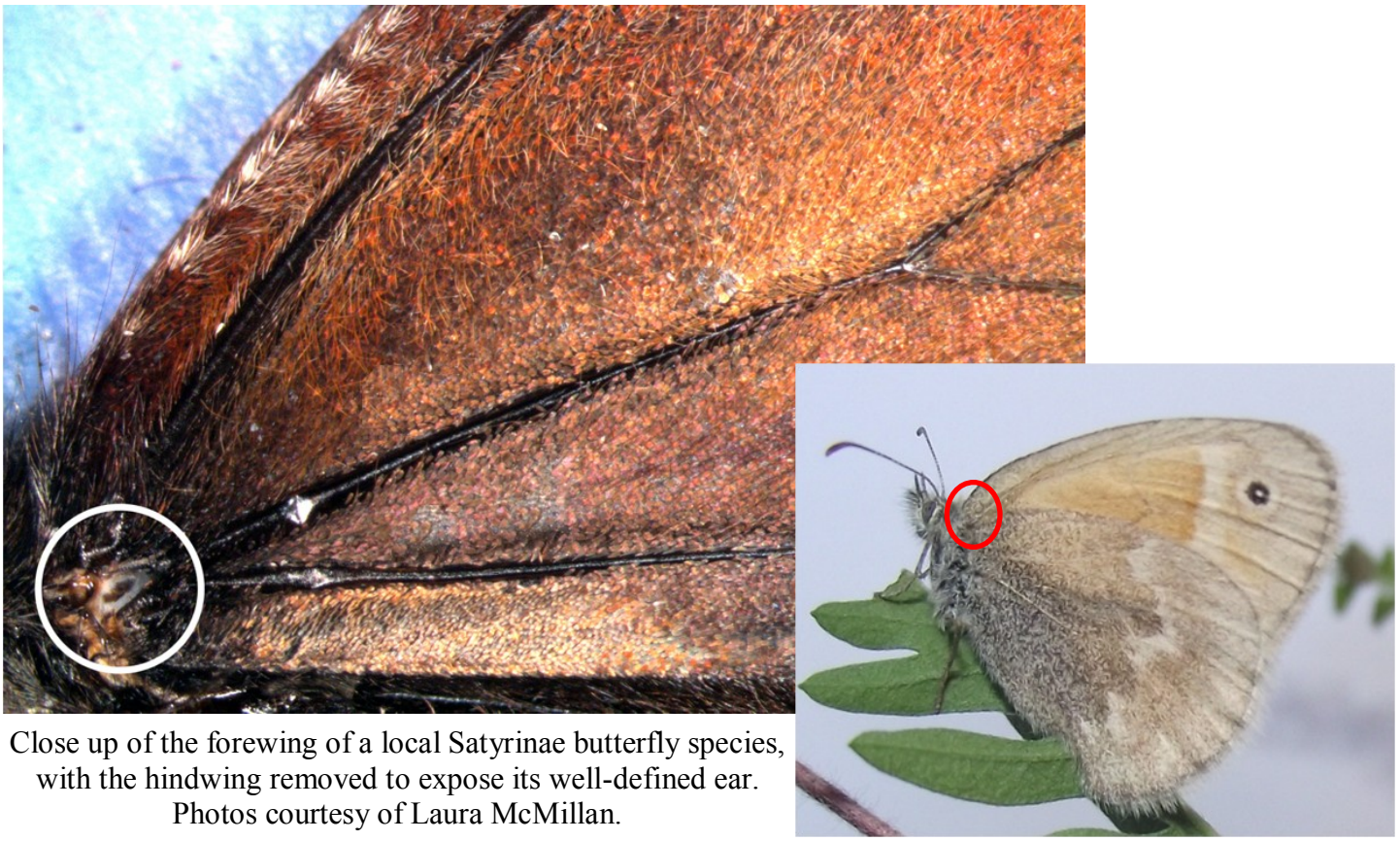
The natural construction of insects makes them inherently noisy - they possess tough cuticle that can rub together with every movement producing sound-waves through the air and vibrations through the substrate. The question of sound production in insects is one that can be readily explored through observation, and there is an abundance of literature spanning centuries describing anecdotes of insects stridulating, drumming, clicking, hissing and buzzing. However, in addition to his above point on how noisy insects are, Lutz (1924) went on to caution that just because an animal is capable of producing sound does not mean that the animal is intentionally trying to communicate a message through sound (1).

Sound Production

There are a few insect taxa containing members who have always been understood to have an acoustic sense (those who intentionally use sounds as signals in communication), even long before the inception of the field of bioacoustics. For instance, who among us, entomologist or not, is not familiar with the chorus of insects that intensifies as the sun sets on summer evenings? Those are the singing insects, which include members of three groups of Orthoptera (Gryllidae, Tettigoniidae, and Acridoidea) and one family of Homoptera (Cicadidae). Their musical talents have been appreciated by humans since Chinese antiquity, where the habit of keeping musical insects as domestic pets first began with crickets (2). Furthermore, scientific interest in insect sounds dates back to Aristotle, who separated Homoptera into two groups based on the presence or absence of sound production (3).

Initially, the study of insect sounds was based mainly on human auditory impressions (4). With the introduction of recording and playback devices to research, scientists have been able to objectively study sound production in insects, even those producing sounds not audible to the human ear (4). It is now known that specialized sound producing organs have evolved independently many times within insects. There are now many examples of unlikely animals in fact being highly acoustic. Soft-bodied larva of holometabolous insects, for example, might not leap to mind when one thinks of noisy insects. This is perhaps why the discovery of sounds being emitted by such individuals is always of great interest, and has yielded an abundance of reports in the literature over time (even the very first volume of the Canadian Entomologist included two reports of "musical larvae" (5,6)). To date, there is an ever growing body of evidence

A silk moth caterpillar (*Antheraea polyphemus*) rearing back while producing clicking noises, likely as part of an anti-predation display



Close up of the forewing of a local Satyrinae butterfly species, with the hindwing removed to expose its well-defined ear. Photos courtesy of Laura McMillan.

suggesting that sound production in larval Lepidoptera is widespread. Moreover, not only do these incredible sound producing larva produce sounds, some species can produce *complex* sounds by sequentially or simultaneously employing multiple sound-producing mechanisms that can emit multi-component acoustic signals varying in temporal, spectral and amplitude domains!

There are diverse functions for production of sounds in insects. Most commonly studied are those sounds that are employed as part of sexual behaviour (7). However, sounds may play a role in many intraspecific contexts depending on the species, including aggression, territoriality, grouping/spacing behaviour, etc. Additionally, there are many interspecific contexts in which sounds may play a role as part of defensive strategies including startle, aposematic warning, etc. (8).

Hearing

Just as the production of a sound does not necessarily mean that the sound is intended for communication (i.e. a signal vs. a cue), the sounds produced by an organism may also not necessarily be audible to that organism in the sense that it has a nervous mechanism capable of hearing. Even within the last century, there were still researchers who were uncertain as to the extent of the acoustic sense in insects and whether they could in fact communicate using this means. Lutz (1924) wrote that "whether insects themselves hear... is an important question and one that has not been - possibly cannot be - determined beyond all doubt." (1) Despite the cynics, by that time there had been many accounts, anecdotal or experimental, of insects *responding* to sound and therefore implying a power of hearing. One notable example was when Johann Regan in 1913 used the newly invented telephone to demonstrate that when a male cricket sings to a female over the phone, she will approach her phone's earpiece (9). Consequently, in response to the doubts of Lutz, his contemporary W.S. Bristowe (1925) wrote: "Are we to explain the facts to our satisfaction by a series of strange coincidences, or by admitting our inability to discover the organs of hearing in insects and spiders up to the present time?" (10)

As history would have it, Bristowe was the one who was correct. To date, there are many examples

of insect ears and conclusive evidence that many insect species use sounds as a means of intra- and interspecific communication. There are three main types of ears an insect may possess (see 11): (1) Tympanal ears. These are similar to vertebrate ears in that they involve an eardrum (tympanal membrane) to detect far-field airborne sounds; (2)Near field sound receptors. These are often found in the antennae of some insects, and are most commonly used to detect the wing beats of a conspecific, predator or parasite; and (3) Vibration-sensitive organs. Vibrational communication is believed to be ubiquitous among adult and larval insects, and these types of acoustic receptors are thought to be widespread. To conclusively determine that a structure is indeed an auditory receptor, Yack and Fullard (1993) set three criteria to be met: "first, a morphologically differentiated receptor system should be identified; second, this sound receptor should respond neuronally to sounds of biologically relevant frequencies and intensities; and third, the putative ear should mediate an adaptive behavioral response to sounds" (12).

Using these rules to identify true insect ears, we now know that hearing (of both air- and substrate-borne vibrations) is widespread among insects. For instance, tympanal ears alone have independently evolved at least 19 times and show great diversity in both location (found almost everywhere on the body including legs, wings and mouth parts) and structure (13). And with tympanate hearing being is the most studied and best-described of the three types (due to the fact that they are present in the insect that produce the far field sounds most conspicuous to humans, e.g. as for the singing insects; 11), one can imagine how long and diverse would be the actual list of eared insects.

Application of knowledge

Now that we are learning just how paramount the acoustic environment is to many insects, we are able to apply this knowledge to many areas of entomological research and management. For instance, the acoustic sense can be used against those pest insects that rely on acoustic signals as a means of controlling them. A vast number of management programs exist where acoustic technology is used to monitor pest insect presence/abundance, as well as to attract and trap them and to interrupt intraspecific acoustic communication and disrupt life history cycles. In basic research, knowledge of acoustic signals can be applied to studies of insect ecology, cell biology, biosystematics and evolution (7). Thus, working towards an understanding of insect acoustic behaviour is not only inherently interesting, but also an important building block for many theoretical and applied areas of entomology.

Amanda Lindeman
PhD candidate
Carleton University

References

(1) Lutz, F.E. (1924) Insect sounds. *Bull. Am. Mus. Nat. Hist.* 50:333-372.
(2) Laufer, B. (1927) *Insect Musicians and Cricket Champions of China*. Field Museum of Natural History, Leaflet 22.
(3) Myers, J.G. (1929) *Insect Singers: A Natural History of the Cicadas*. George Routledge and Sons, London.
(4) Alexander, R.D. (1957)Sound production and associated behaviour in insects. *Ohio J. Sci.* 57 (2):101-113.
(5) Reed, E.B. (1869) A musical larvae. *Can. Entomol.* 1(5):40.
(6) Sanborn, F.G. (1869) Muscial Larvae. *Can. Entomol.* 1(6):48.
(7) Claridge, M. (2006) Insect sounds and communication - an introduction. In S. Drosopoulos and M.F. Claridge (eds.) *Insect Sound and Communication*. Boca Raton: CRC Press. p.3-10.
(8) Masters, W.M (1979) Insect disturbance stridulation: its defensive role. *Behav. Ecol. Sociobiol*. 5:187-200.
(9) Huber, F. & Thorson, J. (1985) Cricket auditory communication. *Scient. Am.* 253: 60-68.
(10) Bristow, W.S. (1925) Sound production by insects. *Nature.* 2896(115):640-641.
(11) Yack, J.E. & Dawson, J.W. (2008) Insect ears
(12) Yack, J.E. & Fullard, J.H. (1993) What is an insect ear? *Ann. Entomol. Soc. Am.* 86(6):677-682.
(13) Yager, D.E. (1999) Structure, development and evolution of insect auditory systems. *Microsc. Res. Tech.* 47:380-400.

The ESO Board of Directors gathered at the **2011 AGM** ; note **Gary Umphrey's** festive shirt. Photo: *Morgan Jackson*.

A Brief (recent) history of the ESO as told by your newsletter

Unfortunately the Bi-annual (sometimes tri-annual if an editor is feeling ambitious) ESO Newsletter (NL) dates back to a time when computers and the internet were less pervasive , and therefore many of those early issues have been lost.

We presume the NL is at least 19 years old if we accept that each Volume (Issues I & II) represents a year published. This would mean that the NL has been up and running since about 1995 if my math holds. The internet was in its infancy, and the personal computer was really only becoming a widespread idea. I personally recall seeing my first laptop sometime in 1998, and it was a large, heavy, clunky box.

Jim Brett ESO member and long-time executive. Jim has been the **ESO Librarian and Archivist** since **2007** (7 years).

We have digital copies (PDF's) of every NL issued since 2001 starting with Volume 6, Issue II. It stands to reason someone purchased a computer between V6 issue I, and issue II, or there was a change of NL editors between issues. There is no record within the V6-II to indicate who the editor was at the time. We don't get a record, or recognition of the Editor, until 2002, V7-I, with the appearance of **Neil Carter**.

In the following issue (V7-II), interestingly, we see in the New ESO Member announcement section, the sudden appearance of **Jim Brett**, who goes on to become an integral ESO Executive, our Society's Librarian and Archivist. **Jayne Yack** from Carleton University is another member of note for 2002.

In 2003, **Dana Gagnier** took over as NL editor and instantly expanded it from 8 to 12 pages in Issue I, and to 14 pages for Issue II, and dressed it up a bit with pho-

tos and graphics. This also appears to be the first time that a 3rd Issue was produced in a Volume.

Jennifer Allen accepted the task as editor in 2005 for V11-II, and maintained her predecessor's improvements while adding new and interesting news articles, and most importantly actively sought submissions from burgeoning writers and insect enthusiasts. Jennifer apparently realized that the NL could be much more.

Interestingly, in 2007's V12-II, our very own **Morgan Jackson** makes his first appearance with an Honourable Mention:

THE FRUIT FLIES OF ONTARIO (Diptera: Tephritidae); AN INTEGRATION OF MORPHOLOGICAL AND MOLECULAR IDENTIFICATION. **Morgan D. Jackson**, Stephen A. Marshall and Robert Hanner.

We also see **Jeff Skevington** appear as newly elected Director for 2007-09.

In this same issue Jennifer published what amounts to a scientific article:

Kimoto, T., Humble, L.M., & Bullas-Appleton, E. 2005. Insect Rearing: Tool for Detection of Non-indigenous Wood Boring Insects. *ESO Newsletter* 12 (2): 12-13.

2009 saw the appearance of some of the most *active* ESO members in recent time.

Reported in V14-I, a young go-getter named **Joel Gibson** accepts the role of Student Representative to the ESO. As you know, Joel continues to be very active in the Society and most recently was elected Director for 2012-14.

In the same issue, **Jeff Skevington** and **Hanna Fraser** were nominated as Presidential Candidates (with Hanna accepting the President's role in 2009, and Jeff in 2012), our 2014-15 President-elect, **Ian Scott** as a Director (2010-2012).

Crystal Ernst was also reported as a "Missing Member" in 2009, but thankfully someone found her.

Shiyou Li also accepted the role of Treasurer in 2009 from long-timer **Kevin Barber** . Shiyou is Treasurer to this day.

And last and certainly not least, longstanding Secretary **David Hunt** handed off the solemn duty to **Nicole McKenzie**, who held that position until the fall of 2013 at which time she was several months pregnant. She was replaced by the diligent **Michelle Locke**, our current Secretary. Incidentally, Nicole was just settling in as Secretary when Michelle was elected Student Representative. She has come a long way.

Thomas Onuferko with his MSc Supervisor, **Dr. Miriam Richards** at Brock University, both ESO members. Miriam was the Editor of JESO for many, years, and now Tom is stepping in as Technical Editor all these years later. *Photo: Courtesy of Dr. M. Richards.*

2010 was another major year of change for the ESO. Jennifer Allen stepped down as Editor of the NL after a span of 5 years (2005-10). Jennifer had taken the NL and made it her own, setting the standard for all those who followed. **Angela Gradish** replaced her and worked diligently to maintain that excellent tradition for another 3 years, introducing many new ideas of her own, including the Featured

Jeremy McNeil runs for **ESO President** in **2012**

ESO Member section.

Our current President, **Jeremy McNeil** was also elected a Director for 2010-12, with **Bruce Gill** serving as President. **Jess Vickruck** took on the task of Technical Editor of JESO under the JESO Editor and ESO lifer, **Miriam Richards** (See a Special Thanks to Jess Vickruck, p. 93). She worked on the Journal up to and including this year (2014).

Also, in 2010, longtime ESO Webmaster **Barry Lyons** passed the reigns to **Morgan Jackson**, who

"Miriam had one of the longest running tenures of any ESO executive."

reworked the website to better suit the modern needs of the Society and it's members. Morgan held this position dutifully for 4 years, including during the chaos of the **ESC-ESO Jam** in Guelph. It is fairly common knowledge that without Morgan's assistance the 150th AGM would not have been as good as it was (See A Special Thanks to Morgan Jackson, p. 92.); his contribution to the ESO cannot be overstated.

In the spring of 2014 Morgan stepped down as Webmaster to focus on his PhD work. I (**Trevor Burt**) replaced him, though I still cannot help but bother him for a variety of reasons.

In V16-I the ESO announced that longtime JESO Editor, **Miriam Richards** was stepping down. Alongside **Jim Brett** (Librarian and Archivist), **Kevin Barber** (Secretary), **Barry Lyons** (Webmaster), Miriam had one of the longest running tenures of any ESO executive. Enough cannot be said for her contribution. She was replaced by ex-ESO President and Director **John Huber**, who is still working on the Journal today.

In 2010 the **Bug Eye Photo Contest** (V15-I) was born, and we have had some amazing entries every year since, including the cover of this very issue supplied by **Crystal Ernst**. Thankfully, **Sophie Cardinal** (one of our very active current Directors) has graciously spearheaded this ESO favourite for the last couple of years. Arguably there would be no Bug Eye Photo Contest without Sophie.
2011 saw **Jeff Skevington** run for President and win, becoming the President-elect in 2012 under **Bruce Gill**, right around the time that I was for-

mally introduced to the Society. I had been a member since about 2008. The 2012 AGM was my first introduction, and needless to say, it was memorable.

At this time, **Jeremy McNeil** became the President-elect; **Sophie Cardinal** ran for a Directorship, along with **Brent Sinclair**, and **Wayne Knee**.

Student member **Thomas Onuferko** was granted a Travel Award, along with **Miles Zhang** at the 2012 AGM. Today, Thomas has agreed to take over for Jess Vickruck as Technical Editor of JESO, under John Huber.

In the spring of 2013 I ran as Student Representative against **Lauren Des Marteaux** (V18-I). Lauren graciously won and took the seat at the following AGM in Guelph. She has been doing a great job since and brings a lot of spirit and energy to the post. Sometimes, when I'm feeling bad about the defeat, I like to comfort myself by equating her victory to the candidate photo I submitted to Angela for the NL (V18-I); as you can see I look like a serial killer who enjoys a good cup of coffee (pictured left). Nevertheless, at the 2013 meeting I was nominated as ESO Newsletter Editor alongside **Amanda Lindeman**. We both humbly accepted the roles as Co-Editors, working together to squeeze the most out of the NL.

For our first issue (V19-I) we tried to maintain the style and tradition that our predecessors had established, and this was made all the easier with the aid of **Angela Gradish.**

For issue II (V19-II) we decided the NL could do much more, thinking back to the ground covered by Jennifer Allen during her tenure. We decided to rebrand and reshape the NL to make it more accessible and exciting for members. Up to this point, the NL has only been about 8-14 pages, mainly black text on a white background, giving general updates and ESO news; just what you would expect. Amanda and I have attempted to restyle the NL after a science magazine (80-150 pages), with ESO-specific content. Our thinking is that more than just members will read the newsletter in this format, and then, they might be more inclined to become ESO members.

The ESO Newsletter is a sort of informal chronicle of the Society in a personal way that JESO or the ESO Website are not. There are some great stories and wonderful images of, and about, members having a blast at AGM's, getting a paper published, or receiving an ESO Award. Often they serve as markers for those who have passed, like **Dr. J. Richard Vockeroth** (V17-II), or **Dr. Sydney Camras, M.D**. (V19-II). Their memorials have been written by friends and colleagues, not strangers.

Good times and great times, and sometimes less so, are well documented in the NL up to this point. It's a shame we do not have more that reach back to our origins.

There are many people who I did not mention in this short history (**Pat Bouchard**, **Andrew Young**, **Christine Bahlai**, **Rose Buitenhuis**, **Antonia Guidotti**, to name a few), but they are so omitted only out of ignorance and space constraints. And then there are those special characters like **Gary Umphrey** whose dedication and festive shirts deserve an article all their own.

Read all the digitized NL's from 2001 onward on the ESO Website.

Trevor Burt
Co-Editor
Webmaster

2014 Electoral and Fellow candidates

President Elect Candidate: Joel Gibson

Dr. Joel Gibson, University of Guelph

Although still at an early phase of my academic career, I have been working in the science of entomology and specifically with the ESO for more than fifteen years. My elementary and secondary school years were spent mostly outdoors in and around St. Thomas, Ontario. I completed my B.Sc. in Wildlife Biology at the University of Guelph in 1999. While in Guelph, I was employed at the Insect Collection as a student curator. Following an internship with the US Geological Survey in Hawai'i Volcanoes National Park, I enrolled at Iowa State University. I completed a M.Sc. with a thesis examining the systematics of Southeast Asian aquatic flies. Upon returning to Canada in 2002, I completed a B.Ed. at the Ontario Institute for Studies in Education at the University of Toronto. I then embarked on a career as a high school Science and Biology teacher. After four years of hard work in the classroom, I decided to refocus on my own education. I began a Ph.D. programme in 2007 working at Carleton University and the Canadian National Collection of Insects. Since completing my doctoral thesis in 2011 I have been employed as a Project Manager and postdoctoral research fellow at the University of Guelph.

My research has been chiefly on insect biodiversity and systematics. I have investigated the evolutionary biology of three different families of beetles and flies.

My current research focuses on using phylogenetic relationships to develop improved next-generation sequencing protocols for biodiversity analysis and on using the vast amounts of sequence data available from next-generation methods to explore phylogenetic and ecological relationships in communities of terrestrial invertebrates.

Outside of the lab, I have sought to contribute as much as possible to the entomological community. I have been involved as a presenter or organizer at dozens of regional, national, and international scientific meetings. I have also been invited as a guest lecturer for elementary and secondary school classes, undergraduate courses, and amateur entomological and naturalist groups.

I served as Student Representative to the ESO board from 2008 to 2010 and as Director from 2012 to 2014. I also served as co-chair of the Scientific Programme Committee for the 150th Anniversary ESO-ESC JAM held here in Guelph last October

If elected as President-Elect of the ESO, I look forward to filling my term with valuable contributions to the state of entomology in Ontario. I would like to help increase the ESO's presence in both the online world and the real-world communities of which we are a part. The further development of our flagship journal will ensure its continuation as the oldest entomological publication in North America. This development will proceed hand-in-hand with the major strides that have recently been taken by the ESO board (and webmaster, Trevor Burt, in particular) to update and optimize the ESO website. I also anticipate continued development of our community outreach events (i.e., Bug Days) and Annual Meetings.

Director Candidate: Jocelyn Smith

Jocelyn Smith , UoG Ridgetown College

I have strong ties to Ontario agriculture and am rather passionate about it. Both of my parent's families have a long history of farming in south-western Ontario, and in 2012 I bought my first farm so that I could join the family business growing corn, soybeans, wheat, and sugar beets. It was the 3rd year "Natural History of Insects" course at Guelph that steered me into entomology and inspired the rest of my undergraduate and graduate studies, not to mention summer and post-undergraduate jobs. I felt that studying a science that is so fascinating and important to agriculture was the perfect fit for a career for me; so I've never left.

Since completing my M.Sc. at Guelph in 2006, I have managed the field crop pest management research program at the Ridgetown Campus of the University of Guelph under the direction of Dr. Art Schaafsma. My research activities include collaborations with agricultural commodity organizations, seed and crop protection industries, researchers in Canada and the US, and OMAFRA specialists on both basic and applied management of key pests of corn, soybeans, and wheat. I lead the monitoring program on susceptibility of Western corn rootworm and European corn borer to transgenic Bt-corn in Canada. I am also currently working part-time on my PhD studying aspects of the biology and management of a new corn pest in Ontario, Western bean cutworm. I am currently an executive member of the Canadian Corn Pest Coalition which is a working group of government, academic, industry, and producer representatives committed to stewardship of corn pest management technologies, strongly focused on IRM for transgenic corn.

While pursuing my career in entomology I have met and learned from so many great people within this field in Ontario and elsewhere. I've been an ESO member since 2006 and would be very pleased to serve as a director and become more engaged in the organization.

Dr. Dave Beresford, Trent University

Director Candidate: Dave Beresford

I am from Peterborough Ontario, and live on a nearby beef farm where I conducted my graduate research. During my undergraduate years I nursed a passion for dragonflies. Afterwards, I ran my own business for ten years, then I returned to my studies, entering graduate school in 1997 under the supervision of Jim Sutcliffe at Trent University. I graduated in 2006. My PhD thesis examined the overwintering success and population dynamics of stable flies on dairy and beef farms in southern Ontario, and I have been involved with biting flies of one kind or another since that time – usually as bait!

I have continued my stable fly research, I am developing a stable fly matrix population model using degree day time steps, and have published my research in Journal of Economic Entomology, Journal of Medical Entomology, Journal of Dairy Science, Oikos, and JESO. I am collaborating with my American colleagues on a wide scale

(Continued on page 64)

phenological study of stable fly emergence and population growth. This work takes place on the farms in the Peterborough area.
My other research looks at species diversity for conservation purposes, focusing on Tabanidae diversity in the Hudson Bay lowlands region of Northern Ontario. To this end, I spend much of my summer at an MNR field camp on Akimiski Island in James Bay. One of my graduate students is studying the insect diversity in the Ring of Fire region of Ontario, a second study is looking at the effect of biting flies on caribou avoidance behaviour. My other two graduate students are working on forensic applications, one with carrion beetles (*Necrodes surinamensis*) and the other on blow fly diversity across Canada in cooperation with the OPP and the RCMP.
At Trent University, I teach introductory entomology, forensic entomology, biology of invasions, and invertebrate biology. I currently have four graduate students, and have supervised over 30 undergraduate thesis. I have been privileged to have had great students over my past several years of teaching. Three of my students have published in JESO, and I am very proud of their continued post-graduate success.
I am delighted with this opportunity to submit my name as a Director. If I get elected to this position, I will bring the same enthusiasm and dedication that I bring to all my endeavours.

Director Candidate: Justin Renkema

Dr. Justin Renkema, University of Guelph

I am currently the Webster Post-doctoral Fellow in the School of Environmental Sciences at the University of Guelph. As a member of Rebecca Hallett's lab, I am investigating the chemical ecology of spotted wing drosophila, a nasty new generalist pest of fruit crops in Ontario and most of North America and Europe. Last summer we captured another new fruit fly, African fig fly, for the first time in Ontario and Quebec that also has potential to become a fruit pest (check out our article in the 2013 edition of JESO). I completed my PhD at Dalhousie University, spending many hours in blueberry fields capturing blueberry maggot and experimenting with management practices to conserve natural enemies. I spent a year as a post-doc at the Dalhousie Agricultural Campus in Truro, NS learning molecular methods in order to do gut-content analysis of predators for evidence of pest predation.
I grew up in small-town, agricultural southwestern Ontario where at Ridgetown College, University of Guelph, Art Schaafsma introduced me to the world of applied entomology through employment as a summer student. I then undertook an MSc and investigated the spatial distribution of and insecticide efficacy for European chafer grubs in field corn. Other entomological achievements include: discovering a new rove beetle species, *Pella glooscapi*, in a blueberry field in NS, working in Belize on sphingid moth identification and host-plant associations with undergraduate students and the Natural History Museum in London, and being responsible for pest management as an intern on an organic vegetable farm in Ontario.
I was a student member of the ESO during my MSc and upon returning to Guelph was excited to rejoin this excellent group of entomologists. During my graduate work in NS, I participated in the Acadian Entomological Society (an almost as excellent group of entomologists) and was on the Student Affairs Committee of the ESC. As part of the directorship of the ESO, I am looking forward to organizing annual meetings, serving on committees, and promoting the study of insects and the important impacts they can have on our lives, crops and economy. Finally, if you can't decide which candidate has the most entomological cred and who then to vote for, consider this: while exploring the Belizean tropical moist forest I became the proud host of two botflies, *Dermatobia hominis*, keeping one in my forearm for a few months for observation despite the sting-like pain and discomfort.

Student Representative Candidate: Casey Peet

I have been fascinated and enthralled by insects for as long as I can remember, and countless summer days have been spent lifting rocks to discover the mysteries beneath, or capturing insects in jars to feed and study them.

I grew up in Edmonton, Alberta and briefly lived in Hamilton, New Zealand, and Calgary, Alberta before moving to Ottawa in 2000. I spent a few years in Kelowna, British Columbia after my B.Sc., and now I'm thrilled to be back in Ottawa again.

My BSc. Honour's project at the University of Ottawa was on nest-site selection in Eastern hognosed snakes, and the hours I spent in the field each day led me to discover a new hobby – photographing insects. I was also able to take an entomology course and a field course with a module on insect fieldwork during my undergrad which only fueled my interest. When I decided to apply to a Master's program I knew that it had to involve insects.

I am very excited to be starting my M.Sc this fall at Carleton University with Tom Sherratt as my supervisor, and I will also be working with Jeff Skevington and Sophie Cardinal (and taking advantage of their expertise on Diptera and Hymenoptera). I will be studying hover fly mimicry in the UV spectrum, which means I'll be collecting live insects in the field, using UV photography, and utilizing the amazing Canadian National Collection of Insects in Ottawa.

I would love to contribute to the work the ESO does as a student representative. I have always been passionate about increasing public awareness about insects and I think that insect research is increasingly important as our world changes. I also believe that it is important to assist students in finding employment opportunities and to encourage and nurture student interest in the field of entomology.

A proposal to amend the Entomological Society of Ontario constitution

A proposal to amend the Entomological Society of Ontario Constitution to allow the elected/serving president to serve for a 2 year term upon taking office.

Rationale:

The current electoral process only permits the President a 1-year active term where he/she is able to put forward new ideas and see them implemented. This constitutes an unnecessary limitation and prevents the Society from moving forward and expanding, and therefore has the effect of stagnation upon the society. The acting President barely has time to propose ideas that might benefit the society in membership or prestige, let alone the time required to work on accomplishing them. The proposed amendment is designed to give the elected President more time to implement new ideas in an effort to keep the ESO vibrant and growing while maintaining longstanding tradition and a level of inner consistency.

Specifics of Amendment:

-Upon successful election the *Incoming President* (i.e. the President Elect) would serve a total of 1 year *prior* to taking office.
-After inauguration, the *Acting President* would then serve a 2 year term.
-Upon adjournment of his term as President, the *Outgoing President* (i.e. now the Preceding President) would serve a total of 1 year.
-In all, the elected president would commit to 4 years of service as an executive on the Board of the ESO.

Major Differences

The major differences between the current process and the proposed amendment, other than a two-year Presidential term, are the frequency of elections for this office as well as eliminating the overlapping tenure between the Incoming and Outgoing Presidents. Under the present system, the tenure of the Incoming, Acting, and Outgoing Presidents overlap and the amendment would partially reduce the redundancy; under the proposed system, the 2 year term of the Acting President would mean that the Incoming and Outgoing Presidential terms would not overlap

Benefits

The purpose of changing presidents is to ensure that new ideas are put forward and allow the Society to grow and progress. Given that the ESO only has one *Annual General Meeting* in addition to a *General Meeting of the Board of Directors*, this leaves very little room for the acting President to leave his/her mark on the Society. With a longer tenure each President would have a greater opportunity to implement more elaborate ideas that move the Society forward. Splitting the difference between the Outgoing and Incoming Presidents during the Active President's tenure will allow the President to retain ESO traditions and standards through the Outgoing President, while looking ahead with new ideas and strategies to expand the Society with the incoming President.

Trevor Burt & Jeremy McNeil

Launch of the new ESO website www.entsocont.ca

The ESO Website was first established by **Barry Lyons** around 2002, just as the internet was really starting to take off and was likely seen as a way to reach out to new prospective members. Barry ran the site through many incarnations until landing on **entsocont.com,** which eventually became **entsocont.ca.**

The site was placed on a variety of servers as well, not all of which is documented, but we do know that it was housed in Toronto for a few years, and then wound up in Guelph on a server in some abandoned and derelict office. Barry was the webmaster from 2002-2010 at which time he passed the job to **Morgan Jackson**, who added some features to make it more accessible for members, such as adding a ***Paypal*** feature to avoid the bother of mailing membership cheques.
Also, it was widely used to advertise upcoming **AGM's** and other events, along with the **Newsletter**. Most importantly it continued to serve as the home for submission information and any digitized back issues of **JESO**, our longstanding scientific journal. Up 'till recently only issues going back to **Volume 130** were fully digitized and available as single article PDF's on the site. In the fall of 2013 I gathered up a single copy of every issue going back to 1871 from a damp utility closet at the University of Guelph, under the direction of Jeff Skevington.

Thanks to Jeff and Michelle Locke, all the back issues of JESO have now been digitized and are available on **Biodiversity Heritage Library**.

In May (2014), **Morgan Jackson** stepped down as Webmaster. I replaced him and set to work building a new site that will hopefully serve the Society for years to come. The URL is the same: www.entsocont.ca

I have tried to encompass everything the Society needs and attempted to address some troubling issues we are having with JESO; namely that the Journal was not really accessible via a Google, or GoogleScholar Search, or any other Search Engine.

I have retained all the features of the old site. They are important, and maintain a sense of consistency and tradition.

Also, it was widely used to advertise upcoming **AGM's** and other events, along with the **Newsletter**. Most importantly it continued to serve as the home for submission information and any digitized back issues of **JESO**, our longstanding scientific journal. Up 'till recently only issues going back to **Volume 130** were fully digitized and available as single article PDF's on the site. In the fall of 2013 I gathered up a single copy of every issue going back to 1871 from a damp utility closet at the University of Guelph, under the direction of Jeff Skevington.

Some New Features

The **ESO Website** is now on a commercial server for which the Society pays an annual fee.

This provides the following **benefits**:

Technical support - something the ESO has never had.

Unlimited Webpage Builds – This is important as it pertains directly to **JESO**. With unlimited pages, we can create a **dedicated URL** for every single article or biology note ever published in **JESO**. This means that individual articles from **1871** onward will be searchable with **Google**, or **GoogleScholar**, and any other web search engine.

Unlimited Webpage Builds; we can structure as many **Special Event** pages needed.

Websites– this is important because we can build a standalone website for any of our **ESO AGM's**, or **Bug Day** events.

Web Builder can be used by virtually anyone who wants to learn basic web-building skills. This means that anyone taking over as **Webmaster** will be able to do so without disruption to Web-service.

Module-based System for ease of use, but also allows customization and HTML coding.

My goal was to build a site that would do a lot more for the ESO than collect Membership dues. The site should serve as a central hub for Entomology news, updates on ESO events, including the AGM, and most importantly, provide a strong web presence for **JESO**.

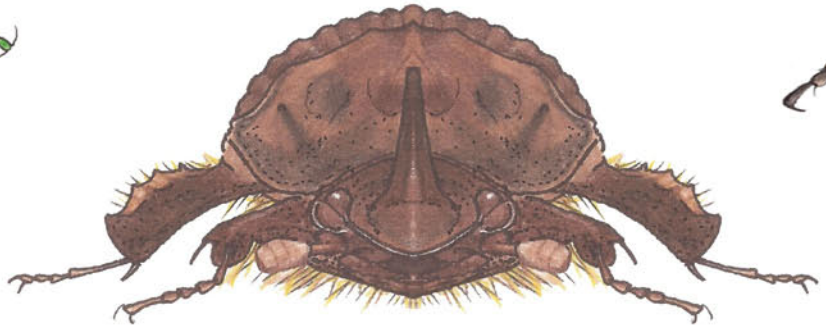
Trevor Burt
Webmaster

2014 AGM

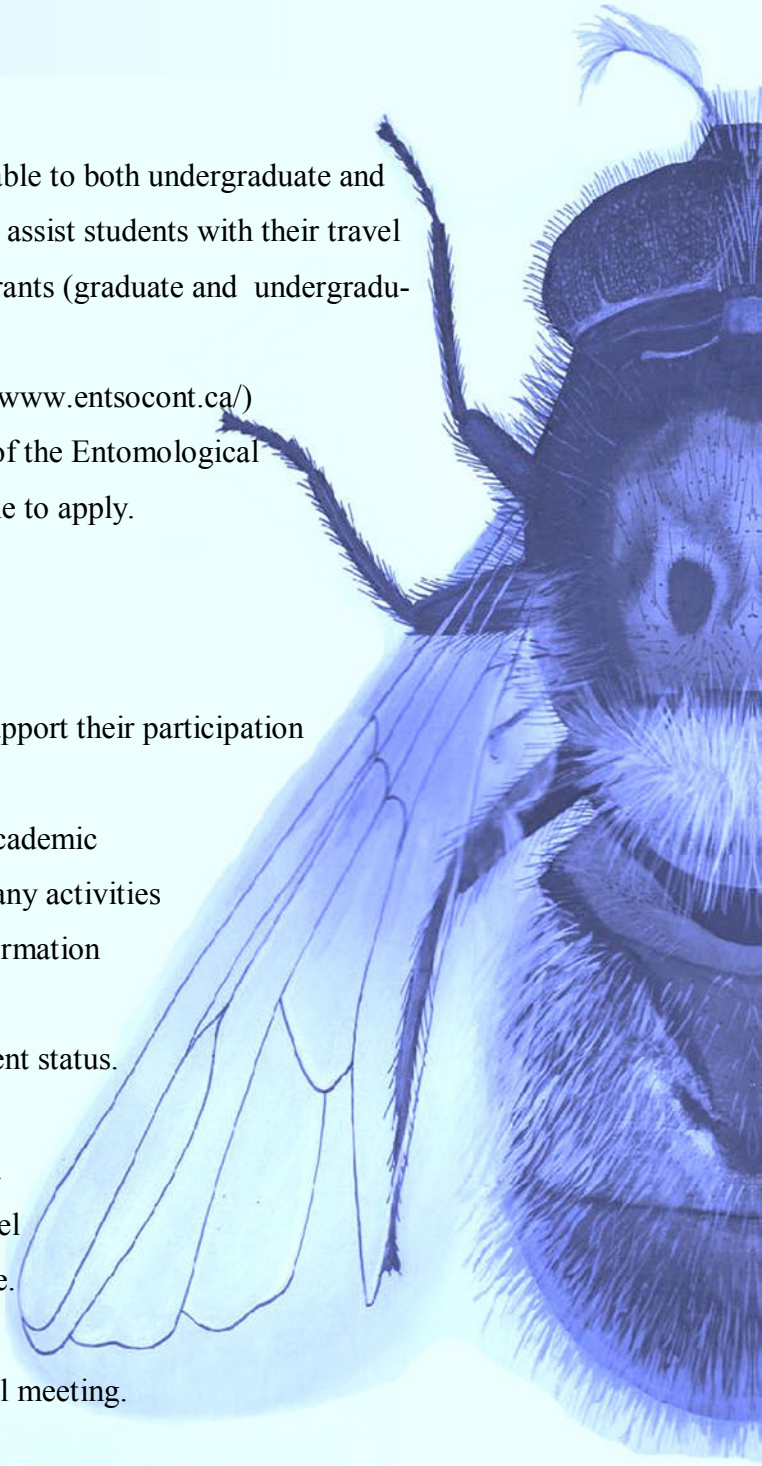
October 3-5, 2014
The University of Toronto

Accommodation:
Holiday Inn, 280 Bloor St. W.
Group Code: ESO
Booking link address:
http://www.holidayinn.com/redirect?path=hd&brandCode=hi&localeCode=en®ionCode=925&hotelCode=YYZBS&_PMID=99801505&GPC=ESO
You may also call
1-877-859-5897

Please keep an eye on the ESO web-site for information updates.



ESO Travel Awards



Make the trip to Toronto in 2014!

The Entomological Society of Ontario has travel awards available to both undergraduate and graduate students. Each year the ESO provides travel grants to assist students with their travel expenses to the annual meeting. The ESO awards two travel grants (graduate and undergraduate) **worth $250 each**!

Student members of the ESO (registration is free—visit http://www.entsocont.ca/) who are presenting a poster or a paper at the Annual Meeting of the Entomological Society of Ontario being held October 21—23 2014 are eligible to apply.

Interested students should forward:

(1) a title and short abstract for their project;

(2) a statement outlining why/how the funds will be used to support their participation in the meeting;

(3) a curriculum vitae or similar document highlighting past academic achievements, publications and awards/scholarships, and any activities that promote entomology in Ontario as well as contact information (phone number, mailing and email address); and

(4) a letter or email from their supervisor indicating their student status.

Only active student members of the ESO who are enrolled in a graduate or undergraduate program will be considered for travel awards. Students may receive only one travel award per degree.

Deadline for application is **September 15, 2014 at 12 pm**.

Recipients will be notified at least two weeks before the annual meeting.

Please send applications electronically to:

entsocont.membership@gmail.com

With the subject line “ESO Travel Award”

2013 BugEye Photo Competition Winner
Promachus vertebratus

Categories:
Best Photo & People's Choice Awards

Morgan Jackson

2014 BugEye Photo Contest

Check out all 2013 finalist photos at https://www.flickr.com/photos/103398327@N06/sets/72157637346945866/

BugEye Photo Contest 2014

Prizes for:
Best photo ($50)
Best photo of an Ontario insect ($50)
Best photo by a junior entomologist under 13 (1st $25, 2nd $20, 3rd $10)
People's Choice Award ($50)
Open to ESO members and all Ontario residents, no entry fee
Submission deadline: September 14th, 2014
Submit photos to: esophotos@gmail.com
Winners announced: October 4th, 2014

Ontario resident means anyone who makes their primary residence in Ontario—international students welcome! Copyright for the photo remains with photographer; use must be granted for ESO promotional material. Images must be of insects or closely related arthropod species (e.g. Mites, spiders). All submissions must be as digital files. The judging criteria will be based on: **a)** Image composition; **b)** Visual impact of image; **c)** Subject interest; **d)** Sharpness of subject; **e)** Difficulty of image acquisition; and **f)** Lighting.

Photographic enhancement is allowed as long as it is something that could also be achieved in a real darkroom with a colour or black & white negative (e.g., adjustment of contrast, colour enhancement, cropping, etc.). However, very obvious enhancements will be negatively scored.

You may submit up to 3 unique images, but can only win one prize plus the People's Choice Award. Submit the image file by creating a digital file that is the equivalent of 7.5 inches by 10 inches (19.5cm by 25.4 cm), at 300 dpi, formatted as a jpg. Create a filename using an appropriate title, underscore, your last name, underscore, first initial (e.g. dragonfly_smith_j). Images may be either "Landscape" or "Portrait" in orientation. Images recorded on film must be digitally scanned and then edited according to the prescribed resolution (i.e., 7.5 inches by 10 inches, at 300 dpi) for submission.

The best pictures submitted will be selected by judges and entered into the **People's Choice Award competition**. The selected pictures will be posted on the ESO website and/or on a photo sharing website such as flickr for the community to vote on. The pictures will also be displayed at the Annual General Meeting of the Entomological Society of Ontario for further voting. If you do not wish for your pictures to be posted in such a way, you can choose to not participate in the People's Choice Award.

Please include a short description of your entries (where they were taken, why you like them, etc.) and whether the picture is of an Ontario insect and if you are a child under the age of 13. You must also indicate if you would like to be considered for the People's Choice Award. Do not forget to include your complete address.

2013 competition winner
Category:
Best photo by a junior entomologist
"Dryomyza on stinkhorn"
Alexander Skevington

Announcements

bug day! Ottawa 2014

When: Saturday, September 6th, 10 am to 3 pm

Where: Canada Agriculture And Food Museum
861 Prince of Wales Drive, Ottawa, Ontario

Who: All ages **Cost: FREE!!!** **Paid parking available on site**

The Ottawa Field-Naturalists' Club

CANADA AGRICULTURE AND FOOD MUSEUM

2013 guided insect expedition

Join us on Saturday, **September 6th** for Bug Day! Due to last year's overwhelming response, Bug Day has moved to the **Canada Agriculture And Food Museum** to accommodate more people and some new "buggy" activities. In honour of Bug Day, access to the museum will be **free** for the day thanks to a generous donation from the **Ottawa Field-Naturalists' Club**.

Activities include:
Live insect zoo
Guided insect expeditions
Insect cooking/eating
Cockroach races
Kids' insect crafts
Ask a bug expert

Giant walking sticks from insect zoo

Come learn all about insects from numerous world renowned bug experts. Throughout the day, entomologists will lead guided **insect expeditions** and show you how to spot fascinating insects. Have your hand at holding a giant walking stick at our **live insect zoo**. Cheer on your favourite cockroach to victory in our always exciting and unpredictable **cockroach races**. Learn how to attract native **pollinators** to your garden and how bugs help pollinate food crops such as blueberries and apples. Visit the museum's **Taking Care of Beesness** exhibition and try to spot the queen bee in the live observation hive. Tantalize your tastebuds by eating some deliciously prepared critters. Tired of playing plain old bingo? Come play a game of **Bug Bingo**! We will also be doing **insect crafts** and **face painting** throughout the day. Numerous other activities and displays will be going on to help you discover the amazing world of insects.

Why not pitch in?

If you're an insect enthusiast and want to get involved with local projects or events that the ESO is running, please send us an email and we would be happy to have your help. We are always looking for volunteers to help out with **BUG DAY!**

Contact: Dr. Sophie Cardinal

Email: sophie.cardinal@agr.gc.ca

Donate

If time is something you can't spare, or you can't make the **Bug Day** event to help out, you can always pitch in, in other ways. You can make a monetary donation that the Society could surely use to offset the cost of **Outreach Program** days like **BUG DAY**!

Every little bit helps. . . .

To donate visit
http://www.entsocont.ca/bug-day-ottawa-2014.html

4th Annual Batman's Bugfest

Where: Batman's Cottages and Campground near Sheguiandah on Highway #6, Manitoulin Island

When: Saturday, July 5 at 10:00 am

Cost: Free!

On Saturday July 5, join us at Batman's Cottages and Campground near Sheguiandah on Highway # 6 to learn about butterflies and moths of Manitoulin Island.

The day will start at 10: 00 am in the Recreation Hall with displays and a presentation on butterflies and moths. We will then walk Batman's trails and fields to observe butterflies and try our hand at catching some. Techniques in preparing butterflies and moths will be demonstrated after lunch. Butterflies and moths collected throughout the day will be prepared for the Batman's Insect Collection or your own collection.

10:00 am – 12:00 pm. Displays and presentations in the Recreation Centre

12:00 – 1:00 pm. Lunch at your own camp site or join us for a $2.00 themed bug lunch

1:00 pm – 3:00 pm. Preparing butterflies for collections using spreading boards

9:00 to 10:00 pm. Observe night-flying moths using a black light at the Recreation Hall and baiting trees with a sugary liquid.

Why not pitch in?

If you're an insect enthusiast and want to get involved with local projects or events that the ESO is running, please send us an email and we would be happy to have your help. We are always looking for volunteers to help out with **BUG DAY!**

Contact: Dr. Joe Shorthouse

Email: jshorthouse@laurentian.ca

Donate

If time is something you can't spare, or you can't make the **Bugfest** event to help out, you can always pitch in, in other ways. You can make a monetary donation that the Society could surely use to offset the cost of **Outreach Program** days!

Every little bit helps. . . .

To donate visit www.entsocont.ca/bug-day-manitoulin-island-2014.html

Bug Day! London 2014

This summer (Date TBA) as part of the ESO's desire to reach out to the community we will be holding a **Bug Day** event right in **London**!

Last summer (2013) was the first Bug Day event, held in Ottawa. Needless to say it was a huge success, with guided nature walks from renowned Naturalists, face-painting for the kids, cockroach races, and loads more. There was a little something for everyone!

Why not pitch in?

If you're an insect enthusiast and want to get involved with local projects or events that the ESO is running, please send us an email and we would be happy to have your help. We are always looking for Students and Professionals alike to help out with **BUG DAY!**

Contact: Dr. Ian Scott, Lauren Des Marteaux

Email: ian.scott@agr.gc.ca, ldesmart@uwo.ca

Cost: **Free!**

Donate

If time is something you can't spare, or you can't make the **Bug Day** event to help out, you can always pitch in, in other ways. You can make a monetary donation that the Society could surely use to offset the cost of **Outreach Program** days like **BUG DAY!**

Every little bit helps. . . .

Donate Here . . .

www.entsocont.ca/ bug-day-london-2014.html

You can donate as much as you like . . .

Humber Bioblitz Report

Ontario Bioblitz – Humber River Watershed May 24-25, 2014

After months of planning, the weekend arrived! The weather was ideal, not too hot, and not too cold. The size of the area to survey and the approximately 500 registrants, made our organizational challenge slightly greater this year ;). The Humber River watershed extends from Lake Ontario to north of Glen Haffy C.A. and Seneca College King campus.

I was pleased to have over 40 entomologists on the teams that I coordinated. Divided into butterfly, aquatic, odonate and arachnid groups; each one of them had superb taxon leads to guide the less knowledgeable participants. It would have been impossible to organize so many without their assistance.
It is certainly too soon to report the number of arthropod species that were recorded.

Certain groups have somewhat final data:
Spiders: 108+
Butterflies: 15
Moths: 87
Odonates: 8
Aquatic (so far) - 30

People are still working at processing, mounting and identifying specimens that were collected over the 24 hour period. We have estimated the total insects that will be identified to be around 500 (give or take).

Next year's bioblitz is in the Don River watershed sometime in July. Hope to see you there! Check out http://2014.ontariobioblitz.ca/wp/ for more information.

Antonia Guidotti
Royal Ontario Museum

Call for Submissions

THIS YEAR the **Ontario Pest Management Conference (OPMC)** will be held **November 13,** 2014 at the **Victoria Park East Golf Course, Guelph, ON**. Research presented at the **OPMC** will focus on all aspects of pest management associated with food and fibre production, and animal and human health. The theme of this year's conference is "***Advancing Plant Health in a Changing World.***"

As we have a limited number of openings on the 2014 agenda for submitted posters we hope that you make a decision to participate in this year's OPMC as early as possible. Submissions will be accepted on a first come, first serve basis.

Deadline for Submissions: **Monday, September 22, 2014**

Abstract should be sent to:

Dr. Melanie Filotas
Specialty Crops
IPM Specialist
Ontario Ministry of
Agriculture and Food and Ministry of Rural Affairs
Email: melanie.filotas@ontario.ca

Abstract Submission Requirements:

Abstracts should contain no more than **250 words**. Editors reserve the right to shorten your abstract should it exceed this word limit. Abstracts must be submitted by **email in Word format**. A fax submission will not be accepted. Include the following information with your abstract:

-**Author**(s) names(s) – indicate name of presenter in bold

-**Address** of each author – use superscript numbers to indicate the proper address for each author, including telephone, fax and email information.

-**Abstract** – 250 words or less

-You will be notified by **Dr. Melanie Filotas** within 10 days of submission whether your presentation has been accepted for **OPMC 2014.**

www.opmconference.ca

Crop Life Student Graduate Student Paper and Poster Competition

OPMC Undergraduate Student Poster Competition

Call for Submitted Papers and Posters - Students

Once again, ***Crop Life Canada – Ontario Council*** will be sponsoring awards of **$500 each** for Best Student Paper and Student Poster presented at the 2014 OPMC. In addition, OPMC provides a **$250.00** award for the best undergraduate student poster presentation.

The 2014 agenda has openings for a maximum of **6 graduate student papers (oral presentations)**, 6 **graduate student posters** and **4 undergraduate posters**. Student submissions will be accepted on a first come, first serve basis. We hope that you make a decision to participate in this year's OPMC as early as possible. Your abstract for the 2014 OPMC should be sent to **Dr. Melanie Filotas,** melanie.filotas@ontario.ca (OMAF and MRA) by :

4 pm on Monday, September 22, 2014.

Categories of presentation:

Paper (Oral) Presentation – One **$500** award (Crop Life-Ontario Council) and plaque for a graduate student

Poster Presentation – One **$500** award (Crop Life -Ontario Council) and plaque for a graduate student

Poster Presentation – One **$250** award (OPMC) undergraduate student

Eligibility:

The student must either be currently enrolled in a degree program (undergraduate or graduate) or have graduated from a degree program (undergraduate or graduate) since the last conference (November 2013);

The student must be the principal investigator and presenter of the paper or poster; and

Canadian and International students are eligible to participate in the competition.

Paper (Oral) Presentations:

12 minutes + 3 minutes for questions and discussion

All presentations should be in Power Point format.. To minimize potential incompatibilities between the software versions you use to create your presentation, limited use of animation, and use of common Windows fonts for text and symbols fonts for equations is recommended and you are asked to test the final copy on a different computer than the one used to create it.. **You will be asked to email a copy of your presentation to the conference organizers 2 days prior to the conference (by Tuesday, November 11) so it can be pre-loaded on the conference computer.** Bring a back-up copy of your presentation on a USB memory stick to the conference. All presentations will be placed on one computer to facilitate close adherence to the schedule..

Poster Presentation:

Posters must be 4' (length) x 3' (width), portrait format. Compliance with these dimensions is important. The header should include the title, authors and institution where the work was conducted. Photos of the student presenting the poster also can be included on the right side of the header. You must be present at the poster during the designated judging time. Following submission of your abstract and acceptance of your poster you will be given a Poster Number.

A copy of your poster must be sent to **Dr. Melanie Filotas** by email (melanie.filotas@ontario.ca) three (3) days prior to the conference – **Monday, November 10, 2014**, by **4 pm**. This is so the judges can have access to your poster content ahead of time, ensuring efficient judging at the conference. **Failure to submit a copy of your poster by November 10 could result in disqualification from the competition.** When you arrive at the conference your poster should be placed on the board displaying your Poster Number. Posters can be set up beginning at 8:00 am **on November 13** and must remain in place until afternoon coffee is over. Any posters not claimed at the end of the conference will be removed and discarded by organizers unless other arrangements have been made.

Conference Web-site:

More information on the 2014 OPMC can be found at

www.opmconference.ca

Submissions

Why not submit something to the Newsletter?

If you have a story, project, photo, profile, job posting, or upcoming event that you would like ESO Membership to know about, please contact the **ESO NL Editors** via email at:

amanda.lindeman@gmail.com

trevburt@gmail.com

Subject: *ESO Newsletter*

We would love to hear from you. If there is something you would like to see in the ESO NL, or some activity or event you feel the ESO should be a part of, please let us know.

Topics of Interest

ESO Buffoonery

Field Seasons

Conferences/Events

Biology Note

Funny or Interesting Anecdote

Book/Article/Conference Review

Fun Fact

Scientific Illustration

Photography

Special Projects

Thesis Summaries

ESO Buffoonery . . . again

Complaints about Funding

. . . anything you find interesting

Guidelines

This is *not* a Scientific Journal like **JESO**. **This is a general interest Newsletter/Magazine, so you should try to have some fun with it. We encourage photos and figures, and your profile information with a photo of yourself.**

We *only* recommend:

500-2000 words

A Title

We do NOT pay for content.

Publish in JESO

Consider submitting your next manuscript to the . . .

Journal of the Entomological Society of Ontario

Instructions to authors are available on-line at:

www.entsocont.ca

As of 2011, page charges in JESO have been waived!

Electronic submissions should be directed to:

john.huber@agr.gc.ca

Submissions should be directed to:

John Huber, JESO Editor
Canadian National Collection of Insects
Agriculture and Agri-Food Canada
960 Carling Ave.
Ottawa, Ontario, Canada
K1A 0C6

Tel: 613-759-1840

A *Special* Thanks to Morgan Jackson

JESO Webmaster 2009–2013

Morgan has been an integral member of the ESO since 2009. While trying to find time to work on his MSc and now PhD in Guelph, he revamped the society website and got it looking relevant and current. Back issues of our journal were put onto the site and a facility to pay for membership renewals online was organized and developed by Morgan. In addition to this rather herculean effort, Morgan also played a key role on the organizing committee for the ESC-ESO AGM in 2013. It seemed that every time we had a question or needed something done for the meeting, we were emailing Morgan. He was patient through it all, despite us all asking him for constant help while I was harping on him about getting publications out during the same conversation.

We want to thank Morgan for all of the effort he has put into the society to date and look forward to his continued involvement in the ESO in the future.

Jeff Skevington

A *Special* Thanks to Jess Vickruck

JESO Technical Editor 2010–2013

Jess Vickruck, completed her M.Sc. on biology of small carpenter bees, *Ceratina* spp., under Dr. Miriam Richards, former editor of **JESO**. In 2010, Jess began her Ph.D. in September, 2010, working on the evolution of division of labour in the large carpenter bee, Xylocopa virginica. At about the same time she also became the Technical Editor for JESO, a position she held until volume 143 was published in December, 2013, at which time she resigned due to the imminent birth of a son. Over the past four years (three under the current editor), she proved to be a competent and reliable technical editor for volumes 141–144 of JESO, with a sharp eye for catching errors in manuscript proofs. Her efforts in seeing these volumes to press took a lot of the burden off the editor. Meanwhile, Jess has published five papers based mostly on her M.Sc. research.

It was a pleasure working with her and I wish her best of luck in her future work on bees.

John Huber

Job Postings: *Graduate Student Opportunity*

Master of Science Student – University of Guelph

An M.Sc. position is available (Start date: September, 2014) for a student with a strong interest in sustainable agriculture, crop production and entomology. ***This position will focus on the biology and management of the Carrot Rust Fly (*Pictured above*).***

Qualifications:

an B.Sc.in biological sciences with courses and an interest in integrated pest management and entomology is essential;
demonstrated experience working with crop production and agronomy, and hands-on experience with plot/field research is valuable;
strong organizational skills and a strong work-ethic are essential;
must possess a Class G Driver's License;
should be fluent in English; and
excellent oral and written communication skills.

Project description:

The carrot rust fly (CRF) is serious pest of carrots in southern Ontario. The larvae cause direct damage to the harvestable crop. High levels of damage occur in some years, despite monitoring and insecticide sprays. This project will focus on the development of new or modification of existing IPM strategies for CRF with specific focus on the following objectives:

1.Study the biology of carrot rust fly : a) determine if there is a correlation between day degree predictions and trap counts; b) determine the population dynamics of the first generation of rust flies; and c) determine relationships between environmental stresses (heat, drought) on survival of larvae and damage to the crop.

2. Evaluate reduced risk insecticides and methods of insecticide application for management of the carrot rust fly in commercial carrot fields.

3. Assess the potential effects of CRF management options on non-target beneficial insects that inhabit the agro-ecosystem in the Holland Marsh.

Student Location: Academic studies and lab research will be at the University of Guelph (School of Environmental Sciences/ Plant Agriculture) – Main Campus, Guelph, Ontario; Field research will be conducted at the University of Guelph – Muck Crops Research Station located at the Bradford/Holland Marsh (http://www.uoguelph.ca/muckcrop/).

Funding: The successful candidate will be provided with a graduate stipend according to the University of Guelph Graduate Program Policies (www.uoguelph.ca/ses/content/graduate-programs) for 2 years (6 semesters).

Primary Contacts:

Dr. Cynthia Scott-Dupree, Professor – School of Environmental Sciences, University of Guelph; Email: **cscottdu@uoguelph.ca**

Dr. Mary Ruth McDonald, Professor – Dept. of Plant Agriculture, University of Guelph; Email: **mrmcdona@uoguelph.ca**

Job Postings: *Graduate Student Opportunity*

Master of Science Student – University of Guelph

An M.Sc. position is available (Start date: September, 2014) for a student with a strong interest in sustainable agriculture, crop production and entomology. This position will focus on the biology and management of the **Carrot Weevi** (Pictured Above).

Qualifications:

an B.Sc.in biological sciences with courses and an interest in integrated pest management and entomology is essential;
demonstrated experience working with crop production and agronomy, and hands-on experience with plot/ field research is valuable;
strong organizational skills and a strong work-ethic are essential;
must possess a Class G Driver's License;
should be fluent in English; and excellent oral and written communication skills.

Project description:

The carrot weevil (CW) is serious pest of carrots in southern Ontario. The larvae cause direct damage to the harvestable crop. High levels of damage occur in some years, despite monitoring and insecticide sprays. This project will focus on the development of new or modification of existing IPM strategies for CW with specific focus on the following objectives:

1. Study the biology of CW : a) determine if there is a correlation between day degree predictions and trap counts; b) determine if there is a second generation of CW in the Holland Marsh region of Ontario: and, c) determine relationships between environmental stresses (e.g., heat and drought) on survival of larvae and damage to the crop; and

2. Evaluate reduced risk insecticides and methods of insecticide application for management of the CW in commercial carrot fields.

3. Assess the potential effects of CW management options on non-target beneficial insects that inhabit the agro-ecosystem in the Holland Marsh.
Student Location: Academic studies and lab research will be at the University of Guelph (School of Environmental Sciences/ Plant Agriculture) – Main Campus, Guelph, Ontario; Field research will be conducted at the University of Guelph – Muck Crops Research Station located at the Bradford/Holland Marsh (http://www.uoguelph.ca/muckcrop/).

Funding: The successful candidate will be provided with a graduate stipend according to the University of Guelph Graduate Program Policies (www.uoguelph.ca/ses/content/graduate-programs) for 2 years (6 semesters).

Primary Contacts:

Dr. Cynthia Scott-Dupree, Professor – School of Environmental Sciences, University of Guelph; Email: **cscottdu@uoguelph.ca**

Dr. Mary Ruth McDonald, Professor – Dept. of Plant Agriculture, University of Guelph; Email: **mrmcdona@uoguelph.ca**

Cover & Section Photo Credits

Most photos were reprinted from those submitted to the 2013 ESO BugEye Photo Competition! Submit your bug photo to the 2014 competition

On the Cover
Harris' Three-Spot (*Harrisimemna trisignata*).
by: **Crystal Ernst.**

Crystal entered this photo in the **2013 Bug Eye Photo Contest** and was nominated for the **People's Choice Award!**

If you enter the **Bug Eye Photo Contest,** your picture could be used in the **ESO Newsletter**!

Photo Credits