Newsletter of the Michigan Entomological Society

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Inside this Issue:

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MES Officers Needed

As always, we are seeking nominees for two MES Governing Board positions: President Elect, and Member at Large. Please consider nominating yourself or another member. Contact any Governing Board member for more information. The next elections will be held in spring 2015.

61st Annual MES Meeting: June 26-28, 2015

Angelica J. Pytel, President-Elect
Department of Biology, Hillsdale College, Hillsdale, MI 49242

The 2015 MES annual conference will take place on June 26-28, 2015 at the G.H. Gordon Biological Station and Rockwell Lake Lodge (http://www.therockwelllake-lodge.com), located in Lake County approximately 25 miles southeast of Cadillac, MI. This is the largest private college biological station in Michigan, combining an active research station with a functioning resort and conference center.

The property features a 50-acre lake with good fishing. There are kayaks, canoes, and other boats available for attendees to use free of charge. The property also contains a small creek, upland forest, meadows, and various types of wetland habitats. There are also several miles of interpretive hiking trails. Insect collecting is encouraged. Elegant rooms for 1–2 people at the Lodge will be available (which includes breakfast). Beds in the cabins are also available for a much more modest price. Meals can also be purchased in any combination from the Lodge. All lodging options include free Wi-Fi. Look for more specific registration details that will be mailed to all members and will also be found on the MES Website in the near future.

Our keynote speaker will be Dr. R. Ed DeWalt of the Illinois Natural History Survey. Ed will be speak on his past and future modeling efforts of aquatic insect distributions based on climate change and other factors.

We hope to see you at this year's meeting. We encourage submission of oral and poster presentations on any topic related to entomology. Undergraduate and graduate students are especially welcome and there will be cash awards for the top student presentations. For more information, contact Angelica Pytel by phone at (517) 607-2582 or by Email at <apytel@hillsdale.edu>.

Breaking Diapause Saturday, 14 March 2015

Breaking Diapause is the annual MES spring entomology meeting. It is an informal gathering for members and those interested in becoming members. **The meeting will be held from 9:30 AM till mid-afternoon in Room 244 of the Natural Science Building (Nat Sci: 288 Farm Lane) at Michigan State University in East Lansing.** In addition to socializing with a variety of professional and amateurs there will be plenty to do. The insect museum at Nat Sci will be open so bring along your unidentified insects. Folks will be available to show you around the collection if you're unfamiliar and assist you with any unknowns you have. Bring along entomological duplicates you'd like to trade, sell, or just give away. You might also bring along specimens or images to show, trade, or give away. If you have an entomological display, do bring it along. As usual we'll also have a variety of finger foods. In addition, we will discuss and show how Mo Nielsen's Lepidoptera Collection is being incorporated into the general collection. See you then!

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.....dstanton@svsu.edu
President-Elect..... Angie Pytel
.....apytel@hillsdale.edu
Immediate .....Martin Andree
Past President .....mjandree@koeze.com
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..... amobrien@umich.edu
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..... mvande@rosepest.com
Member-at-Large (13-16).....Julie Craves
.....jcraves@umich.edu
Member-at-Large (12-15).....David Cuthrell
.....cuthrell@msu.edu
Journal Editor..... Therese Poland
.....tpoland@fs.fed.us
Associate Journal ..... Anthony Cognato
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Editor ..... dhoughton@hillsdale.edu
Associate Journal ..... Ronald Priest
Editor ..... priest@msu.edu
Associate Journal .....Daniel Swanson
Editor .....drswanny@gmail.com
Newsletter Editor .....Robert Haack
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..... mfobrien@umich.edu

Current Annual Dues Schedule

Student (through Graduate School) $12.00
Active $25.00
Institutional $45.00
Sustaining $35.00
Life $500.00

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MES Historical Notes

Robert A. Haack, Newsletter Editor

1989 – 25 years ago. In early 1989, Phil Watson was President; Dick Snider was President-Elect; Ken Kraft was immediate Past-President; Mo Nielsen was Executive Secretary; Dick Fleming, Gary Dunn, and Mark Scriber were the three Members-at-Large; Mark O'Brien was Journal Editor; and Bob Haack and George Heaton were the Newsletter Editors. The 35th MES Annual Meeting was held on 2-3 June 1989 at Hidden Lake Gardens near Tipton, MI, with the evening banquet held at the Hathaway House in Blissfield, MI. Ken Christiansen from Grinnell College in Iowa was our guest speaker who spoke on "Caves as Natural Evolutionary Laboratories." There were 11 additional talks at the annual meeting that addressed hop vine borer biology, mate choice in tiger swallowtails, the *Cerotoma* complex, gypsy moth control, Galapagos insects, urban drosophilids, mosquito attractants, harvestmen, silk moth host relations, forest insects along an acid rain gradient, and colletid bee nest architecture. Other stories that were featured in the MES Newsletter dealt with the monarch butterfly overwintering site in Mexico by Bruce Giebink, and the pear thrips, a new exotic pest of maples from Europe, by Bob Haack. Entomology Note #20 on acorn insects by Charles Williams was published in 1989. Annual dues were $8 per year for active members, $4 for students, and $20 for libraries. Journal page charges were $30/page. There were 438 members in good standing and 158 library subscriptions at the close of 1988.

1964 – 50 years ago. In early 1964, Stanley Gangwere was President, Mo Nielsen was President-Elect, David Cook was immediate Past-President, and Julian Donahue was the Executive-Secretary. The 10th annual meeting was held at Michigan State University in East Lansing on 28 March 1964. The annual meeting was held in conjunction with the Michigan Academy of Sciences annual meeting. Eleven MES talks were presented on such topics as stable flies, 4-H entomology, acridid grasshoppers, potato tuberworm, cicadellids, katydids, water mites, June beetles, non-target pesticide effects, and forest floor arthropods. Feature articles from the 1964 MES Newsletters covered subjects like bumblebees and mites by Robert Husband, entomologists and plants by Ed Voss, and advances in black lighting by John Newman. In 1964, MES dues were $2 per year for regular members and $1 for students, the Society had a balance of $374, and there were 76 members.

Notice: Check out the websites of these two Michigan Butterfly Associations for upcoming meetings and field trips:

Southeast Michigan Butterfly Association
http://www.sembabutterfly.com/

West Michigan Butterfly Association
http://www.glsga.org/wmba.htm

Dragonfly Society Annual Meeting Held in Northern Wisconsin

Ken Tennessen
PO Box 585, Wautoma, WI, 54982
Email: ktennessen@centurytel.net

Good weather, good food, and really good dragonflies set the stage for fun and success at the 25th annual meeting of the Dragonfly Society of the Americas (DSA) held in northern Wisconsin June 11–18, 2014. Nearly 100 people (Fig. 1) from 25 states and Canada attended the week-long event. Field trips led by Bill Smith, Robert DuBois, Denny Johnson, Ryan Chrouser and Ken Tennessen to the Eau Claire, Chippewa and Flambeau rivers, plus the Vilas County lake region, provided opportunities to see 24 species of gomphids, including several rare species of *Ophiogomphus* with restricted distributions. Outings to several wetland/peatland habitats, including an un-surveyed fen (dubbed Ken's Fen) in the Flambeau River State Forest, turned up a number of Corduliidae (Fig. 2), including some "lucky-to-find" species such as *Williamsonia fletcheri* and five species of *Somatochlora*. Also found here was an aeshnid that is sparsely distributed in Wisconsin, *Gomphaeschna furcillata*. In all, adults of 84 species of Odonata, including a number of new county records still to be tallied, were found through the week.

This meeting celebrated the 25th anniversary of the DSA and was held in conjunction with the 3rd meeting of the Wisconsin Dragonfly Society (WDS), providing opportunity for emerging odonatologists to meet and discuss mutual interests with some "old-timers." On June 14 (luckily the only totally cloudy-windy-rainy day the entire week), the group met inside the Ladysmith Public Library for the business meeting, presided over by President-Elect Chris Hill of Coastal Carolina University, and for the scientific presentations. Sixteen 20-min. talks covered topics such as taxonomy, phylogeny, life history, migration, and the landowner/odonate landscape. That evening, a delicious banquet was catered by a local restaurant, plus a silent auction was held that netted over $1400 to support DSA's website (OdonataCentral) — a fitting ending to a long day.

Wearing our new t-shirts (Fig.3), we sort of "stood out" in the small northern Wisconsin communities. Many local folks were curious about what we were doing, and when meeting some of the dragonfly enthusiasts, they were anxious to tell them how abundant the mosquitoes were this spring (not new news to us, all bit up, by the way) and how after the dragonflies finally showed up in June, the numbers of mosquitoes declined. Some people were also concerned about "the dragonflies," commenting that the number they were seeing in some areas appeared to be much lower than in years past.

Figure 2. A male of *Cordulia shurtleffi*, a fairly common northern corduliid, photographed in Oneida County, Wisconsin, by Ken Tennessen, 17 June 2014.

Figure 1. Attendees of the 25th Annual Meeting of the Dragonfly Society of the Americas, held in Ladysmith, Wisconsin, 11-18 June 2014. Photo by Steve Valley.

Figure. 3. T-shirt sold at the 25th Annual Meeting of the DSA

Urban Entomology: What Services Homeowners and Businesses Purchase in the Great Lakes Region

Mark VanderWerp BCE
Rose Pest Solutions, 1130 Livernois Rd, Troy, MI 48099
Email: mvande@rosepest.com

We view insects as a blessing, an immensely complex rainbow of biodiversity that can only bestow wonder, mystery, and excitement; not to mention inexhaustible scientific inquiry! If insects were somehow horribly removed from the face of the planet we would be at an indescribable loss (not to mention the ecological disaster that would ensue). I suppose that's what makes entomologists special, as much of the general public is quite comfortable with doing away with any and all insects found on their premises! Perhaps that is an overstatement, as public consciousness is beginning to register remorse over bee declines and feels sympathy towards certain charismatic endangered species, like the Karner blue butterfly.

Of course, there are plenty of bona-fide pest species that should be controlled in the urban environment in the interest of protecting public health and property, and preventing other economic losses. Rose Pest Solutions, my employer, has been doing just that since 1860, making it the oldest pest management company in the United States. The remainder of this article will share what Rose's clients (primarily residing in the States of MI, IN, and OH) have been buying for the first three quarters of 2014.

Bed Bugs. You've heard that they're back, but how big of a deal are they really? They're big! Rose did its first bed bug job (since the resurgence) in 2002. Since then it has grown at an unbelievable rate and now comprises about 12% of our annual revenue! The rate of growth in this market has slowed but shows no signs of disappearing anytime soon. There are a number of products that work against bed bugs, but all require skill and thoroughness to achieve control. There is no indication of any silver bullets that would dramatically simplify or lower the cost of treatment coming out of any university or industry that is researching the pest. With the general public's current mistrust of pesticides, this blood-sucking ectoparasite might be here to stay for a while. Interestingly, bed bugs had not been considered medically significant and many health departments were reticent to deal with the pest. A paper out this past November found bed bugs to be competent vectors of the often undetected and potentially deadly trypanosome that causes Chagas' disease; it's still too early to see if that will be a game changer.

Public Health Pests. When it comes to protecting public health the control of mosquitoes, ticks, rodents, and stinging insects (mostly yellow-jackets) are of prime importance. However, when looking at our production numbers by these target pests they are fairly minor categories. Taken together, jobs specifically for the public health pests make up about 5-6% of our production. (It should be noted that recurring clients, namely "commercial PC" and "home service," get rodent control included and many also receive stinging insect coverage at no extra charge, so these numbers are deceptively low.) But this does indicate that very few homeowners call us specifically to deal with rodents, mosquitoes, ticks, or stinging insects. This is probably attributable to the fact that all of these pests have control products including repellents, knockdown aerosols, and baits that are widely available and specifically marketed to the general public. It will be interesting to

Balsam Woolly Adelgid Quarantine – On June 24, 2014 Michigan Department of Agriculture and Rural Development (MDARD) established a quarantine to protect Michigan's fir (*Abies* spp.) trees from balsam woolly adelgid (BWA, *Adelges piceae*), an exotic pest that has caused the death of millions of fir trees in North America. The BWA quarantine generally prohibits the shipment of fir nursery stock and fir timber products into Michigan from infested states. Fir nursery stock and forest products from non-infested areas are allowed, although they must be accompanied by a phytosanitary certificate indicating the place of origin. Certain low risk fir products are exempt, including Christmas trees and wreaths and heat-treated timber products. The quarantine also allows fir seedlings grown under an active pest management program to be shipped into Michigan.

The BWA quarantine imposes strict restrictions on shipment of true fir species (*Abies* spp.) into Michigan from infested US states and Canadian provinces.

a. Currently known infested states include California, Idaho, Maine, New Hampshire, New York, North Carolina, Oregon, Tennessee, Vermont, Virginia, Washington and West Virginia.

b. Infested Canadian provinces include British Columbia, New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island.

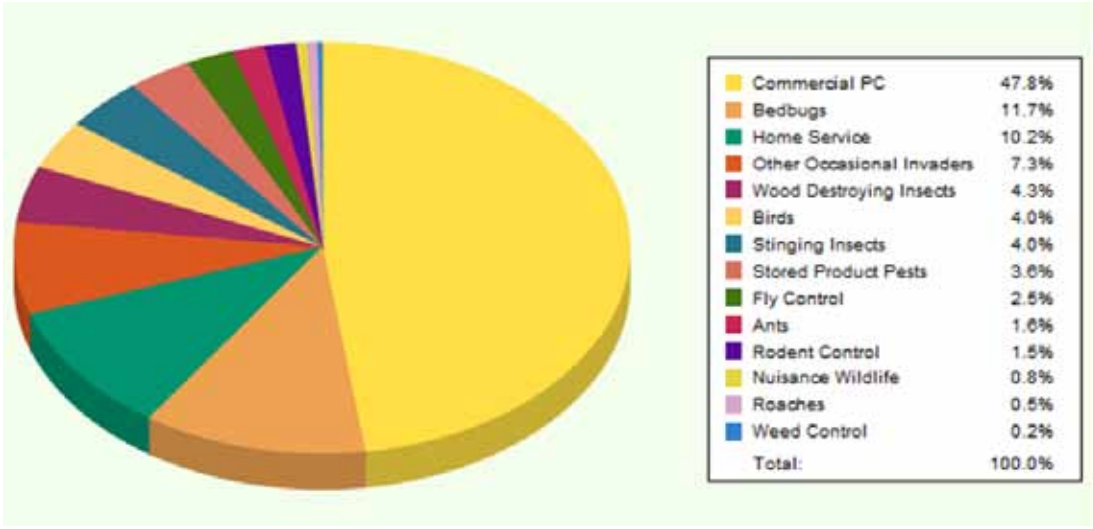
Fir products exempt from the provisions of this quarantine include fir forest products with the bark removed, forest products with bark attached that have been heat treated or treated with wood preservative compounds, seeds and cones of fir species, and composted or shredded fir bark and mulch.

Additional information about the BWA quarantine is available at <www.michigan.gov/mdard>. For more information on BWA visit the following web sites (MDARD) <http://michigan.gov/exoticpests> and (MDNR) <www.michigan.gov/invasivespecies>.

see what the future of rodent control will bring as the EPA has recently cancelled the registrations of 12 rodent control products manufactured by Reckitt Benckiser, the maker of D-con, that will impact their availability beginning in 2015.

Cockroaches. Once the dominant group of insects of the pest management world, cockroaches are now scarcer in homes and businesses. When a problem does arise it can generally be handled with less effort and less expense nowadays thanks to a variety of very attractive commercially available baits. Through September 2014, they have only comprised 0.5% of our business. However, they are considered a "covered pest" for commercial and home service clients so this number is lower than the actual effort that we expend for them. If anyone has been keeping up with the cockroach literature you have certainly heard of glucose aversion, which is a type of behavioral resistance that is emerging to these bait products that use glucose as an attractant—or, as momma cockroaches call it, kids that are picky eaters! Undoubtedly, cockroaches will again rise to prominence in the future as they become harder to control with easy to use baits.

When working with insects it's always an interesting and dynamic experience; no doubt there will be plenty of surprises ahead for us, 154 years of experience, or not!



Rose Pest Solutions production by target pest during January – September 2014. The total number of jobs was 26,200.

Dr. Angus "Gus" J. Howitt, Pioneer in Applied Tree Fruit Entomology: 1919 - 2010

David Biddinger
Fruit Research & Extension Ctr.
Pennsylvania State University
PO Box 330. Biglerville, PA 17307
Email: djb134@psu.edu

Born in a farm house without electricity or running water on February 9, 1919 in Guelph, Ontario, Gus served in WWII with the Royal Canadian Air Force in a patrol bomber searching for German submarines from 1939 until the war ended 6 years later. As part of the Canadian GI Bill, he obtained his bachelor's degree from the University of Guelph in biology in 1949. For those that knew Gus, it is of no surprise that he helped put himself through school as a middleweight boxer with no losses in 30 fights. He still remained feisty and ready to take on all comers well into his 70s. He moved to the U.S. to obtain his Master's degree in entomology from Montana State University in 1951 researching the biological control of rangeland grasshoppers. In only 2 more years, he earned his Doctorate in entomology at Kansas State University in 1953. That same year he accepted a faculty position at Washington State University where he worked on vegetable crops developing host plant resistance breeding trials and working on the control of pests such as symphilids. In 1955, Gus the boxer married Eva Mae Delaney, a figure skater, who remained the love of his life until she died 38 years later. They had one daughter, Colleen Callahan, who gave him two granddaughters.

Gus Howitt standing next to a plum tree being evaluated for cambium-feeding damage by the American plum borer in 1987. Note the bark peeled away to examine the dark injured cambium layer beneath.

Dr. Angus J. Howitt, Director of the Michigan State University Trevor Nichols Fruit Research Farm & professor of Entomology (mid 1970s)

His tree fruit career began in 1960 when he accepted a faculty position in the Department of Entomology at Michigan State University (MSU) and established the Trevor Nichols Research Complex at Fennville. The station was about 2.5 hours away from the MSU campus, but where it needed to be in the heart of the fruit industry where fruit growers had daily access to Gus and where he could

William Thompson (MSU Extension), Gus Howitt, and student Jim Cole examining pheromone monitoring traps (1971).

work directly in research and grower orchards to find solutions to pest problems and become one of the pioneers in Integrated Pest Management in the early 1970s that would optimize pest control while reducing pesticide inputs and increasing reliance on biological control agents. At first, working out of a donated WWII Quonset Hut with a minimal budget and relying mostly on research grants from the fruit industry, Gus began planting orchards for applied research programs and then began teaching fruit growers about pest biology and control in "winter fruit schools" every winter until his retirement in 1989 at the age of 70. A compilation of his notes from those winter classes, as well as results from student thesis projects, and pictures from the field served as the basis for his book, Common Tree Fruit Pests (NCR63 1993), which he published after his retirement in 1989. One of the farmers he taught (Trevor Nichols) donated 80 acres of his farm to Michigan State University in 1967, which formed the nucleus of the current 175 acre station which is considered one of the premier pest management facilities in the U.S. Formally instituted as a research station soon afterward, Gus continued to build facilities and capabilities of the station through grower support and through financial donations for pesticide evaluations from the pesticide industry. Receiving a Fulbright Scholarship in 1967, Gus traveled to Uruguay and throughout South America and also to New Zealand, working with fruit researchers in each country. These experiences provided Gus with many adventures with which he loved to regale his students and fruit growers with. It was often said that the best Gus story, could only be told by Gus himself. His professional awards included the Entomological Society of America Recognition Award for Best Applied Entomologist in North America (1984), Fruit Man of the Year (1983), Pioneer Award from the North American Blueberry Association, National Cherry Industry Award (1994), Outstanding MSU Extension Specialist Award, and Outstanding Award for Pear and Grape Research.

Often remembered mostly for his pesticide work, he also mentored over 30 graduate students, many of which were encouraged to determine the natural history, monitoring techniques, and natural enemies of each pest. His love and appreciation of nature continued throughout his life and he passed it on to all those he worked with. That was the legacy with which Gus was most proud of. Gus had a lively "larger than life" personality and was given to outrageous statements at times, but his students and fruit growers knew him as a compassionate friend whose generosity knew no bounds and who never hesitated to help those in need. His example to his students, such as myself, who continue to work in applied entomology, is an inspiration to never lose the joy and excitement of discovering new things in nature as we did when we were children, to always use your talents to help meet the needs of growers, and to always pass on your experiences to a new generation of students or growers. He always felt he could learn from growers 'who did this for a living' and never felt superior to them.

Gus, George Ayers (Gus's first graduate student and later on the MSU Entomology faculty), and Matt Daly (farm manager) outside the research laboratory of the station (circa 1985).

Gus examining apple shoots for insect pests soon after the Trevor Nichols station was established in 1967.

That was the secret to his success and why the fruit industry loved him so much. Gus passed away peacefully at the age of 91 on April 24, 2010 in Glenn, Michigan. His biggest regret was that his golf game never got better after he retired.

Gus evaluating a tart cherry tree with a hammer and chisel for damage by a new cambium-feeding pest, the American plum borer, in the mid-1970s. This moth became a serious pest of cherry due to the switch from hand harvesting to the use of mechanical trunk and limb shakers during this period. The hydraulic clamps on these harvesters caused the bark to crack and allowed the larvae of this previously insignificant pest access to the inner bark where it feeds in the cambial region and girdled the trees.

Name Game

I can't help making up names
for the bugs that I see,
not that entomologists
haven't named them properly.

It's just the way some behave
and the way that they look
that conjures up names
you don't find in any book.

Like this wild-eyed beetle
looking somewhat like Frodo,
bumping into everything,
I've dubbed it "Crashymoto."

There's this gray grasshopper
that looks like a twig,
festooned with fake lichen—
it's got to be "Fezzywig."

And this black-n-red odonate,
it flits like a butterfly
spilling blood from its veins.
I named it "The Blood-er-fly!"

Well, I better get going,
there's so many to name --
once you get started,
there's no end to this game

. .

– Ken Tennessen 2014

[I thank Cary Kerst for the "wild-eyed" beetle photo.]

The Northern Blazing Star Borer, a Possible New *Papaipema* Species or Subspecies of *Papaipema beeriana*

Ted Herig
237 East Pine St., P.O. Box 201, Elsie, MI 48831. Email: herigs@aol.com

This is my first attempt at describing a possible new species or subspecies of moth. It is by no means a final description -- that will be done by trained taxonomists.

This article is meant to show some of the differences that I have noted between two Michigan populations of *Papaipema beeriana* moths separated by hundreds of miles. The northern population we found is in Otsego County, MI, and appears to be a small isolated population that shows distinct differences in habitat, eggs, larvae, and adults. Since my 2010 MES article (Herig 2010), I have learned much more about the Otsego population by collecting, rearing, and breeding individuals under laboratory conditions. I will refer to the Otsego population as the "*nielseni*" population after its discoverer Mogens "Mo" Nielsen, and the populations from southern Lower Michigan as simply the "*beeriana"* populations. Subsequent field work by myself and fellow lepidopterists in six Michigan counties near to Otsego County did not find any *nielseni* populations. These included surveys in Montmorency, Roscommon, and Clare Counties by Dwayne Badgero; Mecosta County by Ted Herig; and Montcalm and Crawford Counties by Mo Nielsen and Ted Herig. Similarly, in Barry and Clinton Counties in southern Michigan, I have not yet found any *beeriana* populations.

In other surveys, the Michigan Natural Features Inventory (MNFI 2000) did not find any *beeriana* or *nielseni* populations in a 2-year survey of pine barrens near Grayling, MI (Crawford County). However, the MNFI has found another *nielseni* population in Otsego County, a short distance from the original sighting. In a recent publication by Metzler et al. (2005), they describe the *nielseni* population as a "phenotype" of the more typical *beeriana* populations found in Ohio and southern Lower Michigan.


Adult moth of the northern form.

In the text below I will describe some of the differences that I have noticed between the *beeriana* and *nielseni* populations based on personal observations in the field and lab. Up until now, all observations on the northern (*nielseni*) population have been lumped with *beeriana* in the literature. Years ago the late Mo Nielsen told me of a debate regarding whether the Otsego population is truly *P. beeriana* or if it represents a new species or subspecies.

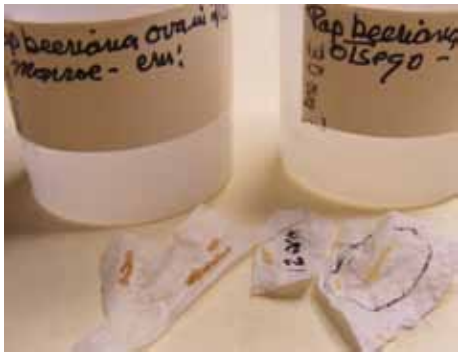
Larval host. In a 2003 report by the USDA Forest Service, the wetland species Dense Blazing Star (*Liatris spicata*) was listed as the preferred host of *P. beeriana*, and Rough Blazing Star (*Liatris aspera*) was specifically mentioned as not being a host. However, in Otsego County, we have consistently reared *nielseni* from field-collected *Liatris aspera* (Herig 2010).

Habitat. The typical habitat for the southern form of *P. beeriana* is wet meadows, swampy areas, around lakeshores and stream banks. However, all *nielseni* populations have been found in dry, sandy pine barrens (Herig 2010). Some of the common plants found in association with *nielseni* include white pine, poplar, black cherry, choke cherry, juneberry, viburnum, blueberry, blazing star (2 species: *Liatris aspera* and *Liatris scariosa,* Northern Blazing Star), Hill's thistle, and various species of goldenrod, aster, grass, sedge, and reindeer club moss.

Ova. Eggs of *nielseni* are usually deposited in groups of six or more but single eggs to as many as 50 have been seen on host plants or on paper toweling supplied to mated females in the laboratory. Color: yellowish buff, until a few days before eclosion when they darken to nearly black with a whitish cast over outer covering. Ova diameter: about 1/32 of inch or 0.08 mm. Finely ribbed from top to bottom. Ova of the southern *beeriana* population are deposited in clusters that are similar to *nielseni*, i.e., clusters of 2 to 35 eggs have been found on host plants and on paper toweling in the laboratory. Ova are reddish pink in color, if fertile, turning darker a few days before eclosion. Ova diameter: slightly smaller, about 0.07 mm. Under similar laboratory conditions, *beeriana* ova tend to eclose 2-3 days earlier than *nielseni.*


Typical habitat in Otsego County where the northern form occurs. Mo Nielsen shown collecting at the site on his last visit in 2012.

Larva--1st-2nd instars. In *nielseni* the head capsule is yellowish tan. Prothoacic shield: pale yellowish with a small vertical black collar. The collar is sometimes absent in second instars. Thoracic legs are black in both instars. Spiracles: small, nondescript but more pronounced in 2nd instars. Prolegs on segments A3-4 are not functional in the 1st and 2nd instars, but they become functional by the 3rd instar. Body color-yellowish orange, lighter between segments, all segments have vertical orange-brown bands, unlike other species of *Papaipema* that have dorsal/subdorsal banding. Segments A3-6 are slightly darker than the others, this holds true for the 2nd instar also. No dorsal/subdorsal bands. The anal plate is yellowish brown, with some black scalloping along the top. Overall length of 1st instar averages about 1.6 mm, and about 6.0 mm for 2nd instars. The head capsule on *nielseni* tends to be larger than on *beeriana.* Setae: full, but not readily notice-


Eggs of southern form (left, reddish) and northern form (right, yellowish)

Northern form (left) and southern form (right) of mid-instars.

able, but slightly more visible in 2nd instars.

Larva--3rd-4th instars. In *nielseni*, head capsule is light reddish tan, mouthparts black. Prothoracic shield: yellowish brown, wide black base. Spiracle bold below shield. 4th instar similar. Thoracic legs black in both instars. Spiracles dark brown almost black, much bolder but even bolder in 4th instars. Setae: D1, D2, SD1, SV1, SV2 plus others more prominent on their respective segments. The bases of the setae (pinacula) are deep dark reddish brown in both instars. Body segments T2 through A9 dark purplish tan-brown bands, yellowish green between segments when larvae extend themselves. Segments A1-A4 are slightly darker brown in both 3rd and 4th instars. Anal shield- yellowish tan, black scalloping along top and extending down each side. Body length of 3rd instars averages about 7.9 mm, and about 15.9 mm for 4th instars.

Some of the differences between 3rd and 4th instar *nielseni* and *beeriana* include: 1) segments A-8,9,10, along dorsal area, base of setae (pinacula) are larger and darker brown in *beeriana* than in *nielseni*; 2) segment A9, pinacula lower on the sides merge together on *beeriana*, but are well separated on *nielseni*; and 3) anal shield segment on A10 is dark black on *beeriana* with black scalloping along the sides that continues to the upper portion of the anal proleg, lower anal proleg yellow, while on *nielseni* the anal shield is yellowish overall, and the anal proleg is all black.

Larva--5th-6th instars. In *nielseni* the head capsule is reddish tan, mandibles black, prothoracic shield is dark yellowish tan, with mild black scalloping below the shield along the sides. Thoracic legs are black. Spiracle on T1 is black, bold. Spiracles on other segments A1-A8 are black, bold. Setae are visible on all segments, the base of setae (pinacula) are dark reddish brown. Anal shield is yellowish tan, with weak black scalloping. Body color- pale pasty white between segments, vertical bands light tannish brown with a pinkish hew, especially on 6th instar larvae. Body length of 5th instars averages about 29.1 mm, and 6th instars average about 44.1 mm.

Some differences between 5th and 6th instar *nielseni* and *beeriana* include: 1) in *beeriana* on segments A-8,9 10, dorsal area, base of setae (pinacula) are larger and dorsal spots on A-9 merge into a solid area, but do not merge in *nielseni*; 2) in *beeriana* the anal shield on segment A10 is black and extends down the outer sides of the anal proleg, and the lower portion of proleg is yellow, while in *nielseni* the anal shield is yellow with no black scalloping, and the anal proleg is all black; and 3) the prothoracic shield in *beeriana* has heavy black scalloping on the sides of the shield that extends across front of the shield between the head capsule and prothoracic shield, while in *nielseni* the scalloping is less prominent. In addition, the shield in *beeriana* is darker red than in *nielseni*.

Larva--7th instar. In *nielseni* the head capsule is dark reddish brown, mandibles black, prothoracic shield is dark yellowish brown, no black scalloping, spiracle T1 is black and bold. Thoracic legs: black. The spiracles are bold, black, on segments A1 thru A8. Anal shield is light tan, with almost no black scalloping. Setae: moderate, pinacula on all segments not colored. Body color is pasty white, and the vertical banding is very weak or nonexistent. Overall body length averages about 44.5 mm, but appearance is heavier/stouter. Time from egg hatch to pupation, 80-90 days on average, at room temperature.

The main differences between 7th (prepupal) instar *beeriana* and *nielseni* are that in *beeriana* the anal shield is black and the anal prolegs are yellowish with black scalloping extending down the prolegs, while in *nielseni* the anal shield is yellowish and the anal prolegs are black.

Pupa. As in other *Papaipema* the pupa is rather long and wine colored. As is typical of pupal Lepidoptera, wing casings, proboscis, antennae, spiracles are all very visible, and the pupa wiggles when touched. Color just after molting is more orange, whereas in *beeriana* the new pupa is whitish at first, then turning wine colored. In my rearings, *nielseni* pupae tend to be slightly larger (22.2 to 24.6 mm long) than *beeriana* (19.1 to 23.8 mm). Both *beeriana* and *nielseni* pupate in the soil near their host or in the root of their host if large enough.

Adult moth. The adult *nielseni* from Otsego County, Michigan, are more colorful, and more variable in adult coloration than adult *beeriana*, which are a more uniform, dark mousy gray/brown with a few adults showing a reddish-brown tint on the forewings on occasion but very little contrasting color or other markings. There is a spotted form of *beeriana* known as *P. beeriana* form *lacinariae*, which has white spots in the orbicular and reniform areas of the forewings. The spotted form comprises roughly 10% of adult *beeriana* moths, whereas over 98% of the *nielseni* adults have spots. The following text is my attempt to describe the *nielseni* adults from Otsego County, Michigan.

Head area. Palpus: In *nielseni* the color of the palpus ranges from light reddish brown to dark reddish brown and even to a light buff, most have frosted tips (scales) and some adults have a real hoary appearance. Eye: dark blackish brown in all color forms of adults. Antennae: bicolored, light gray or buff below, darker reddish brown or buff colored on upper side, also finely haired. Thoracic area: (collar, lappet or tegulae) (patagium or shoulder lappet) and (thorax) are all hairy and can be either dark reddish brown, reddish brown, light reddish brown, and even light buff colored, and some with the frosted white (scales) tips. Some adult moths have a hoary appearance and a very prominent tuft at top of the thorax when the adult moth is fresh. Legs: all legs hairy; with femur the same color as upper thorax.

Wings. Front wing. Color can range from reddish brown, to light reddish brown, to light reddish buff, to a nearly all buff ground color. Contrasting colors of darker reds and browns on some adult moths at the basal area extending out to the apex, down to the median nervure

to vein #5. In others the darker mottling may extend nearly to the inner margin. Frosted scaled tips (hairs) are present on some moths but not on others. No basal dash present, reniform center spot lunule tan, others spot's white and fairly large, but vary in size. Orbicular spot, white and varies in size, with other spots smaller and not always present on some adults near claviform. A few adults have these spots filled with color, usually a reddish buff color, making them difficult to notice, form (lanei). The PM line is often the only line with distinct contrast, but occasionally the outer margin can be contrasting. A purplish cast can be seen on some adults from the PM line out to the outer margin. In the hind wing, the ground color is usually pale tan, but can be a darker medium brown, with the outer margin line visible along with the discal cell mark, which is faint in most adults. Wing length: measured tip to tip on spread specimens, is usually 31.8 to 41.3 mm in *nielseni,* whereas in *beeriana* wing length is usually 27.0 to 38.1 mm.

Abdomen. Hairy, color ranging from light grayish buff, to light reddish brown, always lighter than the collar lappet and shoulder lappets. In *beeriana* this area of the abdomen is mousy gray in color.

Considering the many life-history and morphological differences noted above between individuals of *beeriana* and *nielseni*, and the fact that no *beeriana*-like individuals have been collected in Otsego County, suggests that the *nielseni* population represents a new subspecies or species of *Papaipema*. Back in the 1950s, Mo was told by his best friend and mentor John H. Newman that the *nielseni* population appeared to represent a new species of *Papaipema* and that Mo should describe it. However, Mo never completed that task. Given that Mogens Nielsen made the first collections of *nielseni* in 1955 (I have some of Mo's specimens from the 1960s in my personal collection), and for his devotion to the study of Lepidoptera and to mentoring amateur lepidopterists, I suggest that the northern form from Otsego County be named in honor of Mo Nielsen. No matter its final status, this topic obviously deserves more study to determine the correct taxonomic status.

In addition, recent cross-breeding studies (Ted Herig, unpublished data) and DNA analyses (Dwayne Badgero, Kyle Johnson, and Bob Borth, unpublished data) provide further support that the *nielseni* individuals should be considered a distinct form.

Northern form reared from eggs collected in Otsego County, MI

Northern form collected in the field in Otsego, County, MI

Briefly, in the cross-breeding studies conducted in 2012-13 that will be reported in more detail later, I crossed male and female *beeriana* individuals from Monroe County, MI, with male and female *nielseni* individuals from Otsego County, MI. I obtained 133 ova from the Otsego male x Monroe female crosses, and 152 ova from the Monroe male x Otsego female crosses. After overwintering the ova were set up to allow larvae to eclose in spring 2013 using techniques that have been highly successful in the past for rearing *Papaipema*. Overall, all ova collapsed and failed to eclose from the Monroe male x Otsego female crosses, whereas 34 of the 133 ova from the Otsego male x Monroe female crosses eclosed. Most of the 34 larvae died within a few hours after they emerged, and only 3 were successfully reared to adults, which in my experience is typical when crossing different species.

Acknowledgments

I dedicate the eventual naming of this moth to my late collecting buddy and close friend Mr. Mogens (Mo) Nielsen who shared his knowledge of leps with me during many years and nights of collecting and turned my interests to *Papaipema* moths (of which we both shared a love). Thanks Mo! I also thank James Wiker, for many hours of discussion about this species and other *Papaipema* moths; Dwayne Badgero, for collecting *Papaipema* females for ova, for helping to fill data gaps in various life history studies, and for sharing collection data from several areas in Michigan; Eric Quinter, who challenged me to prove that *nielseni* was possibly a new species, and to try to cross breed the two forms; John Peacock, Tom Carr, Bill Taft, Dwayne Badgero, Kyle Johnson, and Jim Wiker for comments on an earlier version of this paper; and to my devoted and beloved wife, Donna Herig, who has put up with hours (actually years) of rearing larvae in our home and at times in the refrigerator, and for supporting me on my many collecting adventures. Thanks all!

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MES 2014 Annual Meeting Minutes, June 13, 2014, 60th MES Annual Meeting, held at Saginaw Valley State University

Present: The General Membership plus Governing Board Members: Martin Andree, Tina Ciaramitaro, Bob Haack, Dave Houghton, Adrienne O'Brien, Mark O'Brien, Ron Priest, and Dave Stanton.

Reports:

Secretary: Adrienne O'Brien - Minutes from the March Governing Board meeting at Breaking Diapause were submitted for review by Martin Andree. Toby Petrice made the motion to approve, seconded by Mark O'Brien, motion was passed. MES membership has been steady at around 270 individuals and 101 institutions.

Treasurer: Tina Ciaramitaro - As of June 13, 2014, total assets were $27,128.25. Printing, postage, supplies and insurance expenses since Nov. 2013 were $2353 and income during the same period from membership and institutional subscriptions, GLE page charges and payments for copyright was $10,080. Angie Pytel made the motion to approve and Dave Stanton seconded, motion was passed. Tina will be leaving Michigan and moving to Mississippi and will be unable to carry out the duties of MES Treasurer. David Houghton has volunteered to be our new treasurer. Thank you Tina and Dave. Your contributions have been (and will be) huge.

Newsletter: Bob Haack – Bob is working on the Spring Newsletter. It will be out in June. This issue will be a tribute to Mo Nielsen, with several stories and articles. As always, please send stories and notices to Bob.

Journal: Therese Poland – submissions are down for the Great Lakes Entomologist. The spring issue, volume 47 (1,2) is late because there have not been enough papers submitted to fill the 100 pages needed. It is in the final stages of editing and will be printed and mailed soon. The fall issue will be delayed as well because of the lack of papers. This seems to be a trend for all scientific journals because there are so many free on-line journals now. Therese outlined several options and the need for more research before we decide what route to go. Toby Petrice made a motion to set up a publications working group and Ron Priest seconded, motion approved. Therese Poland, Mark O'Brien, Ron Priest and Martin Andree volunteered to serve on that committee. (*See update on this page*)

Webmaster: Mark O'Brien – All newsletters are being scanned and will be added to the MES website. There are still a few years of journal articles to upload as well as several years of recent newsletters to upload. Because of possible changes at the UM Museum of Zoology, Mark would like to set up the website, which currently sits on a computer in the UM Insect Division Museum, to a new host, independent of UM. He will research possibilities that will allow us to develop new strategies for improving our online presence.

Old Business: Ron Priest followed up on the leftover funds ($500) from an old grant for Michigan state-listed butterfly species which were donated to MSU Entomology museum to be used for supplies. Mo Nielsen's insect collection has been moved to the MSU entomology collection; his notes and records are with Duke Elsner (MSU Extension). Funds are needed in order to house Mo's extensive Lepidoptera collection at MSU. Mark O'Brien made a motion to approve the idea of MES supporting this effort, Adrienne O'Brien seconded, motion passed. The dollar amount will be determined when Gary Parsons has a better idea of how many more drawers will be needed. The MES board would then vote for approval of the specific funds requested. (*See update on this page*)

New Business: John Douglass suggested an idea to encourage more involvement in MES. His idea is to change the name of the "Member-at-Large" position to "Board Member," reduce the term from 3 to 2 years, and elect 2 Board Members per year. Ideally, one of the Board Members would later run for President Elect, or become involved with another Governing Board position once their term is done. Mark O'Brien made the motion to discuss this further at a Governing Board Meeting to decide if this concept should be brought to a vote by the MES General Membership. Adrienne O'Brien seconded, motion passed.

Elections: Congratulations to our new Member-at-Large, Mark VanderWerp (2014-17) and President Elect, Angie Pytel. Thank you to the other candidates who agreed to be on the ballot: Mark O'Brien and Ted Herig. The winners were each decided by one vote. And, finally, thanks to Sarah Smith, Member-at-Large (2010-13) and Dave Houghton, Immediate Past President, for their service to the MES.

Submitted by MES Secretary, Adrienne O'Brien

Updates

New page charge rates started in 2014 for TGLE. If you didn't notice, the rates to publish in The Great Lakes Entomologist were reduced in 2014. Previously, MES charged $42/page. That rate was changed to $25/page for MES members, and $40/page for non-members. We hope this reduced rate will encourage more people to join MES as well as publish in The Great Lakes Entomologist.

MES Donation to MSU in Honor of Mo Nielsen. The MES Governing Board agreed to purchase and donate 30 Cornell drawers to the Albert J. Cook Arthropod Research Collection at Michigan State University to help house Mo Nielsen's lifelong collection of Michigan Lepidoptera. An expanded story on this topic will appear in the Spring 2015 issue of the MES Newsletter.

Research Request. Seeking permission to measure and photograph Michigan tiger swallowtail butterflies. I would like to see (a) early flight females (collected before June 17), and (b) late flight males and females (collected after July 13). I would need to know the collection date and location (at least county). Thanks. Contact Goran Blomberg by email at: unclefruitcup@gmail.com or 517-402-6471.

60th MES Annual Meeting

The 2014 MES Annual Meeting was held at Saginaw Valley State University (SVSU), in Saginaw, MI on Saturday, 14 June 2014. Thanks to MES President Dr. Dave Stanton for organizing a great meeting, and to SVSU for hosting MES at a Friday-evening social. Our featured speaker was Dr. Eric Benbow, the new aquatic entomologist at MSU. Abstracts of the talks can be found on the next several pages.

Entrance at SVSU Curtiss Hall where our meeting was held

Some of the attendees at the 2014 MES Annual Meeting at SVSU.

MES members visiting Dave Stanton's laboratory at SVSU.

Terrestrial Invaders and Aquatic Insect-Microbe Interactions

M. Eric Benbow
Department of Entomology, Michigan State University, 243 Natural Science Blg., East Lansing, MI, 48824
Email: benbow@msu.edu

Recent studies have demonstrated that microbes may affect how, when and why insects colonize certain resources, while these insects also change the microbial communities of the resource in an unexplored ecological coupling (Ma et al. 2012, Tomberlin et al. 2012, Pechal et al. 2013, Pechal et al. 2014a, Pechal et al. 2014b). Based on these recent studies and advances in next-generation sequencing that is revolutionizing microbial ecology, my lab uses ecological theory to explore interactions between entire microbial communities and individual insects, populations or entire communities in aquatic systems, related to disease ecology and basic and applied research of carrion decomposition (Figure 1). In this presentation, I introduced examples of microbe-insect interactions using these model systems, linking carrion decomposition with aquatic ecosystem function and demonstrating how a riparian plant invader can affect these processes in headwater streams.

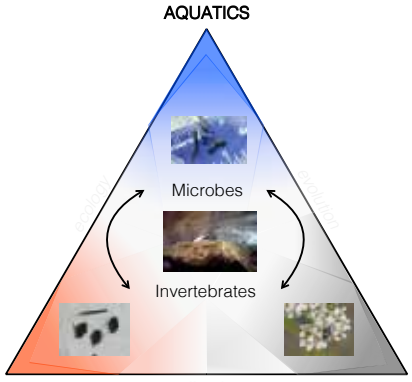

Figure 1: The research in the Benbow lab centers on microbial community – insect community interactions within three systems: aquatic ecosystems, disease ecology and carrion decomposition. The lab focuses on research using ecological theory to explore interactions between entire microbial communities and individual insects, populations or entire communities of insects. The lab is combining insect community and ecosystem ecology with next-generation high-throughput sequencing technologies to better understand the insect microbiome and how this community of microbes mediates insect fitness and community dynamics.

One system that my collaborators have studied to better understand microbe-insect interactions and employ next-generation sequencing technology is that of carrion decomposition and how blow flies (Calliphoridae) interact with microbes to mediate decomposition rates. Given that blow flies directly affect carrion decomposition, they may be important biological mediators of microbial succession and thereby changing these communities through three primary pathways: 1) directly competing with microbes for the resource through feeding activity; 2) introducing antimicrobial compounds to the resource; 3) transporting exogenous microbial species to the resource in a way that shifts community composition and succession; or 4) some combination of these activities. In an effort to explore how fly communities varied with fly species-specific microbiome communities, my lab conducted a survey of blow flies and their associated internal microbiome communities in several ecoregions of the USA to better understand the natural interactions between animals and microbes. Several ecoregions were located in Southeast Alaska, to explore these interactions on salmon carcasses that result from the annual migrations into streams (Figures 2 and 3). The internal microbiome communities were variable among ecoregions at the phyletic and family levels. In the eastern USA, *Phormia regina* microbiomes were dominated by Bacteriodetes while Firmicutes and Proteobacteria dominated *Calliphora terraenovae* microbiomes in Alaska. This study demonstrated that as molecular sequencing technologies continue to improve, microbiome communities and their interactions with animals may become more important considerations for the discovery of novel and potentially transformative ecological interactions.

In addition, benthic macroinvertebrate taxa are commonly used as indicators of water quality (e.g., Ephemeroptera) and are important members of the aquatic

Figure 2: Salmon in a Southeast Alaskan stream during their annual migration into streams for spawning. After spawning is complete, the adults die and their carcasses become a large resource subsidy for the stream and riparian communities, including blow flies (Calliphoridae) that immediately lay eggs on the carcasses and the larvae consume the tissues.

community. However, despite studies from terrestrial habitats suggesting the importance of the insect microbiome to life history traits and ecology of insects, there have been very few studies addressing aquatic insect microbiomes. Here I presented a study that provided descriptive survey of the bacterial communities from the internal microbiome of Heptageniidae collected from four Southeast Alaska salmon bearing streams. There were four Heptageniidae evaluated: *Cinygmula*, *Epeorus*, *Rhithrogena*, and *Aneporus rusticus*. Bacterial DNA was extracted from individuals to assess the internal bacterial community structure using 454 pyrosequencing. There were 25 phyla identified across all heptageniids with five predominate taxa representing 76 to 100% of the community relative abundance: Actinobacteria, Firmicutes, Bacteroidetes, Proteobacteria and Tenericutes. Bacterial community structure varied across mayfly

Figure 3: Salmon carcasses can be very dense in many Southeast Alaskan streams during their annual spawning migrations. Blow flies (Calliphoridae) immediately lay eggs on the carcasses and the resulting hatched larvae consume the tissues of the carcasses to where there is often bones and some skin left.

Figure 4: The invasive riparian shrub *Lonicera maackii* (Amur honeysuckle) forms dense monocultures along riparian corridors of headwater streams. This invasive colonization changes the timing, quantity and quality of organic matter subsidies into these systems, with possible downstream and ecosystem scale consequences.

taxa and stream collection location. Identification of the microorganism communities has potential for better understanding macroinvertebrate life history and fitness trait variation within aquatic ecosystems.

Lastly, I evaluated the impacts the invasive riparian shrub *Lonicera maackii* (Amur honeysuckle) had on organic matter subsidies, nutrient dynamics, and the macroinvertebrate community in a headwater stream in Ohio (Figures 4 and 5). My colleagues and I first reported significant impacts of this invasive species on leaf litter breakdown rates and macroinvertebrate use of leaf packs, suggesting potential impairment on watershed ecosystem processes (McNeish et al. 2012). In a subsequent study, these effects were evaluated in more detail using a restoration approach. Honeysuckle was removed along a 160 meter stream reach in August 2010. Autumnal, in-stream leaf litter was assessed over 75 d, while macroinvertebrate density and secondary production were measured for three years and a nutrient limitation study was conducted during one season. Honeysuckle removal significantly reduced canopy cover and light availability (both $P < 0.01$) and differentially influenced the timing and abundance of leaf litter genera within the stream (McNeish et al. 2014). For example, *Platanus* spp. (sycamore) contributed the most organic matter within the removal reach (35-40%) but was mainly absent in the control reach. Macroinvertebrate biomass increased ~99% one year after invasive removal compared to ~50% increase in the control reach. Honeysuckle removal also resulted in in-stream nitrogen limitation ($P < 0.05$), suggesting

Figure 5: The invasive riparian shrub *Lonicera maackii* (Amur honeysuckle) contributes large volumes of leaf litter into headwater streams during late autumn leaf senescence. The dense colonization along headwater stream banks affects the timing, quantity and quality of organic matter subsidies into these systems, with possible downstream and ecosystem scale consequences. Amur honeysuckle leaf senescence generally occurs 4-6 weeks after native trees have lost their leaves.

a functionally important effect on benthic microbial communities. Future studies will employ the metagenomic techniques that my lab has used for blow flies and mayflies to test how this invasive plant species has impacted ecosystem processes through functional shifts of insect-microbe interactions.

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Case Reconstruction and Mortality of *Pycnopsyche guttifer* (Trichoptera: Limnephilidae) at Different Temperatures

Hannah Russell and Angelica Pytel
Gordon Biological Station 3943 Skookum Rd. Luther, MI 49656
Email: hrussell@hillsdale.edu

This report represents the second year of a continuing study to observe the effects of selected stream temperatures and oxygen levels on the case building behavior and survival of *Pycnopsyche guttifer* under consistent and continuous laboratory conditions. Specimens were collected from the Little Manistee River in northern Lower Michigan and acclimated in a laboratory stream to ambient temperatures (either 14°C or 17°C) for at least 3 full days. Just prior to starting the trials, specimens either had their natural cases removed, by forced evacuation with a blunt probe, or were left in their natural case (controls). Three control and three evacuated specimens were added to each of ten treatment groups (N = 60 per trial). The treatment groups consisted of five different water temperatures (17, 20, 23, 25 and 29°C) all of which were designated to be either aerated or not aerated. All trials ran for 72 hours. Environmental metrics (water temperature, dissolved oxygen, and percent oxygen saturation) were recorded every three hours while behavioral observations (case building behavior, state of case construction, and mortality) were taken every six hours all during daylight hours. Four rounds of experimental trials occurred during late May through mid-June 2014 and these data were added to the data that had been collected in summer 2013 (N = 480 number of specimens for both years). Complete case reconstruction was nearly 80% in the 17°C and 20°C non-aerated experimental groups and almost 90 % with aeration. Case construction was nearly 45% in the 23°C aerated group and half of that in the non-aerated group. A similar trend of lower case construction was observed at 25°C. Mortality was nearly 100 % in the 29°C treatment groups and almost absent at 5% in both the 17°C and 20°C groups. Mortality began to increase at 23°C, which also seemed to be the threshold where case reconstruction began to decline. Interestingly, *P. guttifer* larvae customarily aestivate during the hottest months of the summer; this behavior could be an adaptive mechanism to avoid warming conditions.

Thermal Tolerance of Different Populations of Embossed Stonefly

Markie Zimmer
Department of Biology, Hillsdale College, Hillsdale, MI 49242
Email: mzimmer@hillsdale.edu

The harmful effects of thermal pollution can be assessed by a non-lethal endpoint, Critical Thermal Maximum (CTM), which measures relative thermal tolerance. Four populations of the Embossed Stonefly, *Paragnetina media* (Walker) (Plecoptera: Perlidae), were sampled in mid-May 2014 from the Big Sable River (photo, left) in northwestern Lower Michigan. The Big Sable River passes through 4 km of Bear Swamp that warms the water, which mimics anthropogenic sources of thermal pollution. Specimens were acclimated to 14°C, an estimated average of the river temperatures of the collection sites, during a 60 hour acclimation period. CTM was determined by placing specimens into a Julabo Circulating Heated Water Bath (photo left), which raised the temperature at a rate of 0.33°C/minute. I determined that CTM was reached when specimens lost their grip on the substrate. After the trials were complete, all specimens were monitored for survival over the next 48 hours. The river collection site with the highest water temperature (19°C, compared to 17.9, 18.2 and 18.4°C at the other sites) also had the highest CTM and highest post-trial survival, suggesting that these specimens had adapted to these slightly higher water temperatures. I suspect temperature differences between sites will increase later in the summer; thus, I plan a second round of experiments in July 2014.

A Befuddling Bahamian Borer

Robert A. Haack,[1] Ariën Sikken,[2] Toby R. Petrice,[1] and Steven C. Passoa[3]

[1] USDA Forest Service, Northern Research Station, 3101 Technology Blvd., Suite F, Lansing, MI 48910

[2] FAO Forestry Specialist, Bahamas National Trust, P.O. Box AB 20953, Marsh Harbour, Abaco, The Bahamas

[3] USDA APHIS, The Ohio State University, Museum of Biodiversity, 1315 Kinnear Road, Columbus, OH 43212

Email: rhaack@fs.fed.us, a.sikken@gmail.com, tpetrice@fs.fed.us, Steven.C.Passoa@aphis.usda.gov

In December 2013, I (RAH) received an interesting Email message from Claus Eckelmann, who works out of Barbados as the FAO (Food and Agriculture Organization of the United Nations) Forestry Officer for the Caribbean, informing me about a possible bark beetle outbreak in the pine forests of The Bahamas. I had worked with Claus in 2000 on a major bark beetle outbreak in the pine forests of Belize (Haack et al. 2000), and as a result of that consultation he was contacting me again. As it turned out, I was asked to travel to the island of Abaco in The Bahamas for a week in February 2014 and work with the local FAO forester Ariën Sikken to evaluate the pest problem as well as give a 2-day forest health short-course to the local forestry staff (http://www.bahamas-forestry.com/), most of whom work for the Bahamas National Trust (http://www.bnt.bs/).

The native pine species growing in the Bahamas is a variety of Caribbean pine (*Pinus caribaea* var. *bahamensis*). Currently there are about 180,000 ha of Caribbean pine forest in The Bahamas. This same variety of Caribbean pine also occurs on the nearby Turks and Caicos Islands.

Healthy pines with many exit holes on the bark.

There are five major bark beetle (Coleoptera: Scolytinae) species that infest pines in the southeastern USA, including two species of *Dendroctonus* and three species of *Ips*. All three *Ips* species [*Ips avulsus* (Eichhoff), *Ips calligraphus* (Germar), and *Ips grandicollis* (Eichhoff)] are native to The Bahamas, but no *Dendroctonus* species are known to occur there. Before arriving in The Bahamas, I was expecting *Ips calligraphus* to be the principal bark beetle involved in the local outbreak on Abaco given that I had investigated two *I. calligraphus* outbreaks previously in the Caribbean -- both in the Dominican Republic (Haack 1998, Haack et al. 1989) and worked with this beetle in Florida during my Ph.D. program in the 1980s (Haack 1985, Haack et al. 1984a, 1984b, 1987a,1987b, Slansky and Haack 1986).

After arriving in Abaco, I traveled with Ariën Sikken to visit some of the pine stands on the island. We set up two funnel traps on the day that I arrived and baited each with the two common *Ips* pheromones: ipsenol and ipsdienol (photo, p. 32). The funnel traps were placed in separate pine stands, several kilometers apart and suspended by ropes between pine trees with the collection cup approximately 1 m above ground. The collection cups were filled with soapy water as the killing agent.

As we looked over the pines, most of which were about 50 years old, the trunks of nearly every pine tree had several small circular exit holes (see photo), which are typical of bark beetles and many other borers (Solomon 1995). However, the needles in the crowns of these same trees were still green, indicating the trees were still alive and apparently healthy. Elsewhere in the stands, where there was some recent logging activity, we did find evidence of *Ips* galleries, exit holes, frass, and all life stages on the pine logging slash. As we debarked several of the standing and green-topped pine trees over the next few days (photo, p. 32), as well as a few that had been felled during the previous few days, we noted that under nearly every exit hole there was a single, elongate and irregular gallery, with loose frass that was constructed almost entirely in the thick outer bark, and seldom appeared to reach the inner bark and almost never the sapwood. These were not bark beetle galleries that are typically constructed at the interface of the inner bark (phloem) and sapwood and consist of a maternal egg gallery and several individual larval galleries (Solomon 1995). There was also evidence of woodpecker feeding on most pine trees, and it was clear that they had been preying on these same borers given that their feeding activity was restricted primarily to the outer bark. On only one occasion did we find a live insect in one of these galleries, and it was a larva (photo, p. 32). At first glance it looked like the larval stage of a longhorned beetle (Cerambycidae), but after returning it to the USA (in alcohol) and more careful inspection under a microscope by Toby Petrice and Steven Passoa the larva was clearly a caterpillar (Lepidoptera), with the crochet pattern on the prolegs being similar to members of moth families Cossidae and Sesiidae. Given that only a single larva was recovered, and subsequently placed in alcohol, we could not rear this individual to the adult stage to make a positive identification. Therefore, later we extracted a DNA sample from this larva and compared it with known lepidopteran species that had been entered into the Barcode of Life database. The DNA evidence suggested that the larva was a member of the genus *Givira* (Cossidae), which is reasonable given that there are species of *Givira* that develop in the outer bark of pines in nearby Florida (Heppner 2007, Tschinkel 2002).

Bob Haack talking with local foresters in Abaco, The Bahamas.

As the title of this abstract implies, the identity of this borer is befuddling, although the recent DNA evidence is now directing us on a clearer path. Given that nearly every pine tree on Abaco had dozens of exit holes that led to galleries that were nearly

View from Hope Town Lighthouse, Elbow Cay, near Abaco, The Bahamas

Debarking recently felled pines to search for borers that might be infesting the pines.

completely contained within the outer bark, it appeared that there must have been a local "outbreak" of this borer in the recent past or alternatively that the galleries and exit holes are retained on the tree trunks for many years. In support of the latter hypothesis is the work by Tschinkel (2002) who reported that *Givira francesca* (Dyar) is a rare insect in Florida but because galleries and exit holes can be retained for decades until the damaged bark is eventually sloughed off, local populations of the moth can appear high. For example, of 800 galleries uncovered during debarking, only 3.8% had live *G. francesca* larvae *(*Tschinkel 2002). Ariën had continued to monitor the pine forests of Abaco looking for borers that could be responsible for the observed damage, however, as of December 2014, no other candidates had been recovered. In addition, frass from some of the old galleries was later sampled by Ariën and shipped to the USA to look for insect remains (which is now underway). In fact, the frass of many wood borers is very distinct and can be used in identification (Solomon 1977).

The two funnel traps were monitored weekly by Ariën for the next four weeks following my departure in late February 2014. Overall, for both traps combined, about 3200 *Ips* bark beetles were collected (pooling all 3 *Ips* species together, with most being *I. grandicollis*), 34 weevils (possibly species of *Hylobius*), 114 trogossitid beetles (these predatory beetles were likely species of *Temnochila*, which are often now called *Temnoscheila*), 82 cerambycids that were likely *Acanthocinus obsoletus* (Olivier), and 4 cerambycids that were likely *Monochamus titillator* (Fabricius). Tentative identifications of the weevils and cerambycids were based on Turnbow and Thomas (2008) as well as electronic images sent to Michael C. Thomas (Florida Department of Agriculture, Gainesville, FL). Selected specimens have been stored in alcohol at the US Forest Service laboratory in East Lansing, MI. It is possible that some of the exit holes seen on the bark of the standing live pine trees were made by some of the above insects, but it is more likely that these insects had developed in pine trees that had recently been cut.

There are also several exotic pests that are currently in The Bahamas or on nearby islands that are of local concern. One of the most serious threats to the pines of The Bahamas is a soft scale insect native to North America that is commonly called the pine tortoise scale [*Toumeyella parvicornis* (Cockerell) (Hemiptera: Coccidae)]. The pine tortoise scale was recently introduced into the Turks and Caicos Islands (first reported in 2005; Malumphy et al. 2012) and Puerto Rico (2009: Segarra-Carmona et al. 2010). The pine tortoise scale likely entered these islands on pine Christmas trees that were imported from the USA (Malumphy et al. 2012). In the Turks and Caicos Islands, the pine tortoise scale has caused widespread mortality of Caribbean pine (Green 2011, Malumphy et al. 2012, Sanchez 2012).

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A cossid larva that was tunneling in the outer bark of the pines in Abaco, The Bahamas.

One of the baited funnel traps deployed in Abaco, The Bahamas.

Suitability of green ash (*Fraxinus pennsylvanica*) and blue ash (*Fraxinus quadrangulata*) to emerald ash borer (*Agrilus planipennis*)

Donnie Peterson, Steve Yaninek, and Cliff Sadof
Department of Entomology, Purdue University, 901 W State Street, West Lafayette, IN 47907
Email: peter207@purdue.edu

Blue ash (*Fraxinus quadrangulata*) is the species of ash tree least susceptible and most likely to survive emerald ash borer (EAB), *Agrilus planipennis*, attack in the Great Lakes area of North America. However, the mechanism of resistance has not been well researched. In order to determine the extent to which blue ash may be resistant, green (*F. pennsylvanica*) and blue ash trees were infested with EAB eggs in order to determine host suitability in both field and laboratory studies. In the field, overwintering last-instar J-shaped larvae were significantly larger and weighed more in green ash in contrast to blue ash. Additionally, significantly more larvae overwintered as J-shaped larvae in green ash than in blue ash, 85% vs. 68%, respectively. In the lab, EAB larvae infesting 25-cm-long bolts in green and blue ash were peeled on five sampling dates. EAB gallery width, larval prothoracic width, and larval weight were measured. Average values of these parameters from each sampling period were compared between ash species. There was a general trend that green ash larvae were larger and weighed more during each sampling period for all measurements. This suggests that EAB larvae are developing faster on green ash than on blue ash. The slower development rate of EAB larvae on blue ash may provide more opportunities for natural enemies to attack EAB in the field.

DNA Fingerprinting of Michigan Emerald Ash Borers (*Agrilus planipennis*)

David Stanton
Saginaw Valley State University, Department of Biology, University Center, MI 48710
Email: dstanton@svsu.edu.

The Emerald ash borer (EAB) is native to eastern Asia but was found in Michigan in 2002. It was most likely transported to Michigan in infested wood packaging, such as pallets or crating. In the last 12 years it has spread throughout the Great Lakes region and to much of the eastern United States. The EAB larvae feed primarily on the inner bark and outer sapwood of all species of ash trees (*Fraxinus*) so far encountered and EAB has already been responsible for the destruction of tens of millions of ash trees in Michigan alone. EAB has had a significant negative impact both ecologically and economically in many communities.

EAB adults were collected in the summer of 2013 and the spring of 2014 from three locations in Michigan, including Edmore State Game Area, Baldwin, and Beaverton. Specimens were frozen at -20ºC or stored in a 70% ethanol solution until DNA extraction was performed on leg tissue using a DNeasy extraction kit. DNA fingerprinting was performed for two loci using PCR with dye labeled primers and capillary electrophoresis. Data analysis included determination of the number of alleles per locus, allele frequencies, observed (H_o) and expected (H_e) heterozygosities, Hardy Weinberg equilibrium (HWE), genetic distance (D) and population substructure (F_{ST}).

Three alleles were observed for the C5 locus and two for the C8 locus. Ho values were near He for all populations and all were found to be in HWE. Genetic distances between populations were low (average D = 0.09) and population substructure was low (F_{ST} = 0.04). These results indicate that only a portion of the genetic variation present in native populations of EAB in Asia was introduced to Michigan. This suggests that, if further introductions are minimized, it may be possible that the final geographic spread of EAB within North America may be limited due to lack of high genetic diversity.

Adult Flight Periodicities of 12 Caddisfly Species in a First-Order Michigan Stream: A 3-Year Study

David C. Houghton
Department of Biology and G.H. Gordon Biological Station, Hillsdale College, Hillsdale, MI 49242
Email: dhoughton@hillsdale.edu

The adult flight periodicities of 12 caddisfly (Trichoptera) species were studied from 2010 to 2012 in Fairbanks Creek, a first-order stream located in Lake County in northwestern Lower Michigan. Ultraviolet light trap samples were collected approximately weekly as weather permitted from mid-May through the end of September for all three years. Eight of the species appeared to exhibit univoltine life cycles. Adult abundance of two of these species peaked in May, one in June, three in July, one in August, and one in September. Four species appeared to exhibit bivoltine life cycles. Two species peaked in June and July, and two in June and August. Species richness was highest in July for all three years of the study. Continuing the study for several more years will allow for correlations between yearly differences in adult flight patterns with weather or other factors. Study continuation may also allow for deducing the patterns of additional species at this site whose flight periodicities were not readily apparent.

Attraction of *Agrilus* (Coleoptera: Buprestidae) to Different Trap Colors and Trap Types

Toby R. Petrice and Robert A. Haack
USDA Forest Service, Northern Research Station,
3101 Technology Blvd., Lansing, MI 48910
Email: tpetrice@fs.fed.us

Since the accidental introduction of emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae), into North America there has been a considerable amount of research focused on developing an effective trap for monitoring and detecting this beetle. Prior to EAB's discovery, little research had been conducted on traps for *Agrilus* beetles or other Buprestidae. One of the few published studies was conducted by Oliver et al. (2003) in which different colored cylinders were tested for monitoring buprestid beetles in nurseries. In this particular study, purple and violet captured the highest number of buprestid beetles. Results from this study led researchers to test an array of trap colors for trapping EAB. Their initial results found purple to be the most effective color for EAB (Francese et al. 2005). Later, electroretinogram assays with EAB adults found EAB to be stimulated by colors in the ultraviolet, violet, and green spectrums (Crook et al. 2009). Also, females showed a higher response to colors in the red spectrum compared to males. Another study found that

EAB males were attracted to and landed on dead EAB females that were pinned to foliage (Lelito et al. 2007). In addition, other studies found that males of some other *Agrilus* species shared this same behavior and one species was also attracted to the elytron of a *Cicindella* tiger beetle species that was pinned to foliage of its host plant (Domingue et al. 2011; Lelito et al. 2011). A study by Petrice et al. (2013) found that both dead *Agrilus* used as decoys and large *Agrilus* silhouettes enhanced attraction of certain buprestid beetles to sticky traps and that the response varies among species and even sex. During 2009-2012, we conducted several studies comparing the attractiveness of native *Agrilus* and other Buprestidae to different colors and trap types that had been previously tested on EAB.

In 2009, we tested the attraction of *Agrilus subcinctus*, a native species, to sticky traps that were green, purple, white, or yellow. Traps consisted of corrugated plastic (7.6 cm × 12.7 cm) that was coated with insect trapping glue and hung in ash trees attacked by EAB approximately 2 m high on dead branches above live sprouts. We found that *A. subcinctus* was most attracted to yellow, followed by green trap; purple and white traps were least attractive. In 2011, we suspended green, purple, white, and yellow sticky traps (15 cm × 30 cm) from the lower limbs of hybrid poplar (*Populus* spp.; trap height ranged from 2–15 m) and honeylocust (*Gleditsia triacanthos*; trap height ranged from 1.5–2 m) trees. We found that green traps captured the most native *Agrilus* individuals on both species of trees. Green traps also captured the most *Agrilus* species in hybrid poplars; however, differences in *Agrilus* species captured among trap colors in honeylocust trees were not significant. In 2012, we tested the attraction of green (old green- the same shade used in the 2009 and 2011 studies), a new green (Sabic green-darker than old green), and purple sticky traps; and funnel traps that were green or black. Funnel traps were coated with fluon to make their surface more slippery. We found that the most native *Agrilus* individuals were captured on the old green sticky traps, but the most *Agrilus* species were captured in the green funnel traps.

EAB, *Agrilus planipennis*

In our studies, we found that green sticky traps (old green) were overall the most effective for capturing native *Agrilus*. Funnel traps seem promising for capturing different *Agrilus* species and avoid the use of insect trapping glue. It is important to note that trap color preference can vary significantly among *Agrilus* species and sex, with some species preferring purple or other colors over green.

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Twolined Chestnut Borer
Agrilus bilineatus

Impact of *Corthylus punctatissimus* (Coleoptera: Scolytidae) on the Woody Sub-canopy Vegetation in Central Michigan

Richard Roeper (emeritus) and former students and High School teachers Steven Larson, Michael Allen and Brian Palik
Department of Biology,
Alma College, Alma, MI 48801
Email: rroeper@gmail.com

Corthylus punctatissimus (Zimmermann) is the only endemic ambrosia beetle of the northern deciduous forest of the United States and Canada known to attack and kill woody hosts (Roeper. et al. 1987a). The beetle attacks young maple saplings, constructs a spiral gallery system in the xylem and kills the saplings, which are easily found by their wilted leaves.

For decades the Canadian Forest Service reported that *C. punctatissimus* had an effect on maple regeneration in Ontario and Quebec but failed to provide any definitive data. They reported that the damage caused by the beetle is often localized and can have a significant impact upon maple regeneration. The Canadians suggested that the beetle might actually have provided a benefit by thinning out densely stocked maple regeneration areas. Finnegan (1967) reported eight percent of the young maple saplings were killed annually and that the saplings became immune to attack after about 10 years of age.

Table 1. Attack rate of *Corthylus punctatissimus* on saplings in survey plots in Michigan

Species	No. of saplings surveyed	No. attacked and killed	Percentage of species killed
Maple	1385	179	12.9 %
Oak	58	2	3.5 %
Black cherry	73	5	6.8 %
Total	1516	186	12.3 %

This study was conducted in three mature woodlots with a rich understory of woody saplings in Gratiot County, Michigan. *C. punctatissimus* has been reported to attack 18 species of woody sapling trees and shrubs (Roeper et. al.1987a, http://www.barkbeetles.info/) but our study showed a strong preference for maple saplings (Table 1).

The impact of the beetles on the maple sapling community was conducted using 6x6 m quadrats. The count included all the maple saplings of susceptible age and the number that were actually attacked and killed in each quadrat. The results showed a positive correlation (r = 0.74) between maple sapling density and the number of saplings that were attacked and killed (Fig. 1). The beetle was not observed to eliminate entirely the regenerating saplings from a given area, but did thin and reduce the number of saplings and thus may have the suggested beneficial effect.

In another intensive study of older saplings that were no longer of an age susceptible to be killed by the beetle, we found that some of these older saplings (n=33) had been attacked earlier by *C. punctatissimus* but not killed. A few maple saplings had as much as 75% of their trunk's cross-section excavated by the beetle's spiral gallery system, yet these saplings did not show any sign of leaf wilting. The characteristics of the attacked older maples and the gallery systems of the beetles can be compared to those saplings that had been attacked and killed (Table 2).

Reproduction by *C. punctatissimus* in the attacked but not-killed maple saplings appeared to be much reduced. No phytopathogenic microbes have been isolated from *C. punctatissimus* so it appears that the beetle is not a vector of disease organisms that would kill saplings that survive initial attack.

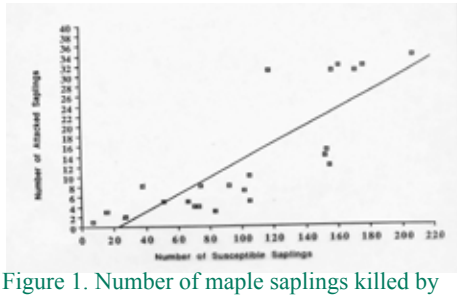

Figure 1. Number of maple saplings killed by *Corthylus punctatissimus* vs. the total number of susceptible maple saplings per 6x6 m quadrats in Central Michigan.

In summary, *C. punctatissimus* preferred to infest maple saplings in Central Michigan, thinning the maple regeneration but not eliminating the maples. The beetle can attack older maple saplings without killing them. Thus in the mature northern deciduous forest the symbiotic association of *C. punctatissimus* and its fungi interact with the regenerating sapling maples to form a complex and interacting niche.

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Table 2. Comparison of understory maple saplings that were killed vs. not killed by *C. punctatissimus* (Roeper et.al. 1987b)

Parameter	Attacked and killed maple saplings	Attacked but not killed saplings
Mean age (range)	5.8 years(3-12)	12 years (8-25.5)
Mean basal diameter of stem (range)	6.9 mm (4-14)	9.6 mm (4.5-25.5)
Mean length of gallery	26.4 mm	16.9 mm
Mean number of larval cradles	4.64	2.9

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Department of Entomology
Michigan State University
288 Farm Lane
East Lansing, Michigan 48824

Requesting First State Arthropod Reports

IT'S TIME AGAIN TO SET THE RECORD STRAIGHT! Have you recovered an arthropod species not before recorded from your state? Perhaps you've recovered one a few years ago which has not yet been reported in print. Publishing new state records significantly adds to our understanding of species ranges as well as their expansion.

Submit your record(s) for our next Newsletter (spring 2015). If you're not sure of the identity of your specimens, it's a great reason to attend our next Breaking Diapause, **Saturday, 14 March 2015** (see p. 17). The more information you have regarding your recovery the better. Include as many of the following points that you have: species, common name (if there is one), family; date, location of recovery, method of recovery, identifier, photograph, habitat, and current specimen(s) location. Of course, you will be credited for all your information!

Send your information to Ron Priest at: priest@msu.edu or 243 Nat. Sci. Bldg., M.S.U., East Lansing, MI 48824-1115. If you have questions, then please contact me by Email, phone: 517-353-3891, or U.S. mail. I look forward to hearing from you, learning what's new, and seeing your records in print

Ron Priest

MES Website News

As the long-time webmaster of MES, I have tried to maintain the site as well as my level of knowledge and time will allow. Until Dec. 9, 2014, the actual website was hosted by the University of Michigan on our divisional server. With the forthcoming move of the UM Museum of Zoology to Varsity Drive, I have no guarantee that anything regarding our webserver will be the same. I was also worried about continuity, as I will not always be working for UM. With those concerns in mind, I did my research on web-hosting services, and with the MES Governing Board's blessing, I set up an account with Bluehost.com and have now completed the transition. I have completed all of the work that is required to move our domain name michentsoc.org to a new hosting service. I have moved all of the MES files from our server here at UM to the Bluehost server, updated links, and made corrections to our website. My next goal is to update the pdf files and add the more recent newsletters and journals to the site. It is now stand-alone with no referrals back to the UM servers. This service will allow us to potentially try some technologies and services that were not previously available on our UM server. It will also provide an independent host so that any future MES webmaster can maintain our files.

So, we are good for at least 3 years, with a stable web-hosting service. The URL remains: <http://michentsoc.org>.

Mark O'Brien, MES Webmaster