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Spore wars: Entomophaga maimaiga *vs* *Gypsy Moth in North America*

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Entomophaga maimaiga, an Asian fungal pathogen of the gypsy moth, was first discovered causing epizootics in gypsy moth populations in seven northeastern US states in 1989. It had not previously been reported from North America although Harvard researchers had attempted to release it in the Boston area in 1910-1911 and numerous pathogen surveys had been conducted in the northeast between 1911 and 1989. We now think that (1) this pathogen was accidentally introduced from Asia relatively recently or (2) there is the possibility that the weakly virulent strain of *E. maimaiga* introduced in 1910-1911 remained relatively inactive in the soil and gradually adapted to North American conditions and to the European strain of gypsy moth present in North America (for a full discussion see Hajek et al. 1995, Amer. Entomol. 41: 31-42). The extensive epizootics that occurred in 1989 were associated with an extremely rainy spring and increasing gypsy moth populations. This pathogen was therefore unique among the gypsy moth natural enemies in North America given that it caused high levels of mortality at low host densities. The gypsy moth nuclear polyhedrosis virus (LdMNPV) was already well known as causing crashes in gypsy moth populations in the US but this pathogen was generally only extremely active in outbreak host populations after defoliation had occurred.

During 1990, the distribution of this pathogen appeared to increase since *E. maimaiga* was recovered in 10 northeastern states but occurred only far from the leading edge of gypsy moth spread. Rainfall during 1990 was relatively abundant in May but June was dry. To evaluate whether this pathogen could be introduced to new locations, *E. maimaiga* resting spores were released at 41 locations in Maryland, Pennsylvania, Virginia, and West Virginia during 1991 and 1992. There was an extremely dry spring in 1991 but fungal establishment was recorded in the majority of release plots, with spread of up to 350 m from release sites. During 1992, *E. maimaiga* was found in almost all release and control plots at very high levels and it had also spread across most of the contiguous distribution of gypsy moth in the Northeast. Studies have demonstrated that conidia of this fungus are airborne and we hypothesize that airborne conidia both from the 1991 and 1992 release plots as well as from areas to the north, where *E. maimaiga* was already established, were responsible for the seemingly simultaneous spread during 1992. Although many methods of spread by *E. maimaiga* are also possible, the only other method investigated to date is movement of *E. maimaiga* resting spores in mud on soles of footwear, which could easily result in more spread.

From 1990 through 1994, *E. maimaiga* was released at numerous sites in the northeast and Michigan. Although it had been confirmed that this pathogen was specific to Lepidoptera, we needed more detailed information about potential infection of non-targets. Bioassays were conducted to test *E. maimaiga* specificity in the laboratory; of the 78 species challenged, while

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Inside this Issue:

"Chanel No. 5" Method of Insect Control Gets Boost

Confusing insects that are looking for mates is a great idea, but getting the potion out into the fields effectively has been a stumbling block.

In September 1998, Michigan Agricultural Experiment Station (MAES) entomology researchers, in conjunction with Michigan State University (MSU) electrical engineering scientists and Ford Motor Co., unveiled a device that reliably and effectively puffs out insect-foiling chemicals. The invention was introduced at Ford's Environmental Showcase at the Dearborn Proving Grounds.

The MicroSprayer puffs regular bursts of synthetic pheromones into fields or orchards for an entire growing season with little or no maintenance. Pheromones are the substances produced by many insects to attract mates. Blowing

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Spore Wars...

optimizing conditions for infection, about one-third became infected but all at low levels except one of two sphingids tested and all lymantriids. During 1994, non-targets were collected from 7 areas during *E. maimaiga* epizootics but only two individuals were infected out of more than 1500 larvae reared, yielding 0.3% *E. maimaiga* infection in *Malacosoma disstria* and 1.0% *E. maimaiga* infection in *Catocala ilia*.

Numerous field researchers have suggested that E. maimaiga might be shortening the duration and lessening the extent of gypsy moth outbreaks.

Epizootics have been reported in gypsy moth populations each year from 1994-1998, somewhere within the gypsy moth range in the US. Land-managers, researchers, and the public are wondering what the overall impact of this fungus on gypsy moth will be. Can it cause population crashes? What will happen to the other natural enemies of gypsy moth? Numerous field researchers have suggested that *E. maimaiga* might be shortening the duration and lessening t he extent of gypsy moth outbreaks. At present, it is too early to be able to substantiate such suggestions regarding general long-term trends. To provide an example of *E. maimaiga*/gypsy moth interactions over six years, I presented results from central New York from 1991-1996. *Entomophaga maimaiga* was first seen in this area in 1990. During the dry spring of 1991, in gypsy moth populations from 4,000-40,000 egg masses/ha, LdNPV was the predominant pathogen with the characteristic bimodal abundance as epizootics developed; however, *E. maimaiga* was also detected in all plots but at lower levels. Gypsy moth populations did not collapse in 1991 although they decreased in abundance. In 1992 when rainfall was slightly greater than normal during the period that larvae were present, *E. maimaiga* was the most abundant pathogen with lower levels of infection in early instars, especially in lower density plots. LdNPV was also present in all plots although more abundant in plots with higher gypsy moth densities. At the end of the 1992 season, gypsy moth egg masses were almost totally absent and basically no defoliation had occurred. From 1993-1996, gypsy moth populations remained at extremely low densities. *Entomophaga maimaiga* was recovered from larvae throughout this time although infection levels varied, but LdNPV infections were very rare. In summary, from plots in central New York, during a year with approximately normal levels of rainfall, *E. maimaiga* and LdNPV were both active during an epizootic, resulting in a gypsy moth population crash. Needless to say, further examples of the long-term dynamics of *E. maimaiga* in association with gypsy moth and other gypsy moth natural enemies are needed before we can derive any predictions regarding the potential changes in gypsy moth dynamics after establishment of *E. maimaiga* in North American gypsy moth populations.

Keynote Address, MES Annual Meeting 1998

Mourning Cloak Antics

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In April 1998, I received the following E-mail message from Fred Heath regarding an afternoon trip through Garden Canyon in Fort Hauchucha, Arizona. It was so interesting that I thought that many members would find it interesting too! Heath gave permission to relay the following story:

"The highlight of the jaunt was a very territorial mourning cloak (*Nymphalis antiopa*) that came out and challenged us. A few minutes later it was seen maneuvering with a bat over the road. At first, we thought the bat was chasing the butterfly, but soon we realized much to our amazement and amusement the opposite was true. The bat flew back and forth a few times with the butterfly in hot pursuit. Finally, the bat headed down the road and out of the butterfly's territory. The mourning cloak then came back up the road chasing a two-tailed swallowtail (*Papilio multicaudatus*) in the opposite direction."

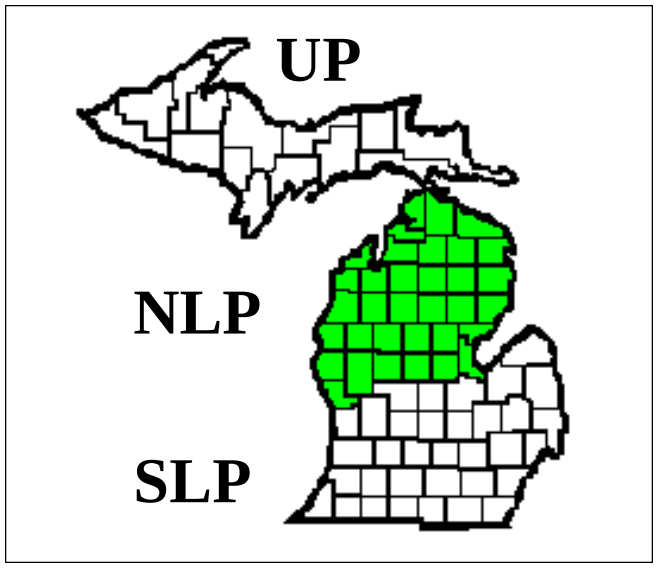
On a more sober note and closer to home, I can report the following. In Otsego County, Michigan, on 10-12 April 1998 under bright skies and warm temperatures, Terry Herig and I encountered numerous mourning cloaks along sandy trails. A few butterflies were attracted to bait traps that we had set up the night before. While the butterflies were flying they appeared to be setting up their special "territories" along the trail. However, we were in no danger of being attacked!

Emergence of Butterflies and Skippers and the El Niño Year

Owen A. Perkins
Michigan Lepidoptera Survey,
2806 Linwood, Royal Oak MI 48073-3023

The 1998 Lepidoptera collecting records for Michigan of Owen A. Perkins offer an interesting observation in the El Niño year of 1998. For 12 species, the date of first collection in Michigan was earlier than any previous record based on the historical collection data compiled by M.C. Nielsen. Seven of these new early emergence records were from the Southern Lower Peninsula of Michigan (SLP), one from the Northern Lower Peninsula (NLP) and four from the Upper Peninsula (UP; see map). An additional 13 SLP, 10 NLP and 18 UP species were recorded as voucher specimens for dates earlier than in any previous year for those particular areas of Michigan. This amounts to 53 new regional records for early emergence dates, just from the collecting by Perkins.

Some examples include: voucher photographs of the threatened *Oarisma powesheik* (Parker), the Powesheik Skipper, on 24 June 1998 in Oakland County, a new state early emergence record and a SLP record; and *Euphyes*



dukesi (Lindsey), the Dukes' Skipper, on 26 June 1998 in Monroe County, a new state early emergence record and a SLP record.

Other first early species records were for *Polygonia comma* collected 28 February and *Erynnis juvenalis*, collected 20 April, both in Oakland County in the SLP. *Artogeia rapae*, *Incisalia polia*, and *Incisalia niphon clarki* were all collected on 4 May in the NLP as was *Celastrina ladon* and *Vanessa atalanta rubria* in the UP for early regional records. The latest of the new early regional records was for *Euphyes conspicua* on June 29.

Using the Baskerville-Emin degree-day accumulations (Base 50°F, 1 March start date) for the recording station at Oxford, Oakland County, Michigan, the degree-day accumulation was 281 on 20 April 1998, compared with 156 on 20 April 1996 and 158 on 20 April 1997. In 1996 and 1997, degree-day sums didn't reach or surpass 281 until 6 May in both years – a difference of 16 days. This degree-day differential continued for the remainder of the 1998 collecting season.

As an aside, nine records for "late collection dates" were also recorded in 1998, including two statewide late collection records. For example, *Epargyreus clarus* was collected 28 September in Monroe County which is a SLP and state late collection record. *Epargyreus clarus* was collected 19 May in Lenawee County, which is an early collection record for the SLP. Thus, this species was collected over a span of 113 days in the SLP in Michigan. The unusually warm weather of 1998 certainly affected the pattern of butterfly and skipper emergence in Michigan. What were the findings of other lepidopterists for the El Niño year of 1998?

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"Chanel No. 5"...

faux pheromones into the air confuses the signals between male and female bugs, foiling mating and thus reducing the number of damaging larvae that can invade a field or orchard.

MAES entomologist James Miller, post-doctoral researcher Rufus Isaacs; Michael Ulczynscki, a recent MSU graduate with a doctorate in electrical engineering employed at Ford; and Brian Wright, research and instructional equipment technologist in the Department of Electrical and Computer Engineering, used Ford Motor Co, fuel injectors as a spray nozzle.

The team has taken a very common Ford automotive part and put it to an important new use," Ulczynscki said.

The MicroSprayer resembles two household insecticide canisters connected by a small pipe capped by the fuel injector to atomize the chemicals. The triggering mechanism uses a 9-volt battery.

The MicroSprayer, which perches on a PVC pole, discharges a pheromone cloud about every three minutes.

"Laboratory and field testing of the MicoSprayer has shown that this device provides a robust, reliable method of dispensing defined quantities of pheromone under field conditions," Miller siad. "The results from field tests clearly demonstrate that this new technology is intended to operate throughout a growing season without the need for maintenance."

Field tests done by MSU indicate more than 90 percent mating disruption of leafrollers, a common damaging apple pest.

Pheromones are frienddly to humans and the environment. A patent for the MicorSpryer has been applied for through MSU. "A farmer can use this and not have to worry about it for a year," Wright said. "You basically hook it up and walk away from it and not worry about it."

Reprinted from:
Messenger, Michigan Agricultural Experiment Station, October 1998, p. 2.

Notices:

Meeting. Michigan Mosquito Control Association annual meeting – 4-5 February 1999, Southgate Holiday Inn, Southgate, MI. Contact Gloria Katch, 211 Congress St., Saginaw, MI 48602. Phone (517) 755-5751

Volunteer Research Opportunities. The nonprofit EARTHWATCH Institute is recruiting volunteers for a number of insect research projects around the world. For example, some of the insect projects are taking place in Peru, Mexico, Brazil, Costa Rica and Ecuador. Others are closer to home in Mississippi, Texas, and Manitoba. For more information, phone 800-776-0188 or search the Internet at **http://gaia.earthwatch.org**

New Butterfly Books. "The Butterflies of Canada" published by the University of Toronto Press; cloth or paper. "The Butterflies of Point Pelee National Park" published by the Ontario Natural History Press. "The Butterflies of Papua New Guinea" published by Academic Press.

New Journals. "Journal of Insect Conservation" by Chapman & Hall, and "Agricultural and Forest Entomology" by Blackwell Science.

Butterfly Gardens and Educational Games. Contact Kathy Wildman by phone (614-965-2133) or by mail (PO Box 1069, Sunbury, Ohio 43074) to obtain a current list of items for sale, including butterfly garden designs, plants to attract butterflies, and several games.

EntoPrint: Label Making Software. A new product from Entomation to prepare insect labels for the Apple Macintosh. Print thousands of multiple-line labels in minutes. You can **serialize** your labels and use any font. EntoPrint requires a Macintosh II or better, System 7.0, and a laser printer for best results. Cost $29 plus $2 shipping. Contact: Entomation, 2742 Beacon Hill, Ann Arbor, MI 48104-6502. Phone: 313-971-6033; Email: entomation@aol.com.

Wanted: Michigan Orthoptera Records. Contact: Roger Bland, Department of Biology, Central Michigan University, Mt. Pleasant, MI 48859. Telephone: 517-774-3455; FAX 517-774-3462.

For Sale: Light traps, 12 volt DC or 110 volt AC with 8 or 15 watt black lights. Portable and easy to use. Battery charging system for 12 volt batteries for use in vehicles while traveling. System plugs into cigarette lighter. Can charge up to four batteries in three hours. For free brochure, contact Leroy C. Koehn, 6085 Wedgewood Village Circle; Lake Worth, FL 33463. Phone: 561-966-1655.

In Search of a New Editor for the Great Lakes Entomologist

Mark O'Brien
Insect Division, Museum of Zoology, University of Michigan, Ann Arbor, MI 48109-1079

Looking for a new challenge? Do you want to learn new skills? Consider becoming the Editor of the *Great Lakes Entomologist*.

As Editor of the Great Lakes Entomologist since 1988, I feel it is time for me to hand the duties over to someone else. My work with the Michigan Odonata Survey demands more of my time, and I do not want to detract from the quality of the journal. Ideally, I would like a new editor in place by spring 1999.

Much has changed since I took over from David Gosling. In 1988,producing an issue of the Great Lakes Entomologist was quite different from today's electronic publishing process. Editorial skills today are a meld of classical editing skills and computer savvy. Accordingly, some processes are streamlined. Manuscripts are no longer typed by the typesetter from marked up pages provided by the editor. Now, the entire issue is provided on disk to the typesetters after the manuscripts have been formatted according to the journal's standards. Photographs and line figures are scanned electronically by the typesetters. After the proofs have been checked and corrected, the typesetter sends the issue on disk to the printers and the journal is printed. The result of this has been fewer errors and corrections, a faster turnaround time from submission to proofs, and lower costs to the Society. As a result, our page costs have actually decreased, taking account of inflation.

I believe our Society offers a regional journal of good quality, excellent subject matter and provides a real service to the membership. Of course, this could not have happened without the support of the many people who help by reviewing the manuscripts, and of course, the authors themselves. I feel fortunate to have worked with so many people in the Society over the years. I think I have learned a lot from the authors and reviewers, too. Remarkably, only five editors have served the MES since the inception of the journal in 1966.

There is no long list of requirements to be met by potential editors— only that the person(s) doing the editing make an honest effort to produce a quality journal that represents the interests of the members of the Michigan Entomological Society. Of course you have to have a reasonable command of English, as well as some basic editing skills and attention to detail. There is a lot of OJT (On the Job Training) involved, and nobody is expected to be perfect. It is a wonderful way to enhance your career and in the process, gain new skills and contacts. This is a volunteer position, and the editor is also a member of the MES Governing Board.

I realize that few potential editors will have all of the computer skills that I put to use when readying an issue for the typesetters. Therefore, I am willing to be an interim "Associate Editor" to handle the electronic aspects of the journal, while the new Editor takes care of incoming manuscripts, gets them through the review process, and edits them to satisfaction.

If you are interested in becoming the editor of the Great Lakes Entomologist (or wish to nominate someone), please give me a call (734-647-2199) or email me (mfobrien@umich.edu). The editor's job description will be on the MES website at: http://insects.ummz.lsa.umich.edu/MES/editor.html.

FIRST ANNOUNCEMENT

45TH ANNUAL MEETING OF THE MICHIGAN ENTOMOLOGICAL SOCIETY

"Insect & Ecosystem Diversity in the Great Lakes Region"

Now is a great time to mark your calendar for the next MES Annual Meeting on **4 June 1999**.

A NEW MEETING SITE. This year's meeting will be held at a location new to MES: the Ralph A. MacMullan (RAM) Conference Center. It's just off US-27 and eleven miles south of Grayling, MI. The RAM is one of those sites made for entomologists. It is located among thousands of pristine forested acres and on the north edge of Higgins Lake. Three great tasting daily meals, in ample supply, are prepared by RAM staff. Plenty of rooms are available for overnight stays at the five on-site lodges. Camping sites are also nearby.

A DIFFERENT MEETING FORMAT. This year's meeting will have a theme that hopefully will appeal to everyone: **"Insect & Ecosystem Diversity in the Great Lakes Region.** Most presentations will be by invitation, with a sprinkling of submitted papers. We'll look at the conditions that encourage and limit insect distribution in the Great Lakes area . We'll also look at what we know about insect species diversity within a few insect groups. In addition, we'll learn the goals, efforts, and perhaps frustrations, of various agencies that are working to protect our species of concern.

We're again inviting posters and adding a special invitation for displays that depict special techniques or equipment used to collect or study insects. Are you working as an amateur, student, or professional on a project that you could demonstrate as a display or poster? Even a photographic display of your favorite study areas, whether in the Great Lakes area or not, would be of interest to others. Have you developed equipment or a technique for recovering or studying insects that could be presented as a display? You don't have to be a "pro" to have a good idea. Be a "showoff " and do a display!

As you've guessed, there will be plenty of opportunities to study, photograph, and collect insects. There will be light trapping Friday night and sites to visit on Saturday. So free your calendar for the 4th and 5th of June for some SERIOUS FUN! Look for registration forms in the spring 1999 issue of the MES Newsletter.

Submitted by Ron Priest

1998 Michigan Entomological Society Annual Meeting

The 44th Annual Meeting of the Michigan Entomological Society was held on 5 June at Hidden Lake Gardens in Tipton, Michigan. The Annual Meeting was a great success, thanks to Leah Bauer's great organizing skills. There were 10 submitted papers and 1 invited speaker: Ann Hajek of Cornell University. A summary of her Keynote Address forms the cover story of this issue of the Newsletter. Brief summaries of the submitted talks follow on the next few pages. We would like to thank George Heaton for taking photos at the MES meeting. Bob Haack and Therese Poland, Newsletter Editors.

Annual activity variation of the American dog tick, *Dermacentor variablis*, in northwest Ohio

C. Lee Rockett and John Arnold
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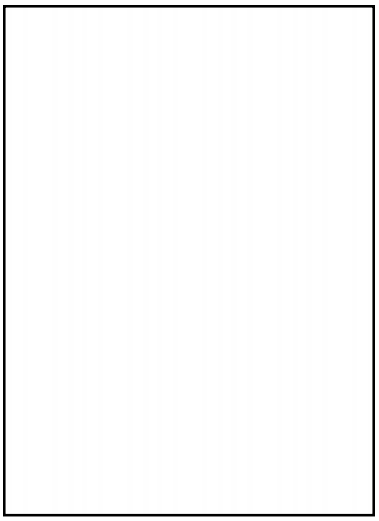
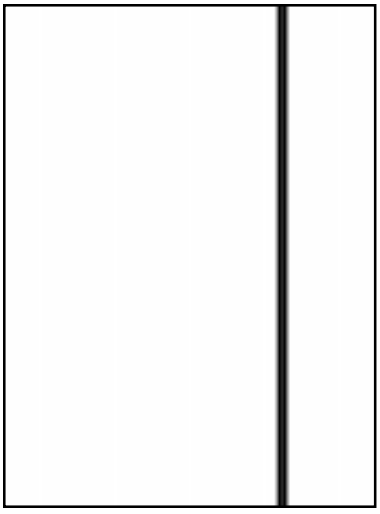
Beginning in 1979, ecological investigations on the American dog tick, *Dermacentor variabilis*, were periodically conducted in the Ohio metropark system of Lucas County. A single metropark was surveyed in 1979 and 1980, two parks were surveyed in 1989 and 1990, and five parks were surveyed in 1996 and 1997. All parks were separated from each other by a minimum of 8 km. Overall, for all surveys, adult tick activity began in late April, with peak abundance occurring from early May to mid-June. Significant differences in tick populations among the different parks were noted. Differences in vegetative parameters, host traffic, and host density are believed to be important variables in determining differences in tick density.

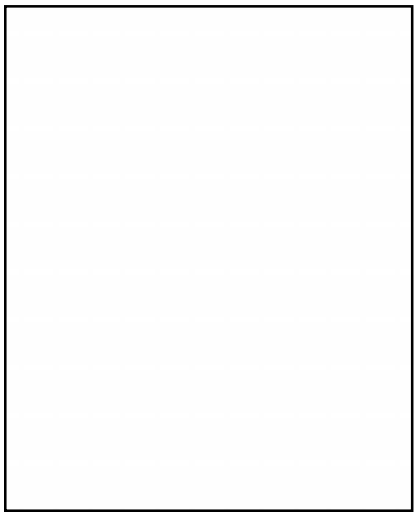




The northern field cricket, *Gryllus pensylvanicus* Burmeister (Orthoptera: Gryllidae): Enemy or friend?

Dora Carmona, Fabián Menalled and Doug Landis
Department of Entomology, Pesticide Research Center, Michigan State University, East Lansing, MI 48824 (E-mail: guidoser@telefax.com.ar) Dora is now at: FCA-INTA Balcarce; (7620) Balcarce; Buenos Aires, Argentina

Laboratory and field studies, conducted during the 1997 summer-fall season, examined the potential of the northern field cricket, *Gryllus pensylvanicus* (Orthoptera: Gryllidae), as a weed seed predator in annual crops. Laboratory no-choice tests showed that both male and female *G. pensylvanicus* readily accepted and consumed seeds of small and large-seeded annual weeds.



On average, 24-hour seed consumption by female and male *G. pensylvanicus* averaged 12 and 8 seeds of velvetleaf, *Abutilon theoprasti* Medic, 26 and 9 of giant foxtail, *Setaria faberi* Herrm, 87 and 69 of crabgrass, *Digitaria sanguinalis* (L.) Scop and, 223 and 90 of redroot pigweed, *Amaranthus retroflexus* L., respectively. Pitfall trap sampling in outdoor arenas was an effective way of sampling *G. pensylvanicus*. Therefore, pitfall traps were subsequently used to monitor activity and density of *G. pensylvanicus* in 1997 in a soybean, *Glicine max* L. Merr, field with two additional filter strips composed of switchgrass, *Panicum virgatum* L., and a mixture of alfalfa, *Medicago sativa* L., and timothy grass, *Pheum pratense* L. Individuals of *G. pensylvanicus* were first captured on 5 August, peaked in mid-September, and then decreased in October. Numbers of field crickets were greatest in switchgrass filter strips followed by grass-legume filter strips and lowest in soybean. Further studies are needed to elucidate the role *G. pensylvanicus* as a weed-seed predator in field crop systems.

Status of lepidopterans in prairies in Ohio

Eric H. Metzler
The Ohio Lepidopterists, 1241 Kildale Sq. N., Columbus, Ohio 43229-1306 (E-mail: spruance@infinet.com)

Remnant prairies are usually characterized by the occurrence of specific plants. Lepidopterans, as herbivores, are closely tied to plant communities. Maintenance of prairie habitat helps sustain biological diversity by providing for the continued survival of prairie dependent plants and animals.

I systematically collected 253 samples at 39 sites in remnant prairies in Ohio from 1992 through 1997. Overall, 41,600 moths, representing 900 species, were recorded. More than 50 of these species were previously unknown from Ohio.

Thirty eight (38) prairie remnant dependent species of moths were recorded. These remnant dependent moths apparently entered Ohio during the period of Transeau's prairie peninsula, and just like prairie plants, they continue to survive in suitable remnant habitats. In addition to plants, remnant dependent animals can be useful indicators of the health of remnant prairies.

Green leaf volatiles: Potential disruptants for the pine shoot beetle

Therese Poland and Robert Haack
USDA Forest Service, North Central Research Station, 1407 S. Harrison Rd., East Lansing, MI 48823 (E-mail: tpoland/nc_el@fs.fed.us)

The pine shoot beetle, *Tomicus piniperda* (Coleoptera: Scolytidae), is a native pest of pine trees in Europe and Asia. It was first discovered in North America in 1992 and is currently regulated by a Federal quarantine and a National Compliance Management Program. The use of semiochemicals may enhance the efficacy of management tactics for the pine shoot beetle. For instance, disruptive semiochemicals may deter beetles from attacking susceptible hosts for brood production or maturation shoot-feeding. Green leaf volatiles (GLVs) are prevalent in herbaceous plants and deciduous trees and generally disrupt attraction of conifer-infesting bark beetles. Field trapping experiments were conducted in spring 1998 in infested Scotch pine Christmas tree plantations in Michigan and Indiana to test GLVs against the pine shoot beetle. Funnel traps were baited with alpha-pinene lures alone or combined with various combinations of common GLVs and specific volatiles from aspen bark and foliage which elicited antennal responses by the pine shoot beetle. The common GLV alcohols and alcohols from aspen bark and foliage disrupted pine shoot beetle attraction.

Abiotic factors mediate changes in leaf litter quality induced by forest tent caterpillar defoliation

Daniel Herms,[1] Donald Sebolt, [2] and William Mattson[3]
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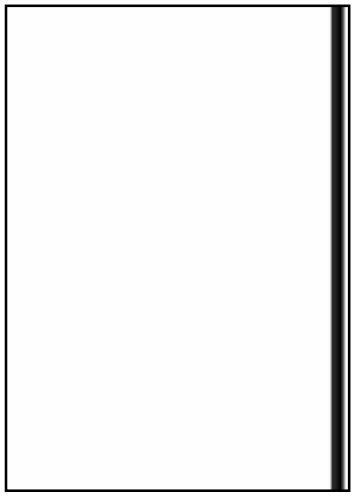
Severe defoliation in one year can decrease the quality of foliage for herbivores in subsequent years. Anti-herbivore traits may also inhibit the ability of decomposers to utilize leaf litter following senescence and abscission. In a controlled field experiment, we tested the hypothesis that changes in paper birch and sugar maple litter quality induced by forest tent caterpillar defoliation can indirectly affect rates of nutrient cycling in the year following defoliation, and that these effects will be mediated by the abiotic environment. Contrary to expectations, defoliation initially hastened the decomposition of foliage from trees that had been fertilized. Drought stress slowed litter decomposition, but not if the trees had been defoliated the previous year. These results indicate that biotic and abiotic factors can affect litter quality. However, the effects of defoliation, drought, and soil fertility were small relative to differences in litter quality between the two tree species that we tested.

Chitinase: Potential for insect resistance

Don Warkentin.
Department of Entomology, Pesticide Research Center, Michigan State University, East Lansing, MI 48824 (E-mail: warkenti@pilot.msu.edu)

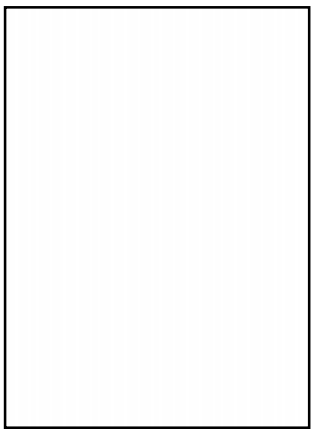


Chitinase is an enzyme produced in many plants. There is considerable evidence that chitinase may be a defensive enzyme against plant pathogenic fungi. Chitinase can hydrolyze the chitin in the fungal cell walls of certain plant pathogenic fungi, thereby inhibiting the growth of fungi in vitro by lysing the hyphal tips. There is also some evidence that chitinase may be a defensive enzyme against insects. Insects contain chitin in their peritrophic membranes. Chitinase can hydrolyze the chitin in peritrophic membranes, thereby killing the insects. Several insect pathogens, including some strains of *Bacillus thuringiensis*, produce chitinase. There is some evidence that these chitinases may aid the pathogens in penetrating the peritrophic membranes of their hosts, thereby enabling them to gain access to the epithelial cells of the insect intestines.

To test the hypothesis that plant chitinases may be defensive enzymes against insects, a chitinase cDNA clone from elm was used to transform creeping bentgrass (*Agrostis palustris* Huds.). The elm chitinase, controlled by the CaMV 35S promoter, was expressed in the transgenic creeping bentgrass. Bioassays indicated that the transgenic creeping bentgrass expressing elm chitinase was resistant to the turfgrass pathogen *Rhizoctonia solani*. Insect bioassays with Japanese beetle larvae are currently in progress to determine if the elm chitinase may be a defensive enzyme against insects.

Tradeoffs in the adaptation of a gall midge to a resistant willow

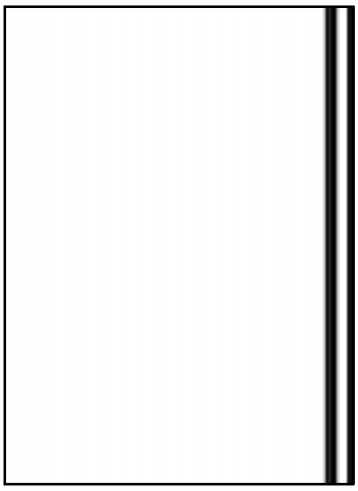
Carolyn Glynn
Ohio State University, Department of Entomology, Ohio Agricultural Research and Development Center, 1680 Madison Ave. Wooster, OH 44691-4096 (E-mail: glynn.12@pop.service.ohio-state.edu)



In Sweden, genotypes of basket willow, *Salix viminalis*, vary in their degree of resistance to the leaf-roller gall midge, *Dasineura marginemtorquens*. This study documented midge adaptation to a very resistant willow and investigated how genotype composition of the willow community may affect population numbers of resistance breachers. Stands consisting of cloned individuals of one resistant and one susceptible willow genotype in three different compositions were created. In one stand, resistant plants grew adjacent to an equal number of susceptible plants. A second stand was composed exclusively of resistant plants. In the third stand, the resistant genotype was rare among many susceptible plants. In the stand where the resistant willow type was rare, the susceptible plants had over 13 times as many galled leaves as the resistant plants. Where resistant and susceptible plants grew adjacent to each other, the resistant plants had many galled leaves. Resistant willows growing alone had very few galled leaves. These patterns persisted for six midge generations during the two consecutive years of the study. Transfer experiments showed that midges originating from resistant plants had a heritable trait that enabled them to survive on the resistant genotype. Midges able to initiate galls on the resistant genotype had longer developmental time on the susceptible genotype. This suggests that there is a cost associated with being adapted to the resistant willow genotype. The data suggest that the driving forces behind the observed host adaptation are selection imposed on the midge population by very strong willow resistance and restricted gene flow in the midge populations due to the special life history features of *D. marginemtorquens*.

The leatherwood leafminer (Gracillariidae): Biology and damage

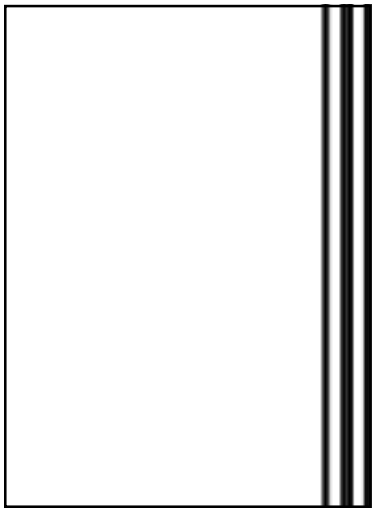
Toby Petrice,[1] **Robert Haack,** [1] **and William Mattson**[2]
USDA Forest Service, North Central Research Station, 1407 S. Harrison Rd., East Lansing, MI 48823 (E-mail: tpetrice/nc_el@fs.fed.us) [2]USDA Forest Service, North Central Research Station, 5985 Hwy. K, Rhinelander, WI 54501



Leatherwood, *Dirca palustris* (Thymeleaceae), is an understory shrub ranging throughout most of the eastern and central US and Canada. This plant contains toxins that are repellent to many vertebrate herbivores. Although uncommon throughout most of its range, leatherwood is an important understory component of some old growth hardwood forests in northern Wisconsin and the western Upper Peninsula of Michigan. In 1997, a study was conducted to identify and determine the impact of one or more insect species that were causing significant leafmining damage to leatherwood plants in Goegebic County, MI. Only one species of leafminer was identified: *Leucanthiza dircella* (Lepidoptera: Gracillariidae), which is specific to leatherwood. *Leucanthiza dircella* was found to have one generation per year in the study area compared with two generations per year in more southern areas of its range, e.g., Ohio. By the end of the growing season, 34% of the leatherwood leaves in the study area contained leafminer damage and 11% of the total leaf surface area was mined. To date, no leatherwood mortality is evident as a result of *Leucanthiza dircella*.

Utilizing Environmental SEM to distinguish elemental differences in *Berosus* egg cases. (Coleoptera, Hydrophilidae)

Eileen Van Tassell
Department of Entomology, Natural Science Building, Michigan State University, East Lansing, MI 48824 (E-mail: vantasse@pilot.msu.edu)



High-pressure electron beam imaging was utilized to reveal textural differences in the fibers of water beetle egg cases of two hydrophilid species of *Berosus* in different subgenera. Advantages of this technique were outlined during the talk. Examination of the egg cases revealed textural differences between *Berosus peregrinus* and *B. salvini* and also a qualitative difference in different areas of the egg case in *B. salvini* that was not seen in *B. peregrinus*. These particular areas on *B. salvini* corresponded to roughened pigmented regions on the case that were present in this subgenus only. Using Energy -Dispersive X-Ray Spectrometry (EDS), an elemental analysis of the cases was made and significant differences were noted between the two species. I gratefully acknowledge the technical assistance of Richard Schalek and the Composite Materials & Structures Center at Michigan State University.

Using carabids to assess impacts of forest management practices

Robert Haack,[1] Toby Petrice, [1] Robert Acciavatti, [2] and Robert Davidson. [3]
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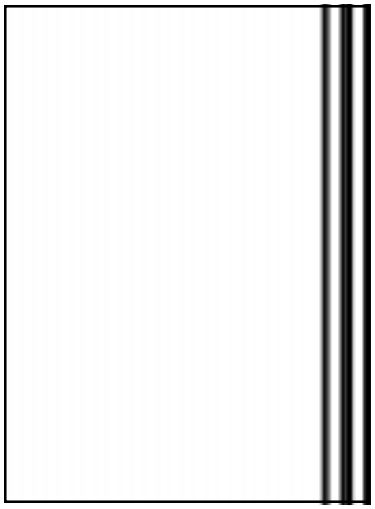


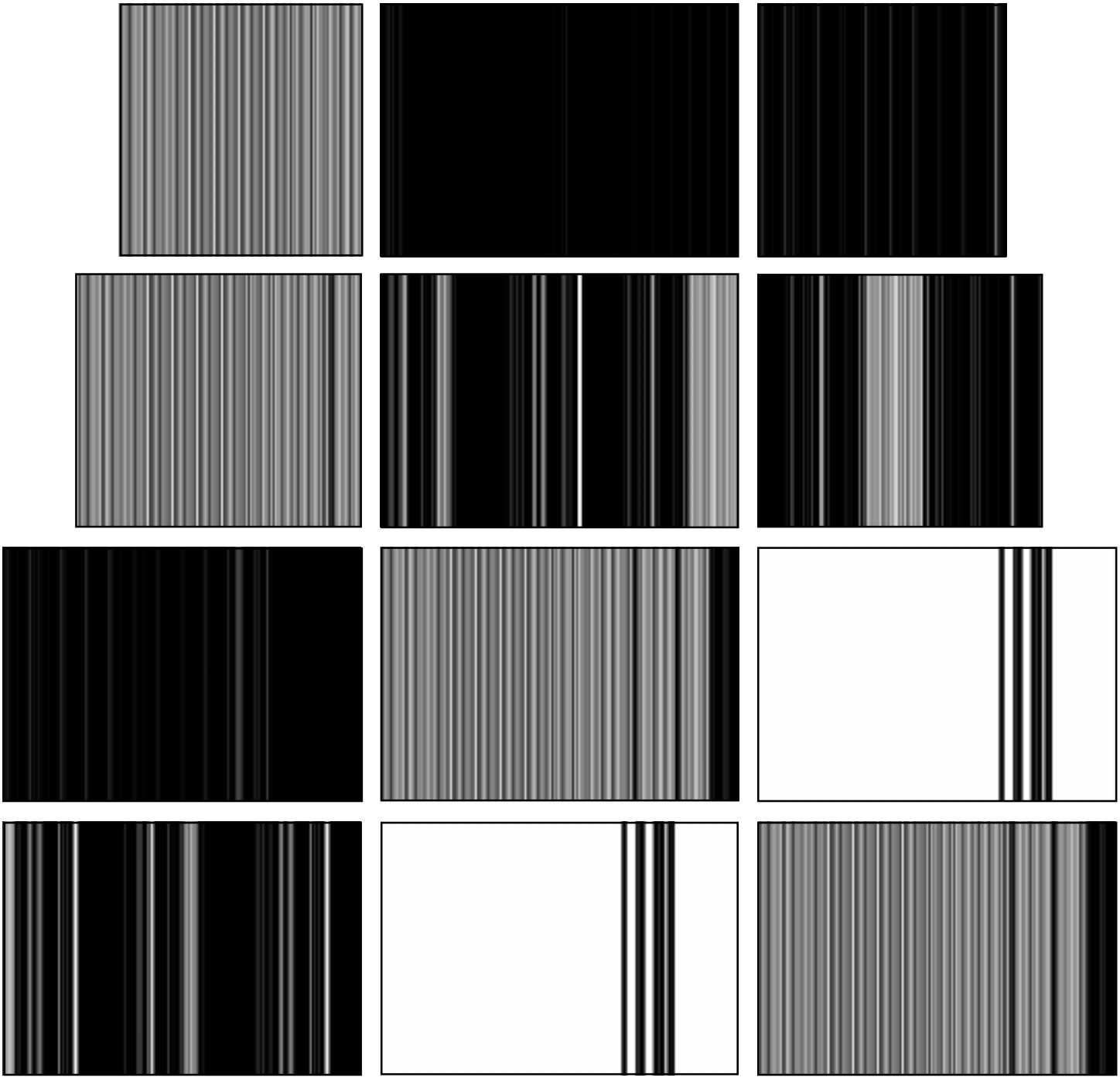
Forest management activities such as gap formation, soil compaction, and clearcutting can affect plant and animal communities, including invertebrates. Most of the studies that have dealt with invertebrates have focused on ground beetles (Carabidae). Ground beetles are often chosen because they are (1) diverse, (2) abundant, (3) well known taxonomically, and (4) appear highly sensitive to habitat change. Since 1994, we have been involved in three studies that have documented changes in the carabid community structure as a result of various forest management activities in Wisconsin and Michigan. Details of each study were presented. Below are a few highlights.

The first study was initiated in 1994 on the Nicolet National Forest in Forest County, Wisconsin, and consisted of creating gaps of different sizes (diameters of 18, 33, 66, 100, and 150 feet and a no-cut control) in a mature northern hardwood forest dominated by sugar maple. During the summer prior to logging, 90 pitfall traps were installed. Overall, more than 15,000 carabids, representing 25 species, were collected and identified. The five most common carabids included: *Synuchus impunctatus* (Say) (7121 individuals), *Pterostichus coracinus* (Newman) (1804), *Calathus ingratus* Dejean (1375), *Pterostichus melanarius* (Illiger) (1001), and *Platynus decentis* (Say) (897). In 1997, 1-2 years post-logging, the study was repeated with 72 traps. Overall, more than 12,000 carabids were collected in the different sized gaps in 1997, representing 57 species. The five most commonly collected carabid species in 1997 were: *Calosoma frigidum* Kirby (3595), *Synuchus impunctatus* (2525), *Pterostichus coracinus* (840), *Myas cyanescens* Dejean (683), and *Platynus decentis* (632). In addition, in 1997, we collected 441 *Pterostichus melanarius* adults, 280 *Calathus ingratus*.

The second study was installed in 1995 on the Huron-Manistee National Forests in Alcona County, Michigan. This study, which is part of a US Forest Service national program that addresses long-term soil productivity, consists of three levels of soil compaction and three levels of organic matter removal. Prior to clearcutting and imposing the treatments, the site consisted of a mature forest dominated by quaking aspen and largetooth aspen. Pitfall trapping, using 64 traps, took place in 1995 during the second growing season post-logging. Overall, about 3,700 carabids were collected, representing 46 different species. The five most commonly collected carabids included: *Cyclotrachelus sodalis* (Leconte) (642), *Myas cyanescens* (541), *Synuchus impunctatus* (472), *Pterostichus mutus* (Say) (392), and *Carabus nemoralis* O.F. Mueller (385).

The third study was initiated in 1996 on the Huron-Manistee National Forests in Newaygo County, Michigan. The overall objective of this study was to monitor changes in plant and insect community structure as mature red pine stands are converted to prairie. In 1996, pitfall sampling, using 45 traps, was conducted in a natural dry sand prairie, as well as in the surrounding mature oak forests and red pine plantations. Logging of the red pine stands took place during the 1996/97 winter. During summer 1997, pitfall sampling, using 50 traps, was repeated in the clearcuts and in the surrounding uncut red pine stands. For the two years combined, more than 8,300 carabids were identified, representing 86 different species. In 1996, the five most commonly collected carabids in the red pine stands were *Carabus goryi* Dejean (2260), *Pterostichus pensylvanicus* LeConte (285), *Myas coracinus* (Say) (86), *Synuchus impunctatus* (Say) (75), and *Pterostichus tristis* (Dejean) (33). For 1997, the five most common carabids in the recently clearcut red pine stands were *Synuchus impunctatus* (Say) (80), *Pterostichus pensylvanicus* LeConte (371), *Myas coracinus* (Say) (136), and *Harpalus pensylvanicus* (Degeer) (103).

Annual Meeting Photos



(Left to right, top to bottom) Row 1: (a) Mo Nielson; (b) Meeting location - Hidden Lake Gardens, Tipton, MI; (c) Bob Haack, Dora Carmona, and Sergio Guido; Row 2: (a) Mark O'Brien and Bob Haack; (b) Dan Herms and Leah Bauer passing the gavel; (c) Ann Hajek delivering the keynote address; Row 3: (a) John Keeler, Mo Nielson, Wayne Wehling and others at coffee break; (b) lunch time with Bob Kriegel and Toby Petrice being fisrt in line; (c) Toby Petrice and Mo Nielson at the registration desk; Row 4: (a) inside the greenhouse; (b) Eileen Van Tassel and Dan Herms; (c) Hidden Lake Gardens.

Addenda to Paul A. Opler's 1995 "Lepidoptera of North America. 2. Distribution of the Butterflies (Papilionoidea and Hesperiodea) of the Eastern United States"

Owen A. Perkins
2806 Linwood, Royal Oak, MI 48073-3023

I present the following collection records as addenda to Paul Opler's 1995 list of butterflies and skippers of the eastern United States. The nomenclature used here conforms with that used by M.C. Nielsen (1998. Checklist of Michigan butterflies and skippers. Newsletter of the Michigan Entomological Society 43(1): 8-10).

County	ST	Date	Spieces
Papilionidae			
Mackinac	MI	May 13, 1998	*Papilio canadensis*
Alger	MI	May 15, 1998	*Papilio canadensis*
Emmet	MI	May 17, 1998	*Papilio canadensis*
Arenac	MI	May 24, 1998	*Papilio canadensis*
Otsego	MI	June 20, 1998	*Papilio canadensis*
Mackinac	MI	August 26, 1997	*Papilio polyxenes asterius*
Oakland	MI	June 23, 1996	*Papilio troilus*
Pieridae			
Oakland	MI	July 12, 1997	*Artogeia napi oleracea*
Chippewa	MI	May 16, 1998	*Artogeia virginiensis*
Branch	MI	August 31, 1947	*Pontia protodice*
Lycaenidae			
Arenac	MI	May 7, 1998	*Incisalia augustinus*
Alger	MI	May 15, 1998	*Incisalia augustinus*
Iron	MI	June 1, 1997	*Incisalia henrici*
Chippewa	MI	June 1, 1997	*Incisalia niphon clarki*
Arenac	MI	May 24, 1998	*Lycaena phlaeas americana*
Newaygo	MI	July 15, 1969	*Lycaena phlaeas americana*
Tuscola	MI	August 23, 1969	*Lycaena hyllus*
Broward	FL	July 26, 1998	*Parhassius m-album*
Wayne	MI	July 15, 1998	*Satyrium liparops strigosum*
Nymphalidae			
Osceola	MI	August 1, 1997	*Aglais milberti*
Branch	MI	August 14, 1997	*Asterocampa celtis*
Genesee	NY	August 14, 1967	*Basilarachia arthemis arthemis*
Arenac	MI	May 24, 1998	*Boloria selene myrina*
Luce	MI	May 15, 1998	*Boloria frigga saga*
Oakland	MI	June 12, 1947	*Phyciodes selenis*
Huron	MI	August 20, 1973	*Phyciodes selenis*
Monroe	MI	May 19, 1998	*Phyciodes tharos*

County	ST	Date	Spieces
Nymphalidae (continued)			
Oakland	MI	June 21, 1947	*Phyciodes tharos*
Calhoun	MI	May 29, 1951	*Phyciodes tharos*
Arenac	MI	June 19, 1998	*Phyciodes tharos*
Washtenaw	MI	July 9, 1998	*Phyciodes tharos*
Lenawee	MI	July 13, 1998	*Phyciodes tharos*
Jackson	MI	June 26, 1966	*Phyciodes tharos*
Branch	MI	August 31, 1947	*Phyciodes tharos*
Lapeer	MI	August 23, 1969	*Phyciodes tharos*
Huron	MI	August 19, 1973	*Phyciodes tharos*
Branch	MI	July 1, 1948	*Vanessa atalanta rubria*
Satyridae			
Branch	MI	July 19, 1951	*Cercyonis pegala nephele*
Ogemaw	MI	August 1, 1997	*Cercyonis pegala nephele*
Otsego	MI	June 19, 1998	*Coenonympha tullia inornata*
Niagara	NY	August 3, 1998	*Coenonympha tullia inornata*
Dickinson	MI	June 1, 1997	*Erebia discoidalis*
Monroe	MI	July 1, 1998	*Enodia anthedon*
Calhoun	MI	May 30, 1951	*Megisto cymela*
Oscoda	MI	June 19, 1998	*Satyrodes eurydice*
Oakland	MI	July 29, 1947	*Satyrodes eurydice*
Danaidae			
Osceola	MI	August 1, 1997	*Danaus plexippus*
Hesperiidae			
Oscoda	MI	June 19, 1998	*Amblyscirtes vialis*
Arenac	MI	May 7, 1998	*Erynnis icelus*
Oakland	MI	June 4, 1966	*Erynnis horatius*
Wayne	MI	July 15, 1998	*Erynnis baptisiae*
Osceola	MI	August 1, 1997	*Euphyes conspicuus*
Broward	FL	July 25, 1998	*Polygonus leo*
Arenac	MI	June 19, 1998	*Thymelicus lineola*
Niagara	NY	August 3, 1998	*Wallengrenia egeremet*

Michigan's 1997 and 1998 4-H Entomology Winners

Jason Sahloff, Monroe County, MI, received the 1998 state 4-H Award in Entomology on 25 June 1998 at Michigan State University's Wharton Center for the Performing Arts. Over the past seven years, Jason has collected more than 500 insects from Michigan metroparks, woods, fields, and streams. His extensive knowledge of insects has made him a sought after resource for news publications. Jason also serves as a young curator in entomology for the Toledo Zoo. The award was presented to Jason by Mary Jamieson, Educational Coordinator, MSU Department of Fisheries and Wildlife. Kristy Diener of Midland County and Greg Hansen of Isabella County received Honorable Mention in Entomology in 1988. The annual "4-H Awards in Entomology" are sponsored by the Michigan Beekeepers Association and the Michigan Entomological Society.

In 1997, Honorable Mention honors again went to Kristy Diener of Midland County, while the 1997 State Entomology Award went to Carolyn Benjey of Washtenaw County. Carolyn had been active in 4-H entomology for nine years, and plans to attend Michigan State University in the future and possibly study entomology. The 1997 Entomology Award was presented to Carolyn Benjey by David Eppleheimer, who is a Kent County 4-H volunteer.

Critical New Acreage Increases Protection for Rare Mitchell's Satyr

Condensed from:
The Nature Conservancy – Michigan Chapter, 1998 Annual Report

During 1998, the Nature Conservancy of Michigan added 210 acres of land at two critical nature preserves in southern Michigan, expanding efforts to protect the endangered Mitchell's satyr butterfly and the wetland and upland complex of habitats that this beautiful insect requires to survive. The satyr is one of Michigan's rarest species, found in very localized, small populations in fewer than 15 sites, of which 3 sites are protected in Nature Conservancy preserves in Michigan.

The 1998 acquisitions added 80 acres at the Grand River Fen Preserve, and 130 acres at the Tamarack Swamp Preserve. With many partners and collaborators, The Nature Conservancy has launched a comprehensive program to protect and maintain the known populations of the Mitchell's satyr, including land acquisition, research, and stewardship programs.

Invasion of the exotic glossy buckthorn and purple loosestrife are serious concerns for the survival of the butterfly. Buckthorn removal will begin this winter when the ground is frozen so that trampling is minimized.

Many of the current sites where the butterfly is found are changing ecologically. Shrubs are replacing sedges in many places. Decades ago, natural wildlfires would have swept through these ecosystems and moved back the shrub and tree invasion. The flow of water underground and at the surface of these fens would also not have been impeded by roads and structures – and water also inhibits invasion by woody plants.

Preserving native plants and animals is a critical investment in the preservation of biological diversity. One butterfly at 15 places on the face of the earth matters greatly in the scheme of conservation achievements – and 210 acres are today's investment.

Become a 4-H Entomology Resource Volunteer

Ron Priest
Department of Entomology, 243 Natural Science Bldg.,
Michigan State University, E. Lansing, MI 48824-1115

Have you ever thought of giving some kids that spark of excitement you have for "bugs?" If you have, but just haven't gotten around to it or aren't quite sure where to start, here's an answer, **4-H!** A number of groups have enthusiastic leaders but just don't have the knowledge of insects that you do. By becoming an entomology resource volunteer you can fill that gap.

There are a variety of levels of activity where you can be involved. Some groups might just want to consider starting entomology. You could provide a one-time introduction to what can be done and show some of the methods and equipment you use. Other groups may already be involved but need your assistance. If you don't have the time now to work with 4-H or can't travel far there's still a way to help. You could, for example, answer entomology questions or give advice by E-mail. These are some of the ways you could assist and be an entomology resource volunteer.

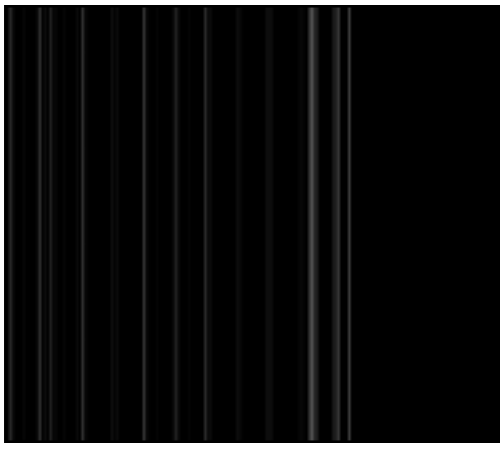
You may have basic equipment but what about printed reference materials? Not to worry! 4-H has just come out with four new (1997) booklets on entomology. There's a Group Helper's Guide and 3 youth project guides for ages 3-12. They teach entomology while helping youth develop decision-making skills. As the Helper's Guide says, "Your main roll is to provide a safe, supportive environment for youth to practice important life skills as they explore the world of entomology." The guides are well illustrated and describe a wide variety of insect projects.

So if you'd like to give a kid or two a jump-start, entomologically speaking, here's the deal. Give me your name, address, county, and phone number where you can be reached with times you'll likely be there. 4-H is contacting their offices to identify groups that are interested in entomology, and at what level. We'll match both lists and let you know the interested 4-H group closest to you. We'll give you the leader's name and contact address and they'll be alerted to expect your contact. The next step is up to you!

We'll continue to be there to provide you with any support we can offer. Whether you're looking for interesting field sites, sources of supplies, literature, or just a bit of advice you can count on us. So, before you put this aside send me your name, address, county, phone or fax, and how you'd like to volunteer. We'll work from there. You can contract me by mail at the address above, or by phone (517) 355-1803 or fax (517) 353-4354. I'm looking forward to hearing from you.

Associate Newsletter Editor Retires: Many Thanks to George Heaton

After more than three decades of service to the Michigan Entomological Society, George Heaton will be stepping down from the post of Associate Editor of the MES Newsletter. George worked as a Biological Technician with the US Forest Service Insect Unit in East Lansing, Michigan, since 1967. During that entire time, and even since his retirement from the US Forest Service in 1995, he has helped publish each issue of the MES Newsletter. George assisted in the design and layout of the newsletter, proofing, and, of course, taking hundreds of candid photos during the MES annual meetings, including those shown in this issue. George will still attend future MES meetings, but now he'll have more time to devote to his real love – rocks! Have fun with those Petosky stones, George, and thanks again for all the help!



Bob Haack, Newsletter Editor

Insects Federally Listed as Endangered or Threatened in the United States as of October 1998

Information obtained from the US Fish and Wildlife Service, Endangered Species Web Site at:
http://www.fws.gov/r9endspp/endspp.html

Year listed	Recovery plan approved	Common name (Scientific name)	US range
Endangered			
1989	Yes	Beetle, American burying (=giant carrion) (*Nicrophorus americanus*)	AR, NE, OK, RI
1988	Yes	Beetle, Coffin Cave mold (*Batrisodes texanus*)	Texas
1997	No	Beetle, Comal Springs riffle (*Heterelmis comalensis*)	Texas
1997	No	Beetle, Comal Springs dryopid (*Stygoparnus comalensis*)	Texas
1994	No	Beetle, Hungerford's crawling water (*Brychius hungerfordi*)	Michigan
1988	Yes	Beetle, Kretschmarr Cave mold (*Texamaurops reddelli*)	Texas
1997	Yes	Beetle, Mount Hermon june (*Polyphylla barbata*)	California
1988	Yes	Beetle, Tooth Cave ground (*Rhadine persephone*)	Texas
1997	No	Butterfly, Behren's silverspot (*Speyeria zerene behrensii*)	California
1997	No	Butterfly, callippe silverspot (*Speyeria callippe callippe*)	California
1976	Yes	Butterfly, El Segundo blue (*Euphilotes battoides allyni*)	California
1992	No	Butterfly, Karner blue (*Lycaeides melissa samuelis*)	IL, IN, MI, MN, NY, NH, WI
1976	Yes	Butterfly, Lange's metalmark (*Apodemia mormo langei*)	California
1976	Yes	Butterfly, lotis blue (*Lycaeides argyrognomon lotis*)	California
1976	Yes	Butterfly, mission blue (*Icaricia icarioides missionensis*)	California
1991	Yes	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)	Indiana, Michigan
1992	No	Butterfly, Myrtle's silverspot (*Speyeria zerene myrtleae*)	California
1980	Yes	Butterfly, Palos Verdes blue (*Glaucopsyche lygdamus palosverdesensis*)	California
1997	No	Butterfly, Quino checkerspot (*Euphydryas editha quino* (=*E. e. wrighti*))	California
1994	Yes	Butterfly, Saint Francis' satyr (*Neonympha mitchellii francisci*)	North Carolina
1976	Yes	Butterfly, San Bruno elfin (*Callophrys mossii bayensis*)	California
1976	Yes	Butterfly, Schaus swallowtail (*Heraclides aristodemus ponceanus*)	Florida
1976	Yes	Butterfly, Smith's blue (*Euphilotes enoptes smithi*)	California
1991	Yes	Butterfly, Uncompahgre fritillary (*Boloria acrocnema*)	Colorado
1995	No	Dragonfly, Hine's emerald (*Somatochlora hineana*)	IL, MI, WI
1993	Yes	Fly, Delhi Sands flower-loving (*Rhaphiomidas terminatus abdominalis*)	California
1997	Yes	Grasshopper, Zayante band-winged (*Trimerotropis infantilis*)	California
1997	No	Skipper, Laguna Mountains (*Pyrgus ruralis lagunae*)	California
Threatened			
1980	Yes	Beetle, delta green ground (*Elaphrus viridis*)	California
1990	Yes	Beetle, northeastern beach tiger (*Cicindela dorsalis dorsalis*)	Northeastern US
1990	Yes	Beetle, Puritan tiger (*Cicindela puritana*)	Northeastern US
1980	Yes	Beetle, valley elderberry longhorn (*Desmocerus californicus dimorphus*)	California
1987	Yes	Butterfly, bay checkerspot (*Euphydryas editha bayensis*)	California
1980	Yes	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)	CA, OR, WA
1980	Yes	Moth, Kern primrose sphinx (*Euproserpinus euterpe*)	California
1985	Yes	Naucorid, Ash Meadows (*Ambrysus amargosus*)	Nevada
1987	No	Skipper, Pawnee montane (*Hesperia leonardus* (=*pawnee*) *montana*)	Colorado

Winged Jewels - A Celebration of Butterflies and Moths

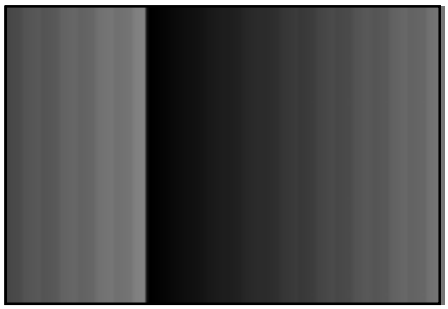
At the MSU Museum, West Gallery, 2nd floor (22 March-31 Dec. 1998)

Created by The Center for Arthropod Diversity Study

Mr. Mogens (Mo) C. Nielsen, Adjunct Curator of Lepidoptera

Dr. Wayne F. Wehling, Collection Coordinator

Professor Frederick W. Stehr, Curator



With the approach of Mo Nielsen's new book on Michigan butterflies, it seemed only fitting to have a museum exhibit to welcome and celebrate its arrival. Planning for the exhibit began during the summer of 1997 as Mo worked feverishly to ready the book manuscript and get the photographs taken for the plates. With the help of Juan Alvarez, Director of Exhibits, at the MSU Museum, many hours of discussion produced a template for the exhibit by December 1997, and work then began shortly after the holidays. Countless hours were spent selecting pictures and specimens that met the needs for the proposed exhibit panels. Overall, thousands of photos and hundreds of thousands of specimens were evaluated. In mid-March 1998, we were able to get into the Museum gallery and start putting the exhibits in place. The transformation from mock-up to final presentation was exciting but took much more time than anyone had anticipated.

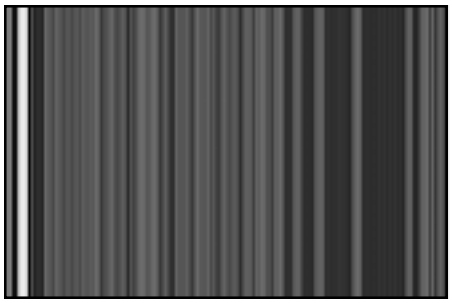
Developing exhibit panels that effectively communicate to a wide audience the information that we wanted to present turned out to be an interesting learning experience for all of us. Early in the planning stages we weren't sure how we would fill the room with exhibits. By the time March rolled around it was evident that we wouldn't have enough space for all of the panels. Eventually, several panels were omitted. The exhibit is comprised of 9 panels with many photographs and about 350 specimens, all of them protected under Plexiglas sheets. The introductory panel tells the story of the lepidopteran life cycle in pictures and introduces the order Lepidoptera, showing a number of different ova, larvae, and pupae. The panels continue on around the room with the order of presentation dictated by fitting the material to the wall space available. Going around the gallery clockwise, topics after the introductory panel include: Gardening to Attract Butterflies and Butterfly Houses, The Diversity of Butterflies and Moths, The Monarch Story, Some Lepidoptera Pests, Michigan Butterflies and Moths, Camouflage and Warning Coloration, Mimicry, and Collecting Lepidoptera. The zebra longwing and orange longwing can be seen flying in the center of the gallery in a display designed for these living jewels. Poetry and unusual fun facts (factoids) are scattered around the gallery and help to keep the atmosphere on the light side. The diversity display is the crown jewel of the exhibit with about 250 specimens showing the largest, smallest, longest, widest, "ugliest," and most beautiful Lepidoptera fanned-out into a cornucopia of diversity.

It has been very enlightening to watch the response of visitors. Most go straight to the living butterflies and tap on the screen. Others question whether the 250 specimens in the diversity display are real. I encourage everyone to come and see the exhibit and tap on the screen (and watch other visitors). We would love to receive your thoughts and comments. Mo, Fred, and I really enjoyed the whole process of pulling the exhibit together. It wasn't something we get to do every day. So far the public response seems very favorable.

The MSU Museum is open 9-5 M-F, Sat. 10-5, Sun. 1-5.

Winged Jewels has been made possible through the generous support of The Herbert H. and Grace A. Dow Foundation, Physician's Health Plan, Gordon and Norma Guyer, and the Department of Entomology, MSU.

Submitted by Wayne Wehling.



MICHIGAN ENTOMOLOGICAL SOCIETY
FINANCIAL STATEMENT-12 MONTHS ENDING DECEMBER 1997

RECEIPTS

Savings account interest	$590.00
Dues	5,587.00
Subscriptions, THE GREAT LAKES ENTOMOLOGIST	3,892.00
Sale of separates to authors	1,820.00
Sale of back issues, journal, newsletter, entomology notes	201.00
Subsidies (page costs)	4,145.00
Michigan Lepidoptera Survey - MDA Grant	4,860.00
Donations, decals, misc. income	421.00
Annual Meeting-Registration fee	585.00
TOTAL RECEIPTS	$22,101.00
(1996 receipts	20,994.00)

DISBURSEMENTS

Publication expenses:	
Newsletter, print, mail	$ 2,583.00
Journal, compose, print, mail	10,388.00
Postage, mailing permit fee	263.00
Graphics, misc. printing/ mailing	507.00
MI Lepidoptera Survey (to MSU, Dept. Entomology)	4,860.00
Annual Meeting, "Breaking Diapause" meeting	1,208.00
Misc. (4-H foundation, copyrights, insurance, etc)	514.00
TOTAL DISBURSEMENTS	$20,323.00
(1994 disbursements	24,860.00)

MICHIGAN ENTOMOLOGICAL SOCIETY
STATEMENT OF FINANCIAL CONDITION
AS OF 31 DECEMBER 1997

ASSETS

CURRENT ASSETS:	
Cash on hand	$12,389.00
Accounts receivable	558.00
Prepayment/ postal fee	85.00
Inventories:	
Postage	29.00
Supplies/ equipment	150.00
Newsletters (est.)	300.00
Journals (est.)	1,500.00
TOTAL CURRENT ASSETS	$15,011.00

LIABILITIES

CURRENT LIABILITIES:	
Life memberships (20)	$6,000.00
Prepaid subscriptions	3,350.00
Prepaid dues	1,515.00
Dues in arrears	1,425.00
Subscriptions in arrears	500.00
TOTAL CURRENT LIABILITIES	$12,790.00
SURPLUS	$2,221.00

MONEYS OF MES AS OF 31 DECEMBER 1997:

Petty cash	$1.00
Checking account	6,308.00
Savings account (CD)	6,080.00
TOTAL	$12,389.00

MONEYS OF MES AS OF 31 DECEMBER 1996 ..... $19,936.00

MEMBERSHIP: As of 31 December 1997, the Society had 390 members in good standing compared to 460 on 31 December 1996.

SUBSCRIPTIONS: As of 31 December 1997 there were 195 paid subscriptions to THE GREAT LAKES ENTOMOLOGIST.

Mogens C. Nielsen, Treasurer, 5 May 1998

MICHIGAN ENTOMOLOGICAL SOCIETY

DEPARTMENT OF EMTOMOLOGY
MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN 48823

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