

A note from the President

This year marked a milestone event — the formation of the Special Members Chapter. Our long standing "special members group" was welcomed into MBC as an official Chapter this past May. In addition, our Constitution was ratified, a four-member Chapter Board instated, Treasury established, and our first Newsletter has gone to print. The basic building blocks are coming together, largely due to the hard work of Jim Hewitt, Secretary; Leslie Kuhn, Treasurer; and Phyllis Higman, Director, who have enthusiastically supported the Chapter the past several months. Thank you for your many efforts.

There are two opportunities for members to help shape the Chapter. The position of Vice-president (2-year term) and Director-at-Large (3-year term) are open positions that need to be filled. Board business is conducted primarily via the internet, thus limiting the need for travel. If you are willing to serve in either capacity, please feel free to express your interest by contacting any of your board members.

The MBC webpage has a new tab, named "Programs of Interest". This page was created for you to use as a forum to announce botanical events occurring in your local area. Please make use of this informative tool by contacting Sheila Bourgoïn at: scbourgoïn@comcast.net, with a description of events you would like to post.

Also note that the fiscal year for membership is January - December. Please remember to renew your membership dues and return the enclosed membership form.

As we move into the coming year, we are looking forward to hearing from you. There are several possibilities for field trips this spring that are described below. Any other suggestions you might have for botanical sites of interest would be most helpful.

Best regards,

Irene Eiseman, President

Special Members Chapter-MBC



*Wild columbine, **Aquilegia canadensis**. Photo taken by Tim Eiseman.*

Field Trips in 2016

Field trips are a popular feature of Michigan Botanical Club chapters and the four established chapters provide their members in the southeast, southwest, and western portions of the Lower Peninsula with regular guided botanical walks. The new Special Members Chapter contains plant enthusiasts from throughout the much larger remainder of the state, and beyond. Contemplating a field trip for this widespread population is more of a challenge. In the Lower Peninsula there are a couple of small concentrations of members: one in the northwest and another in the south-central, and this is where we will focus two walks next year.

The dates are not yet finalized, but one trip will be in the area served by the Grand Traverse Regional Land Conservancy and led by Special Member Angie Lucas who is Senior Land Steward for the Conservancy.



C. S. Mott Preserve at Arcadia Dunes; owned by Grand Traverse Regional Land Conservancy.

The second trip will be in the Albion area and will include the Whitehouse Nature Center on the Albion College campus. It will be led by Special Member Barbara Raffail, a botanist who received her undergraduate degree at Albion.

In January, when the dates are known, Email notification will be made. Wherever you live in the State, we hope to see you at one or both of these field trips in 2016. *Jim Hewitt, Secretary*



Wood Lily, *Lilium philadelphicum* – Mott Preserve. Photo by Jim Hewitt.

2015 Spring Foray

Many members of the Special Members Chapter enjoyed the Spring Foray held this year in Michigan’s thumb region.



Shiawassee National Wildlife Refuge Manager Steve Kahl leading a 2015 Spring Foray field trip.



Pine Haven Recreation Area Field Trip led by Glenn VandeWater during the 2015 Spring Foray.

What do garlic mustard dominance, insect pheromones, yucky broccoli, and cancer-healthy diets have in common?

Leslie Kuhn, MBC-SMC Treasurer, Mid-Michigan Stewardship Initiative Field Projects Coordinator, and Professor of Biochemistry & Molecular Biology, Michigan State University

As someone who enjoys the beauty and pollinator and wildlife habitat provided by our native plants, I’ve been fighting the invasion of garlic mustard for some years in the woods and wetlands around Mid-Michigan. A couple of years ago, I started thinking about how the biochemistry research in my lab at Michigan State University could help. A smart undergraduate, Eric Boerman, and I began investigating the scientific literature on how garlic

mustard (*Alliaria petiolata*) exerts allelopathy and makes itself unsavory to herbivores. While plants have several mechanisms of allelopathy – releasing chemicals that inhibit the growth of other plants – the main one in mustards is the production and release of small, volatile compounds called isothiocyanates, which are toxic to many organisms. Isothiocyanates are toxic because they attack (chemically react with) molecules needed by the organisms to carry out their normal functions.

Why do people hate broccoli? It turns out that plants in the Brassicaceae family, which includes a number of invasive and non-invasive mustards, cresses, alyssum, broccoli, cauliflower, cabbage, turnips, radishes and horseradish, all have the ability to produce isothiocyanates, while most of our native plants do not. You might be asking some questions at this point. Why are so many of these “toxic” Brassica plants actually vegetables that we commonly eat? And is there a connection with the pungent taste we associate with broccoli, turnips, etc.? Yes - we are actually tasting cyanate compounds! However, our bodies, like those of other creatures that can safely eat these plants, have developed special detoxification systems in our gastrointestinal tracts to neutralize the cyanates. Other organisms have not yet developed effective ways of combatting the reactive compounds (sometimes called the “mustard oil bomb”) in mustards, broccoli, etc. That’s



A face we have all seen...

This kid just has sensitive taste buds for isothiocyanates (though the broccoli will only do him good: see below!)
Photo: recruiter.com

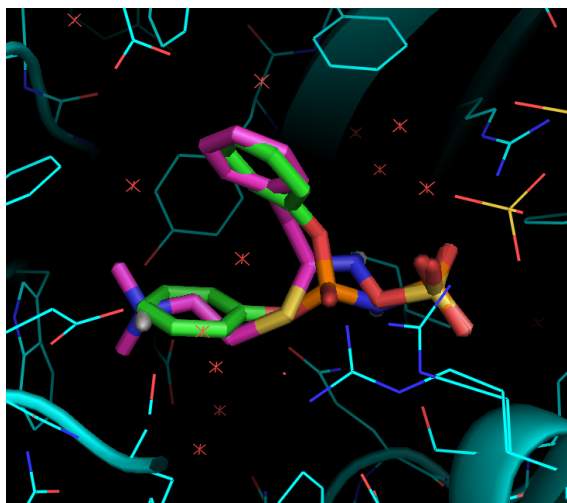
why garlic mustard is not eaten by almost any native bugs, rabbits, deer, etc.; whereas the same creatures have developed digestive systems that can utilize other plants we can’t (like grasses and wood).

Allelopathy is a tool in the battle between plants for limited resources. The release of isothiocyanates explains how garlic mustard avoids being eaten, and the fact that some folks find broccoli repugnant. But what about allelopathy? It turns out that the production of isothiocyanates in all the tissues and seeds of garlic mustard (and other Brassicaceous plants) and their release into the surrounding soil is also what sets back neighboring plants’ growth. Isothiocyanates do this by blocking other plants’ ability to convert nitrogen from the air into forms of nitrogen that can be absorbed as a nutrient. More specifically, they inhibit the fungal/microbial/plant cell associations (mycorrhizae) in the plant’s rootlets responsible for nitrogen fixation and uptake. Unfortunately, not only does garlic mustard release isothiocyanates into the soil when it’s alive, but it also releases all the isothiocyanates remaining in its tissues when it is herbicide-sprayed or naturally dies back and decomposes in the soil. This leads to long-term chemical changes in the soil that inhibit native plants from reestablishing. That’s one reason why it’s best to pull and bag garlic mustard and send it to the landfill rather than leaving the dead plants in place. (While that may be difficult for large infestations, any pulled mustard plants that cannot be removed can be stacked in compact piles.) On the other hand, farmers actually appreciate allelopathy, and have bred brassicaceous vegetables that are ultra-allelopathic, because it reduces competing weeds in those fields. But it also means that crop rotation between Brassica and other crops in the same field will not be as productive: most other crops will be inhibited from taking up nitrogen well once broccoli and friends have grown there.

Battling allelopathy with techniques from human medicine. So, now that we know how garlic mustard defends itself and sets back other plants, what can we do about it? Going a bit deeper into how isothiocyanates are produced: they are released by the mixing of chemicals between two plant compartments, one that’s full of an enzyme called myrosinase, which is situated

next to a second specialized compartment containing glucosinolates (the precursors of isothiocyanates). Just like those two-syringe epoxy kits some of us have used, when glucosinolates are mixed with myrosinase, there is chemical magic, and isothiocyanates are released. If we can find a way to block the myrosinase enzymes before they reach the glucosinolates, then the release of isothiocyanates will be stopped, and there will be no allelopathy! If this can be done by spraying the Brassica plants or surrounding soil with a non-toxic myrosinase inhibitor, then native plants will grow back more quickly on the site.

Our lab specializes in discovering small molecules that specifically inhibit enzymes, which turns out to be quite useful in medicine. Tens of thousands of different enzymes in human bodies are needed for our normal physiology, and yet, under abnormal conditions, enzymes can become unregulated and cause diseases such as cancer or high blood pressure. Most oral medicines we take are small molecules designed to inhibit a specific enzyme. For instance, aspirin and ibuprofen both work by inhibiting an enzyme called cyclooxygenase that



A high-ranking small molecule (green) discovered by molecular screening as a mimic of the isothiocyanate precursor molecule (pink) bound to the 3-dimensional structure of the enzyme myrosinase (aqua). We predict this molecule (green) will bind to myrosinase in garlic mustard and block its ability to release isothiocyanates that inhibit other plants' growth. Testing has begun in our collaborator's lab at Xavier University.

regulates inflammation. Pursuing this enzyme-inhibitor approach, another great undergraduate in my lab, Joe Bemister, has worked on discovering molecules that block myrosinase to block the source of garlic mustard allelopathy. Joe computationally screened millions of molecules to identify those that fit closely into the site on the 3-dimensional structure of myrosinase where the isothiocyanate precursors normally fit. (See figure below.) A garlic mustard allelopathy expert at Xavier University, Kathryn Morris, is now testing a series of these tightly-fitting small molecules proposed as myrosinase inhibitors, for their ability to stop the release of isothiocyanates. The tests involve application to garlic mustard tissue as well as to the soil around the plants. We predict that if one or more of these compounds effectively blocks the allelopathic release of isothiocyanates, then native plants will grow back in areas of previous garlic mustard infestation much more quickly. Like all scientific research, a carefully controlled step-by-step approach is involved, and we are specifically focusing on non-toxic, myrosinase-specific, inexpensive compounds. We are excited about the possibility of limiting the impact of invasive species in a novel way, by using techniques developed for human medicine.

What about invasive insects? So, how does this relate to insects and their pheromones, which are chemicals produced and released by animals specifically to influence the behavior of others in their species? To our surprise, we found evidence suggesting that a myrosinase enzyme is present in the Asian longhorned beetle genome. Like the emerald ash borer, Asian longhorned beetle is a tree-destroying invasive species of enormous concern as it spreads through the Midwest. However, whereas the emerald ash borer is specific to ash trees, in North America Asian longhorned beetle larvae can feed on *many* host trees including maples, poplars, willows, elms, chestnuts, birches, redbuds, ashes, planetrees, *Prunus* species including cherries, mountain-ashes, and mimosas. As such, the Asian longhorned beetle is a much greater threat. In figuring out what

myrosinase might be doing in this beetle, we found that a myrosinase system very much like that in plants is already known to occur in some insects including aphids and flour beetles. In aphids, the isothiocyanates released from myrosinase are used as chemical signals to warn other aphids that a predator is in the area, while in flour beetles, they act as a pheromone to attract other beetles to aggregate at a site. We are now working with Ann Ray of Xavier University to test the possible roles of myrosinase in airborne chemical communication between Asian long-horned beetles. If we can control their behavior by blocking their myrosinase or myrosinase-like enzyme, it could be amazingly useful in thwarting the devastating effects of these beetles on our woods.

Cancer prevention. Finally, why *should* we eat broccoli? Probably not to attract beetles! Broccoli and a number of other Brassica species are also known as cruciferous vegetables, including arugula, bok choy, Brussels sprouts, cabbage, cauliflower, collard greens, horseradish, kale, radishes, rutabaga, turnips, watercress, and wasabi. As we prepare, chew, and eat these vegetables, isothiocyanates are released. They have become a major focus in studies aiming to pinpoint the source of the cancer-preventative effects known for cruciferous vegetable-rich diets. As the National Cancer Institute reports (<http://www.cancer.gov/about-cancer/causes-prevention/risk/diet/cruciferous-vegetables-fact-sheet>): “isothiocyanates have been found to inhibit the development of cancer in several organs in rats and mice, including the bladder, breast, colon, liver, lung, and stomach. Studies in animals and experiments with cells grown in the laboratory have identified several potential ways in which these compounds may help prevent cancer:

- They help protect cells from DNA damage.
- They help inactivate carcinogens.
- They have antiviral and antibacterial effects.
- They have anti-inflammatory effects.
- They induce cell death (apoptosis).

- They inhibit tumor blood vessel formation (angiogenesis) and tumor cell migration (needed for metastasis).

Studies in humans, however, have shown mixed results.” So the research continues, but meanwhile we know that these vegetables are nutritious and full of healthy fiber, and eating them also helps prevent cancer. Soon we will know whether isothiocyanates are the key player in this role, too!

Annual Treasurer’s Report, Dec. 20, 2015

The Treasury of the Special Members Chapter began in early June 2015 following the approval of our new chapter and receipt of a check in the amount of \$842 from the MBC State Treasurer, Bob Kelly. This initial amount for the SMC account was based on memberships to MBC associated with the special members group (MBC members not belonging to any regional chapter), minus the expenses associated with those memberships (publication and mailing of *The Michigan Botanist* in 2015).

A small business checking account was established for MBC – SMC at MSU Federal Credit Union on June 8. Minor expenses have been posted since: \$1 for opening the account, \$5 for establishing the savings account needed to start a checking account at the credit union, \$20 for check printing, \$25 for the requested transfer of one member from SMC to the Southwestern Chapter, \$95 for meal expenses at the foray for student William Hartill (later reimbursed by him), transfer of a \$20 donation to the Michigan Botanical Foundation (MBF) and \$7 to the MBC state treasury to cover *The Michigan Botanist* for a new member.

Seven membership renewals and new memberships have been deposited to the account during the June-December time period. Those received in the last quarter of the year are considered to also cover the upcoming year’s membership, based on our chapter constitution. The account balance as of today is \$959, and the request for

membership renewal for our other ~66 members will be announced in this newsletter.

our members a very Happy New Year, and looking forward to seeing you at our events!

Attached are the details of this year's account credits and debits as described above. Wishing all

- Leslie Kuhn, Treasurer

MSUFCU Small Business Checking Account for MBC - Special Members Chapter

<u>Date</u>	<u>Check No.</u>	<u>Description</u>	<u>Credit</u>	<u>Debit</u>	<u>Balance</u>
6/8/15		Check from Bob Kelly for SMC funds	\$842		\$842
6/8/15		Account opening fee at MSUFCU		\$1	\$841
6/8/15		Transfer to MSUFCU savings acct. (min. required balance)		\$5	\$836
6/8/15		Check printing fee via MSUFCU (120 checks)		\$20	\$816
6/22/15	1031	MBC Southwestern Chapter		\$25	\$791
6/25/15	1032	MBC Southeastern Chapter		\$95	\$696
6/25/15		Deposit - \$25 SMC membership, \$20 donation	\$45		\$721
6/25/15	1033	Michigan Botanical Foundation		\$20	\$721
7/11/15		Deposit - \$25 SMC membership, Laurie Yahr	\$25		\$746
7/11/15		Deposit - \$95 reimbursement for foray meals by Wm Hartill	\$95		\$841
8/14/15		Deposit - \$25 membership Angela Lucas	\$25		\$866
12/3/15	1034	MBC State Treasury		\$7	\$859
12/3/15		Deposit - \$25 membership, John Smith	\$25		\$884
12/11/15		Deposit - \$25 membership, Leslie Kuhn	\$25		\$909
12/16/15		Deposit - \$25 membership, Irene Eiseman	\$25		\$934
12/16/15		Deposit - \$25 membership, Patrick Deacon	\$25		\$959

MBC - Special Members Chapter Board

President:	Irene Eiseman	eisemani@gmail.com
Secretary:	Jim Hewitt	Tz4ggm@aol.com
Treasurer:	Leslie Kuhn	KuhnL@msu.edu
Director-at-Large:	Phyllis Higman	higmanp@michigan.gov

*****2016 Special Members Chapter Dues*****

A New Year has arrived and it is time to pay your Chapter dues. Please see the instructions on the attached membership form and join us for another memorable year!

Michigan Botanical Club
2016 Special Members Chapter Dues

Name: _____

Address: _____

City: _____ State/Province: _____

Zip code + 4 digit code _____ + _____

Telephone: _____ Email: _____

Do you prefer to receive the *Arisaema* newsletter in paper format? _____

Sustaining membership _____ \$40.00 (or more)

Individual membership _____ \$25.00

Family membership _____ \$35.00

Student membership _____ \$15.00 University _____

Make checks payable (in US funds) to: **Michigan Botanical Club- Special Members Chapter**
Mail to:

Irene Eiseman
MBC-SMC
1873 Pierce Road
Chelsea, MI 48118

Thank you for your continued support!