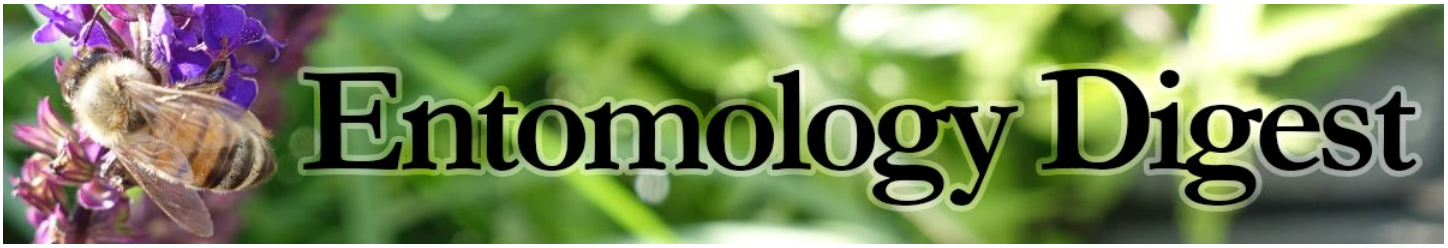


Entomology Digest – Fall 2021

Letter from the Chair

Entomology Community and Friends of the Department, "*ESA Annual Meeting*"

The Department of Entomology just returned from the Entomological Society of America's Annual Meeting held Oct 31st - Nov 3rd at the downtown Denver Convention Center. The meeting was held as a combined virtual and in-person meeting. Online content is available for all ESA members through January, 2022 for viewing. The on-demand program featured over 400 symposia presentations and 10-minute presentations, and featured 150 posters and infographics. Live streamed presentations were also part of the 2021 meeting. The plenary session featured evolutionary biologist Dr. Joseph Graves, Jr. together with the Founders' Memorial Lecture provided by Dr. Vernard Lewis honoring Dr. Margaret James Strickland Collins. Live stream recordings of the lecture are available here.

Among 40 University of Wisconsin-Madison researchers who presented at this year's meeting, we recognize Ms. Skye (Harnsberger) Bruce for her First Place Award in the In-Person, Student Infographics section. Congratulations Skye, and well-deserved!

Early in the Fall, we were visited by our alumni Dr. Michael R. Wagner (PhD 1980), Regents Emeritus Professor in the School of Forestry from Northern Arizona University, Flagstaff, AZ and Dr. Karen M. Clancy (MSc 1980), USDA Forest Service, Rocky Mountain Research Station. Drs Wagner and Clancy traveled to the UW-Madison to meet with the University of Wisconsin Foundation for discussions around support of enhanced education experiences for students, with a special emphasis upon international, hands-on experiential learning.

At the beginning of the Fall 21' semester, the Department was provided reauthorization for two new positions. The first of these, a Vector Biologist/Ecologist, was released in late August and we have screened over 40 candidates and are currently in the interview and recruitment process. A second position, Precision Pest Ecologist, is currently being advertised and will close in early December. With these new positions, our faculty will remain as strong participants in the UW CALS Strategic Planning Priorities including Food Systems, Health and Wellness, Changing Climate, Healthy Ecosystems and Bioenergy/Bioproducts. Our faculty are adept at integrating across these themes wherever arthropods play critical roles.

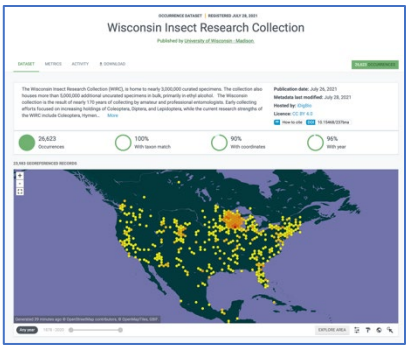
Finally, a new Memorandum of Agreement for administration and financial support of the Global Health Undergraduate Major between the College of Agricultural and Life Sciences, the Department of Entomology, the Department of Nutritional Sciences, and the Global Health Program has been finalized. Enrollments have grown rapidly in one academic year, and Global Health major posted the 4th largest number of undergraduates declaring at the Student Orientation, Advising, and Registration (SOAR) program in CALS.

– Russ Groves

Awards

Skye (Harnsberger) Bruce was the winner of the student competition for Infographics at this year's Entomological Society Meetings in Denver. Congrats Skye! You can see her infographic poster here.

Insect Research Collection (WIRC) update



WIRC specimen occurrence records in the GBIF portal.

The past year was literally transformative for the WIRC. Campus and college grants supported the replacement of all substandard natural history cabinets as well as the addition of a significant number of additional new cabinets. These increased the collection capacity by about 78% in Lepidoptera and roughly 33% overall. Although our project was directly impacted by the ongoing global supply chain and labor issues, the remaining 14 pallets of new insect drawers recently arrived at the MDS facility in Verona, completing our order of nearly 2,000 new drawers.

Collection objects in the WIRC, like those in all natural history collections (NHCs), represent a series of snapshots of the species composition in a given place and time. The associated occurrence data for collection objects thus provide crucial baseline data that allow researchers to track how species distributions and phenologies are changing. Given the increased focus on the global decline of insects, particularly pollinators, the value of dynamic—i.e., growing—NHCs like the WIRC has never been higher. With the imminent completion of our infrastructure improvement project, we are poised to continue growing and serving as an indispensable UW Research Core well into the future. To borrow from Morgan Freeman's character in *The Shawshank Redemption*, now more than ever NHCs need to "get busy living or get busy dying."


Boxes of new unit trays awaiting use.

Progress on our two ongoing NSF-supported projects continues apace. We are pleased to welcome five new undergraduate student hourlies: **Hazel**, **John**, **Mickayla**, **Nathan**, and **Sabrina**. They join **James**, our LTE database specialist, in accomplishing our digitization objectives.

We recently surpassed 115,000 records in our collections object database and are now serving a subset of these records through national and global data aggregation portals, including: Symbiota Collections of Arthropods Network (SCAN), Integrated Digitized Biocollections (iDigBio), and the Global Biodiversity Research Facility (GBIF).

Craig Brabant. Craig joined colleagues Carrie Eaton, Curator of Collections for the Wisconsin Geology Museum, and **Liz Lieth**, Senior Academic Curator of the Department of Anthropology Collections, for a presentation at the joint virtual meeting of the Association of Midwest Museums (AMM) and the Wisconsin Federation of Museums (WFM) just after returning from the ESA meeting in Denver. In Denver, he presented a report in his role as Treasurer of the Systematics, Evolution, and Biodiversity (SysEB) Section of ESA.


Newly hired WIRC student hourlies.

In October, **Craig** presented a virtual tour of the WIRC during the *Insect Collections of the World* symposium for the Entomological Collections Network (ECN) virtual meeting. If you've made it this far, you may enjoy viewing the 13-minute video here to see Craig's nod to Dan's passion for science fiction at the beginning of the tour.

Entomology Graduate Student Association update

The Entomology Graduate Student Association is the group that represents graduate students in the Entomology department, including those in other programs with advisors in Entomology. We have been busy this semester organizing events and building community and support among students. We have held a number of in person and virtual events, and will continue to look for ways to bring our community together through the winter. In September, we partnered with the Chair's Office to hold a Welcome Picnic in September and enjoyed getting to know the new members of our community. Our Insect Ambassadors

coordinators **Jillian Schat** and **Ben Iuliano** led our September workshop on how to get involved in IA and how to give outreach presentations. In October, the graduate students from the **Crall lab** hosted a pumpkin painting party, which resulted in many tiny, sparkly ento-themed pumpkins! EGSA also offered practice sessions in October for students presenting at the Entomological Society of America conference. EGSA usually holds an annual Thanksgiving Swarm event, but we have decided to postpone this until spring when it is warm enough to gather outdoors. Our next workshop is coming up in December (more details below!), and we are planning an early winter workshop on giving land acknowledgements.

Our December workshop will be led by **PJ Liesch** on the topic of talking to the media. Everyone in the Entomology community is welcome to join us on **December 3rd at 2pm** (room TBD and via Zoom). Media interviews are a great way to reach a broad audience, but can be a bit intimidating to the uninitiated. In this workshop, PJ will discuss his own experiences interacting with the media, highlight different interview formats and what to expect during the interview process, and share advice to help you prepare for and deliver media interviews.

EGSA holds monthly meetings that all graduate students are welcome and encouraged to attend. Undergraduates, postdocs, and staff members are also welcome. During our meetings, we discuss issues relevant to students in our department, hear updates from our representatives on all of the departments committees, and plan events. This semester much of our discussion has focused on the new financial burden graduate students are experiencing due to the switch to biweekly payroll. Our EGSA president brought these issues to the October faculty meeting, and we look forward to continued discussion on ways to better support graduate students financially. In our upcoming December meeting, we will elect new EGSA officers to begin their positions in January.

Need a snack? Support EGSA by buying yourself something tasty from our Snack Room in Russell 242. You can now pay for items in the Snack Room via Paypal (look for the QR code next time you stop in). All proceeds go toward our programs and events, like funding our pumpkin painting party! Spread the word to your lab members that might not know. – *Hanna McIntosh*

Diversity, Equity, and Inclusion Committee update

The DEI committee started to meet in September and we were happy to welcome some new members to the committee including two postdocs **Mike Howe** and **Matthew Smith**, and graduate student **Nolan Amon**. We would also like to thank **Taylor Tai** and **Brandon Gominho** for their service on this committee and wish them good luck on their new adventures.

The committee hopes that the activities conducted last academic year were beneficial to everyone and that the field safety guidelines and supporting items (vests and vehicle magnets) put in place this past summer were helpful to you. Please let **Christelle Guédot** know if you have any feedback on these.

The committee has started making plans for a roundtable discussion to identify new equity, diversity, and inclusion priorities for the department. **Please join us on December 3rd at noon.** More to come on this soon.

The committee also finalized the anonymous feedback form. This form is to be used if you have any comments you'd like to share anonymously with the department. The entries will be checked monthly by the Russell Hubs HR staff and they will respond to any feedback by directing it to the appropriate party. Please remember that instances of sexual harassment, hostile and intimidating behavior, etc. will need to be reported through other avenues such as directly to HR or Title IX. For more information on what should be reported elsewhere, please refer to the Code of Conduct. [Note: you must log in with your @wisc account to access the form, but all submissions are anonymous.].

We also would like to remind everyone that, in an effort to improve communication and transparency, the Department uses a Google Drive called Entomology Share where you can see the agendas, minutes, and docs that each committees are working on during the year as well as past meeting documents. The DEI committee has its own folder where you can find all the documents

that we are working on as well as resources and notes taken during town halls. [Note: you must sign in with your @wisc account to access the Entomology Shared Drive].

We hope that this information as well as town halls are valuable to all and we welcome feedback, suggestions, comments as we continue to work on DEI activities in the future. Feel free to direct those to Christelle Guédot at guedot@wisc.edu.

Stay tuned and enjoy the beautiful fall days!

– Christelle Guédot and the entire DEI Committee.

Research Committee update

The College of Agricultural and Life Sciences is offering an opportunity to do a 50-50 cost-share on capital equipment for existing Hatch grants. The Research committee met to prioritize faculty requests for this opportunity.

Lab updates

Schoville Lab

The Schoville lab is participating in a new multidisciplinary Hatch project with **Susan Paskewitz** studying genomic variation in blacklegged ticks and Borrelia in the Midwest.

New lab members: **Michael Troutman**, a research technician, and **Dahn-young Dong**, a graduate student in iBio, studying tick spatial genomics. Outgoing lab members: **Zach Cohen** recently graduated (September 2021) and is now a postdoc with USDA at Texas A&M in College Station, TX.

Crall Lab

We have been really excited to welcome several new lab members in the last few months, including graduate students **Anupreksha Jain** and **Gigi Melone**, postdoctoral fellow **Dr. Olivia Bernauer**, and undergraduate research **Julia Prouse** (through the Undergraduate Research Scholars program), who will be working with **Dr. Matt Smith**.

After a busy first field season of research projects spanning the lab and field (including at Mt. Hood, OR and the Arlington and Hancock Agricultural Research Stations), several of us (graduate student **August Easton-Calabria**, **Dr. Matt Smith**, and **Dr. James Crall**) were excited to present research in person at the Entomological Society of America conference in Denver, CO!

Gratton Lab

There was a nice front page article in a Sunday Wisconsin State Journal on the Gratton Lab's WiBee citizen science project that got lots of coverage.

Lab alum Dr. **Jeremy Hemberger** published his PhD thesis work in *Ecology Letters:* Hemberger, J., Crossley, M. S., & Gratton, C. (2021). Historical decrease in agricultural landscape diversity is associated with shifts in bumble bee species occurrence. *Ecology Letters*, *24*(9), 1800–1813. https://doi.org/10.1111/ele.13786

And news releases (with cool graphics!): https://news.wisc.edu/midwest-bumble-bees-declined-with-more-farmed-land-less-diverse-crops-since-1870/

And some coverage on WPR: https://www.wpr.org/new-study-blames-decline-midwest-bumble-bee-population-lack-crop-diversity

Skye (Harnsberger) Bruce had her first paper come out in the journal *Landscape Ecology* on monarch butterflies in agricultural landscapes: Bruce, A. S., Thogmartin, W. E., Trosen, C., Oberhauser, K., & Gratton, C. (2021). Landscape- and local-level variables affect monarchs in Midwest grasslands. *Landscape Ecology*. https://doi.org/10.1007/s10980-021-01341-4

The Gratton lab has also officially left the Wisconsin Energy Institute where they have been for over 7 years, and moved their full operations to Moore Hall (back on the CALS side of the tracks). We have commingled our labs group with those of **Drs. Chris Kucharik** and **Randy Jackson** to create an informal "Agricultural Ecosystems Research" group. As soon as we are done unpacking, we invite you to come visit us on the 5th floor.

Lindroth Lab

We had several papers of note published in recent months. **Olivia Cope's** premier paper from her Ph.D. research, focusing on growth-defense tradeoffs and genetic selection in aspen, was published in the *Proceedings of the National Academy of Sciences* and received widespread press coverage. In August 2021, Olivia started a position as Assistant Professor at Whitworth University.

Dr. Patricia Fernandez (CONICET, Buenos Aries, Argentina) joined our group as a Fulbright Scholar during summer 2021. Along with other members of our group (in particular, postdoc scholar **Mark Zierden**), Patricia explored the consequences of a major outbreak of spring-feeding *Lymantria dispar* (formerly known as "gypsy moths") on the fitness of summer feeding polyphemus moth larvae. Results are still being analyzed, but (spoiler alert!) early indications are that defoliation by the invasive *L dispar* dramatically reduces food quality of aspen and fitness of the large, charismatic polyphemus moth.

A particular pleasure for me (**R. Lindroth**) this Fall semester has been teaching our graduate seminar (Entomology 901) on a topic into which I've done a deep dive in recent years: *Science literacy, science denialism, and science communication in a post-truth world.* Professor **Shawn Steffan** and I have had great fun in facilitating exploration of this timely and important topic by a record number of students.

Recent publications:

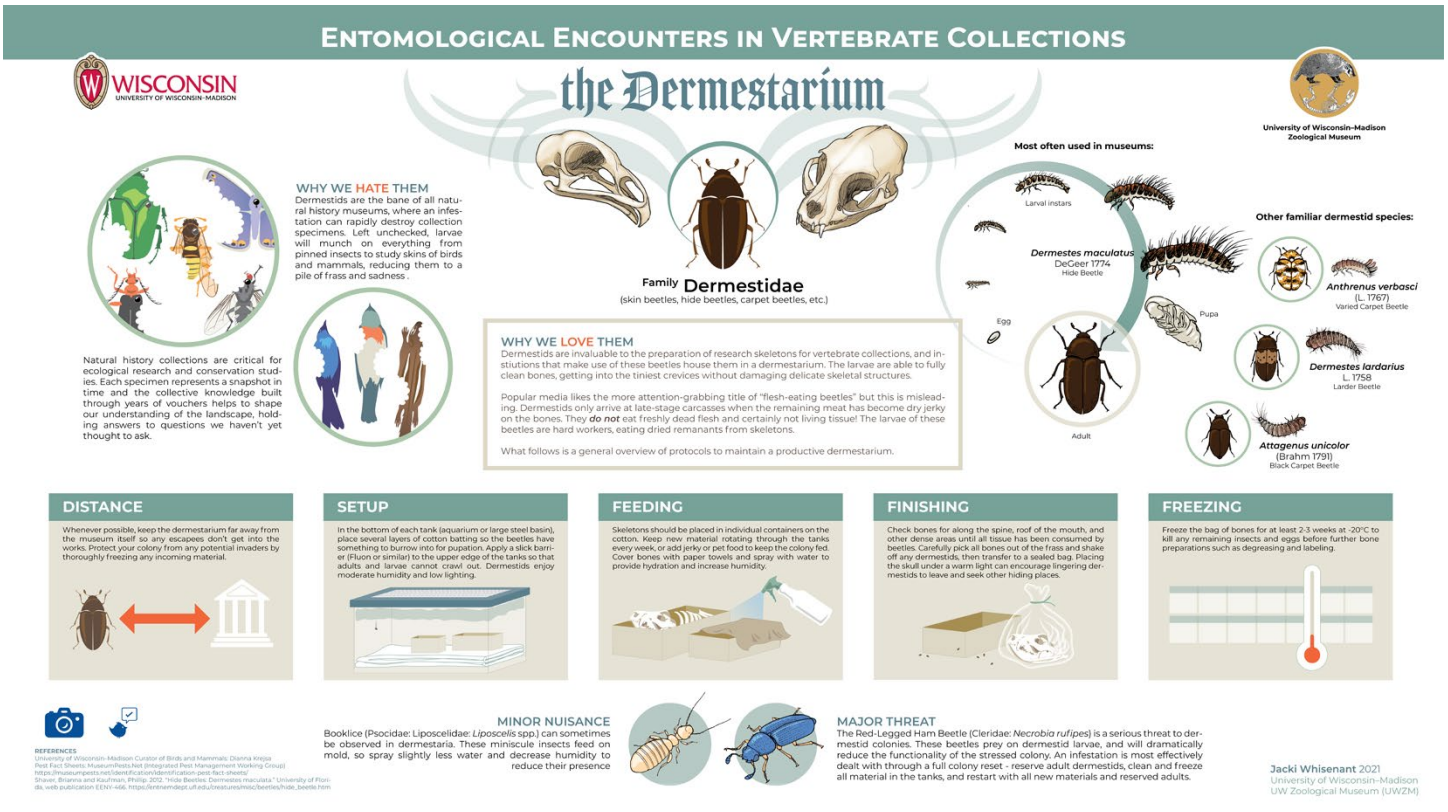
- Cope, O.L., K. Keefover-Ring, E.L. Kruger, and R.L. Lindroth. 2021. Growth-defense tradeoffs shape population genetic composition in an iconic forest tree species. *Proceedings of the National Academy of Sciences* 118: e2103162118 DOI: 10.1073/pnas.2103162118
- *Press release:* https://news.wisc.edu/study-shows-how-aspen-forests-maintain-the-diversity-needed-to-adapt-to-changing-environments/
- Cope, O.L., R.L. Lindroth, A. Helm, K. Keefover-Ring, and E.L. Kruger. 2021. Trait plasticity and trade-offs shape intra-specific variation in competitive response in a foundation tree species. *New Phytologist* 230:710–719. DOI: 10.1111/nph.17166
- Eisenring, M., S.B. Unsicker, and R.L. Lindroth. 2021. Spatial, genetic and biotic factors shape within-crown leaf trait variation and herbivore performance in a foundation tree species. *Functional Ecology* 35:54–66. DOI: 10.1111/1365-2435.13699
- Li, Z., K.F. Rubert-Nason, M.A. Jamieson, K.F. Raffa, and R.L. Lindroth. 2021. Root secondary metabolites in *Populus tremuloides*: effects of simulated climate warming, defoliation and genotype. *Journal of Chemical Ecology* 47:313–321. DOI: 10.1007/s10886-021-01259-w
- Monson, R.K., A.M. Trowbridge, R.L. Lindroth, M.T. Lerdau. 2021. Tansley review: Coordinated resource allocation to plant growth-defense trade-offs. *New Phytologist* DOI: 10.1111/nph.17773

Young Lab

Ann Marsh. Following her summer 2021 ENT 201 Lecturer appointment in the department, Ann is currently serving again as ENT 201 TA in a virtual edition of ENT 201. Ann also begins her Ph.D. on her beloved staphylinids under the joint supervision of Drs. Schoville and Young.

Jacki Whisenant. Jacki continues her master's research: A Survey of the Tetratomidae of Wisconsin (Coleoptera: Tenebrionoidea). Here are a few updates:

- Not teaching this semester has allowed for more mural progress on the 3rd floor.
- All of the designs on the EGSA Spreadshirt t-shirt and merch store now also have sticker versions, more designs coming soon. If you have a T-shirt design for EGSA, we can add it to the store.
- In writing mode - taking off some time from work at Zoology Museum to crack down.
- Big dermestid blowout: the UWZM did a full revamp of the dermestarium and they are back, stronger than ever and helping to clean skeletons for research. [Fortunately, they are sequestered far away from any of the natural history collections.]



Zhihong Zhan. Zhihong completed his B.S. in entomology with us here at the UW-Madison. Following a pandemic dictated stay at hom,e in China, Zhihong is back as a new member of the lab beginning his M.S. with us. Zhihong will be conducting a taxonomic study of the *Lucanus fortunei* species group endemic to China, based largely on a comparative external morphological approach.

During his extended stay at home, Zhihong also collaborated on his first research publications:

- Cheng-Zhi, B. and Zhan, Z. 2021. A new species of *Lucanus* Scopoli, 1763 (Coleoptera, Lucanidae) from Tibet, China. Faunitaxys Revue de Faunistique, Taxonomie et Systématique morphologique et moléculaire 9(27): 1-4.

- Ying, Y., Zhan, Z-H, Wan, X. 2021. New color patterns and new synonym of *Odontolabis sinensis* (Westwood, 1848) (Coleoptera: Lucanidae): insights from a multilocus phylogeny and species delimitation. Zootaxa 4926 (2): 263–275.

Dan Young. Instructionally, summer 2021 saw me teaching our ENT 468 Capstone: Studies in Field Entomology. The pandemic once again precluded our "normal" two week field visits to the Wyoming Rockies and Black Hills of South Dakota. However, we were able to make the best of it with an extended stay up at the Kemp Natural Resources Research Station on Tomahawk Lake.

My current (fall semester) teaching schedule includes ENT 302: Introduction to Entomology, as always; my "FIG" course, ENT 375: Biodiversity and the Sixth Mass Extinction; and ENT 331: Taxonomy of Adult Insects. The spring rotation includes ENT 302 along with Advanced taxonomy of Diptera (with a planned long weekend in the field back at Kemp and several collecting field trips to Hemlock Draw in the beautiful Baraboo Hills).

Wisconsin-based summer 2021 fieldwork focused on a 2nd year of Malaise trap sampling at the Kemp Natural Resources Research Station. A couple other research highlights are noted in the publications, below.

- Young, D. K. 2021. New record of *Idana marginata* (Say) (Diptera: Tephritoidea: Ulidiidae) from Wisconsin. The Great Lakes Entomologist 54: 64-66.
- Young, D. K. 2021. New distributional records for Pyrochroidae (Insecta: Coleoptera: Tenebrionoidea) from the Himalaya global biodiversity hotspot region. In Biodiversität und Naturausstattung im Himalaya VI. Edited by M. Hartmann & J. Weipert. www.naturkundemuseum-erfurt.de Verein der Freunde & Förderer des Naturkundemuseums Erfurt e.V:, Große Arche 14, D-99084 Erfurt. pp. 307-311.
- Janicki, J. and D. K. Young. 2021. Survey of the Attelabidae of Wisconsin (Coleoptera: Curculionoidea). Insecta Mundi 0891: 1-62.

Three additional manuscripts have been submitted with one accepted and two currently in the review process:

- Friant, S. D. K. Young, and T. L. Goldberg. Typical intracranial myiasis in Nigerian red river hogs (*Potamochoerus porcus*) caused by an unknown bot fly (Diptera: Oestridae). International Journal for Parasitology: Parasites and Wildlife [19 manuscript pages + figure plates; in revision]
- Young, D. K. New record of *Gnoriosta macra* Johannsen (Diptera: Mycetophilidae) from Wisconsin. The Great Lakes Entomologist [9 manuscript pages including figures; accepted for publication.]
- Zhao Pan, Jia-Chong Duan, Qi Gao, Daniel K. Young. The adult, larva, and pupa of a new *Pseudopyrochroa* (Coleoptera: Pyrochroidae: Pyrochroinae) from China, with molecular phylogenetic inferences. Insects [24 manuscript pages including figures; in review.]

Steffan Lab

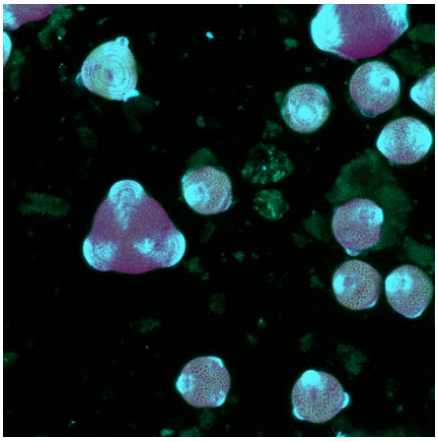
The spring and early summer of 2021 were very busy in the Steffan Lab. Early in the spring, assistant scientist **Dr. Prarthana Dharampal** had a baby! Meet little Aadi (pictured below, left)!

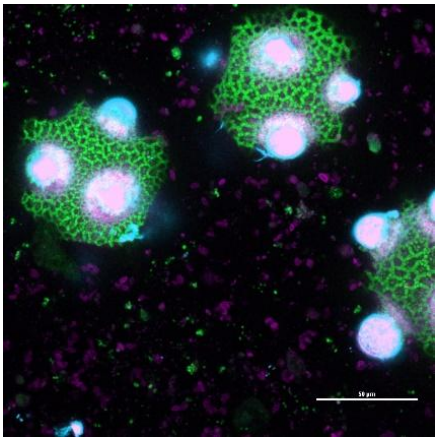
Then, we hosted a film crew (Day's Edge Productions) who were shooting footage of our bee work.

We also hosted a visiting scientist, **Dr. Anna Edlund**, from Bethany College (Bethany, WV) who was photographing the pollen-provisions and all the microbial beasts within.

Later in the summer, **Nolan Amon** (right) joined the lab. Welcome to Aadi and Nolan!

Professor Edlund (chair, Dept of Biology, Bethany College) photographed our bees and their pollen-provisions, producing some exquisite images of pollen grains and microbes. See below for a sampler!





The film company, Day's Edge Productions, was shooting extensive footage of our bee-microbe projects, as well as the work of our collaborators at Cornell (Danforth Lab), UC-Davis (Vannette Lab), and UC-Riverside (McFrederick Lab). Here in Madison, we had bumble bee nests installed within hollowed out logs, as well as *Osmia* bees provisioning their nests within some new nursery posts we'd installed at the UW Arboretum. Filming was done at the Arboretum, Allen Centennial Gardens, and in the wooded backyard of some friends!

Research-wise, we continued to examine the nature and roles of exosymbiotic microbes for solitary and social bees. This work has involved multiple species of *Osmia* bees, as well as *Bombus* species. We are running microbial community-assembly experiments currently, and are looking at how microbial diversity affects pollen consumption, oxygen depletion, and larval performance. We are advancing a new hypothesis that many bees rely on an external 'rumen.'

We also conducted large-scale field experiments refining our pheromone-based mating disruption system in cranberries. And, we continued working at improving our mass-propagation methods for our native WI nematodes, which are virulent bio-control agents for cranberry pests as well as mosquitoes. While the nematodes are great bio-control agents, they've proven difficult to mass-propagate or even to store for more than a few days. We still have a ways to go before they're an off-the-shelf product for US agriculture or vector control.

Guédot Lab

The lab welcomed some new members in the last several months: **Greg Gelembiuk** and returning **Shane Foye** have joined us. Greg is a postdoc working on movement and gene flow in spotted-wing drosophila in collaboration with **Sean Schoville**. Greg is also interested more broadly in how spotted-wing drosophila overwinter and in investigating the use of RNAi with red-headed flea beetle. Shane is refining the use of mass trapping as a new management strategy for social wasps in vineyards and also investigating whether red-headed flea beetle use pheromone, sex or aggregation, to communicate.

Mitchell Lannan started his MS degree in Entomology in January 2021 looking at attract-and-kill management for Japanese beetle in vineyards and **Casey Trickle** started his MS in plant pathology (co-advised by **Leslie Holland**) in September 2021. Casey is interested in the re-emerging false blossom disease of cranberry caused by a phytoplasma vectored by the re-emerging blunt-nose leafhopper and possibly other leafhopper species.

Nolan Amon graduated in May 2021 with his MS degree in Entomology looking at the impact of pollinator gardens on wild bee richness, abundance, and visitation to cranberry flowers. Nolan right away started his PhD across the hall with **Shawn Steffan**, thank you and good luck with your PhD Nolan!

Hanna McIntosh got her first manuscript from her work at UW-Madison accepted in the Journal of Pest Science in which she described how plastic mulches decrease the number of adult and larvae of spotted-wing drosophila by more than 50% compared to grower standard.

Papers from our lab published in 2021 include:

- Jaffe B.D., Wallin M., Fox M., and Guédot C. 2021. Cranberry (*Vaccinium macrocarpon*) is a marginal host for brown marmorated stink bug (*Halyomorpha halys*). Journal of Economic Entomology. 114: 1401–1405 https://doi-org.ezproxy.library.wisc.edu/10.1093/jee/toab032
- Henden J. and Guédot C. Effect of adult feeding on the δ15N signatures of different tissues for *Popillia japonica.* Entomologia Experimentalis et Applicata. https://doi-org.ezproxy.library.wisc.edu/10.1111/eea.13060
- Jaffe B.D., Rink S., and Guédot C. 2021. Life history and damage by red-headed flea beetle (*Systena frontalis*) (Coleoptera: Chrysomelidae) on cranberry (*Vaccinium macrocarpon*). Journal of Insect Science. 21: 1-8. doi: 10.1093/jisesa/ieab004

From an extension standpoint, it was busy year again with 28 in-season newsletter articles on insect pest and pollinator management covering all fruit crops and organizing three webinar series on cold climate grapes and berries with colleagues here (Amaya Atucha in Horticulture and Leslie Holland in Plant Pathology) and at UMN (Annie Klodd UMN Extension).

Groves Lab

The Groves lab has one new paper in pre-print by **Vicky (Lason) Harrod**, a PhD student co-advised by **Dr. Groves** and **Dr. Barak** in the Plant Pathology department:

- Harrod, VL, Groves, RL, Guillemette, E, Barak, J. Give and Take: Salmonella Enterica Alters *Macrosteles Quadrilineatus* Feeding Behaviors Resulting in Altered S. Enterica Populations and Distribution on Leaves. https://doi.org/10.21203/rs.3.rs-828118/v1

Ben Bradford has been working hard upgrading the **CALS Ag Weather** family of websites, which collect gridded weather data from NOAA and UW SSEC covering the upper Midwest and generate daily maps and data access tools for temperature, precipitation, solar insolation, estimated evapotranspiration, a variety of degree day models, and insect pest and disease models. Wisconsin data dates back to 2016; coverage for the expanded upper Midwest region was added several months ago. Check out the Ag Weather site, the Vegetable and Insect Disease Forecasting Network (VDIFN) website, or the Wisconsin Irrigation Scheduling Program. Another excellent weather data source for researchers is Oregon State's PRISM Climate Group.

Bugs in the news

- Sounding the alarm: How honey bees alert their hive to attacks by giant 'murder' hornets. For the first time, the unique sounds honey bees (*Apis cerana*) use to alert members of their hive when giant "murder" hornets attack have been documented. These signals -- including a newly described "antipredator pipe" -- are the focus of new research from Wellesley College associate professor of biological sciences Heather Mattila and her colleagues, whose findings were published in *Royal Society Open Science*. – ScienceDaily.com

- Hungry caterpillars an underappreciated driver of carbon emissions. A study led by the University of Cambridge has found that periodic mass outbreaks of leaf-munching caterpillars can improve the water quality of nearby lakes -- but may also increase the lakes' carbon dioxide emissions. Outbreaks of caterpillars of invasive gypsy moths, *Lymantria dispar dispar*, and forest tent caterpillar moths, *Malacasoma disstria* occur at least every five years in temperate forests. The insects munch through so many leaves that the resulting decrease in leaf-fall and increase in insect excrement has

been found to alter the cycling of nutrients, particularly carbon and nitrogen, between land and nearby lakes on a huge scale. – ScienceDaily.com

- Climatic drivers of honey bee disease revealed. Honey bee colonies worldwide have suffered from a range of damaging diseases. A new study has provided clues on how changing weather patterns might be driving disease in UK colonies. Publishing their findings in the journal *Scientific Reports*, the team led by Newcastle University found that the most severe disease of honey bees, caused by the *Varroa* mite, increased as climate temperatures increased but were reduced during heavy rainfall and wind. – ScienceDaily.com
- Honeybees use social distancing to protect themselves against parasites. Honeybees increase social distancing when their hive is under threat from a parasite, finds a new study led by an international team involving researchers at UCL and the University of Sassari, Italy. The study, published in *Science Advances*, demonstrated that honeybee colonies respond to infestation from a harmful mite by modifying the use of space and the interactions between nestmates to increase the social distance between young and old bees. – ScienceDaily.com
- Satellite images can help with environmental land management. Academics at the University of Surrey's Centre for Environment and Sustainability have undertaken research that proves Earth Observation satellite imagery can accurately assess the quality and quantity of some habitat types. This discovery opens up cost-effective routes to monitoring, reporting, and verifying land management incentive schemes, such as the Department for Environment, Food and Rural Affairs' new Environmental Land Management scheme. – ScienceDaily.com
- Entire genome of Eurasian spruce bark beetle now revealed. Researchers have successfully mapped the entire genome of the Eurasian spruce bark beetle. The breakthrough paves the way for new research into bark beetles and better prospects for effective pest control of a species that can destroy more than 100 million cubic meters of spruce forest during a single year in Europe and Asia. Mapping the genome of the Eurasian spruce bark beetle enables a far deeper understanding of how and why it has become a very successful forest pest. Among other things, the researchers' analysis of the genome revealed that the Eurasian spruce bark beetle has an unusually large number of genes that help to break down the cell walls of plants. In contrast, it does not appear to have an elevated number of genes to enable it to rid its body of foreign substances, which is surprising as the resin in the trees is toxic to the insects. The recently completed sequencing of the entire genome of the Eurasian spruce bark beetle, *Ips typographus*, could potentially pave the way for highly specific pest control using what is known as RNA interference (RNAi). – ScienceDaily.com
- Hoverflies navigate using sun and body clock. Hoverflies use a combination of the sun and their body clock to navigate when they fly south for the winter, new research shows. The insects keep the sun on their left in the morning, then gradually adjust to maintain a southward route as the day goes on. – ScienceDaily.com