NC STATE UNIVERSITY

July 2019

Wolfpack's Waggle

July 2019 Newsletter

NC State Apiculture Program

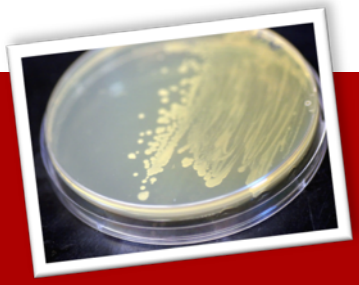
Dedicated to the dissemination of information and understanding of honey bee biology and management

Issue 3, July 2019

More inside

What have we been up to?

Summers are always a busy time of year, and this year is no different. Joe is busy with his third research season, building off of their findings from last year by testing the effects of multiple pesticides on larval survival particularly how it might interact with viral infection. Lauren, now a proud new mom, is back from maternity to finalize the writing of her first chapter and finish the data collection and analysis of her second chapter. Hannah and her team have again been busily sampling the native bee communities all across the state. Jennifer has been juggling all of these efforts, especially the queen rearing and honing her skills at instrumental insemination. Esmaeil is busy with his many projects at UNCG (including those on egg size), and Daiana has moved on to a new position at Cornell but will be finishing up her series of projects on queen quality. Brad continues to expand the queen clinic in new directions, as well as conduct some follow-up studies on drone reproductive quality. Ali has already completed a number of studies on queens and drones using proteomic analyses, and she has recently been awarded a prestigious NSERC fellowship to continue her work. Sharon and Kirsten are busily preparing for the upcoming BEES Academies this fall, which promises to be a great opportunity for intermediate beekeeper education across the state.



Bees, microbes, and undergraduate research

We're in the middle of our third year of the BeeMORE program, which is a USDA-funded Research and Extension Experience for Undergrads (REEU). We have a great collection of students and projects this year.

More on Page 3

Honey Bee Queen & Disease Clinic

Better Data, Better Bees

Quality Assurance

Morphometric Analyses: multiple measures of queen or drone, body and reproductive tract (rearing quality)

Quality Report: a "grade" report of a queen or drone's reproductive quality for your quick interpretation

Semen Quality: total sperm count, and sperm viability in queens (mating success), or drones (mating potential)

Genotyping Analyses: full assessment of paternity for up to 48 workers and an estimate of queen mating frequency

Troubleshooting

Pathogen Screening: identification of presence and relative levels of ABPV, BQCV, DWV(A&B), IAPV, LSV, Trypanosomes, and both *Nosema* species

Mitotyping for Africanization: genetic analyses of maternal ancestry as African or European using population genetic techniques and markers

Your Bees, Your Data: any results or interpretations from our work is held in the strictest confidentiality and anonymity

Customized Experimentation

This highly-tailored collaboration involves custom experimental design, analyses, and interpretation. This unique partnership between science and industry has been utilized to:

- Test the impact of various agrochemicals
- Assess the effects of banking on queen quality measures
- Evaluate novel management practices' improvements in queen mating quality
- Observe the effects of shipping on queen health and sperm quality

Contact us for more information & pricing

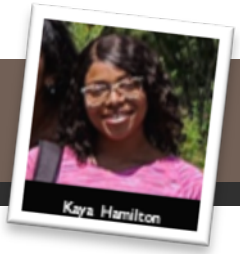
Queen & Disease Clinic Pricing (five sample minimum, bulk pricing available)

Strong Research Foundations
Established as a natural extension service leveraging basic and field honey bee research at NCSU, the clinic has worked to improve colony health for over 10 years.

Analysis	Pricing (per sample)	Samples Tested		
		Queens	Drones	Colonies
Reproductive Quality	$24.00	✓	✓	
Standard Pathogen Screen	$55.00	✓	✓	✓
Apiary Pathogen Screen	$220.00*	*up to 10 colonies, pooled		
Mitotyping (Africanization)	$35.00	✓	✓	✓
Genotyping (Mating Number)	$320.00			✓

Custom Disease Screening
Additional and custom pathogen targets available upon request

Lab spotlight: Kaya Hamilton and Lexi Gauger



In the third year of our BeeMORE program, we have invited two summer interns this year to study the interface between bees and microbes.

Kaya Hamilton is a student at Xavier University in NOLA. She is collaborating with Hannah on her project to quantify how putative honey bee viruses might be infecting native bees across the state.

Lexi Gauger is a junior at the University of Kentucky. She has been helping Joe's project to detect viruses in larvae to see how infections might make them more (or less) susceptible to pesticide exposure.

Both Kaya and Lexi have been fantastic additions to the lab this summer, and their time here has been all too short. Thanks to you both!

This year's cohort of students come from Xavier, Kentucky, Charlotte, Pembroke, Chapel Hill, Durham Community College, and San Diego State University.

BeeMORE – Bees and microbes in organized undergraduate research and engagement

This is our third year of a USDA-REEU grant that recruits undergraduates from off campus to develop and conduct research in how microbes are important to bees.

Student projects all center around bees (honey bees or native bees) and microbes (either pathogens or beneficial bacteria).

Microbiology and microbiologists will play a critical role in advancing food production and economic development around the world. American Academy of Microbiology reports emphasize the enormous economic impact microbiology will have on agricultural, environmental, biotechnology, and health initiatives in the near future. However, often only later in advanced training do students fully appreciate the beneficial microbe-plant, microbe-animal, and specifically the microbe-insect interactions that promote agricultural productivity and environmental health.

The objectives of the proposed program are to have an intellectual and practical focus on honey bees and bee-microbe interactions that introduces a cohort of students to the subject, prepares them for pursuing advanced degrees or industry and agriculture careers with the relevant technical skills, and prepares them for the interdisciplinary, team-driven approaches needed for success. As a concise overview, AFRI ELI program will be structured as follows:

i) Recruit participating students from HBCUs, Community Colleges, and from other Universities in the US and Puerto Rico to actively attract underrepresented groups in science to participate. We aim to have 75% of participating students come from off campus.

ii) Deploy a nine (9) week summer program that begins by teaching students the foundational principles of bees, microbes and pollination, and skills germane to the research projects and future course work.

iii) Transition participants to mentored research in bee ecology, bee-microbe interactions, microbiological processes relevant to agriculture and insect populations, and other areas that 10 faculty mentors have committed to connect with the intellectual focus of the program.

iv) Hold weekly meetings to facilitate project updates, enhance student communication skills in science, and engage guests from academia, industry and associated partners.

v) Offer additional opportunities for the summer participants that can include ongoing research opportunities (especially applicable for regional and NCSU participants), second

BeeMORE program (Continued)

summer or special term internships arranged with collaborating industries, and attendance to periodic seminars or topical sessions on the NCSU campus throughout the academic year.

Current student projects for the summer of 2019 include:

(1) The relationship between sunflower pollen consumption, gastro-intestinal function, gut transit time, and parasite load in bumble bees (**Sam Johnson**); (2) The spread of the parasite crythidia among bumble bee colonies (**Melanie Handley**); (3) Carpenter bee nesting biology and nest microbial community (**Gabriela Quevedo**); (4) The interaction of viral loads and pesticide susceptibility in honey bee larvae (**Lexi Gauger**); (5) Discovering bacteriophage that may be used for biocontrol of American foulbrood disease (**Maggie Rosen**); (6) Selecting opportunistic bacteria from carpenter bees that may help breakdown lignin waste from paper production to make biofuels (**Simran Sidhu**); and (7) Tracking how pollinator communities share viral pathogens across the landscape (**Kaya Hamilton**).

The students recently presented their projects to the Orange County Beekeepers, which were very well received.

NC State Apiculture Program

David Tarpy, Professor and Extension Apiculturist, 919-515-1660
david_tarpy@ncsu.edu

Jennifer Keller, Apiculture Technician, 919-513-7703
jjkeller@ncsu.edu

Erin McDermott, Genetics Technician, 919-513-3967
eemcderm@ncsu.edu

Sharon Munger, Project Manager, 919-513-3967
swmunger@ncsu.edu

Kirsten Benson, Design Coordinator, 919-513-3967
kebenso2@ncsu.edu

Esmaeil Amiri, NRC Postdoctoral fellow (UNCG)
Brad Metz, Postdoctoral researcher
Alison McAfee, Postdoctoral research (UBC)

Joe Milone, PhD Student (Entomology)
Hannan Levenson, PhD Student (Entomology and Evolution & Ecology)
Lauren Rusert, MS Student (Entomology)

Undergraduate Researchers
Ashley Rua (postgraduate researcher), Tess Wiegmann (artist-in-residence), Gaven Bell, Austin Acree, Emily Johnson (media intern), Danyelle Reiskind, Austin Rose, April Sharp, Kaya Hamilton (BeeMORE intern), Lexi Gauger (BeeMORE intern)

Support the NC State Apiculture Program!

The Apiculture Science fund-raising efforts operate under the auspices of the North Carolina Agricultural Foundation, Inc. a 501(c)3 organization. You will receive an official receipt for your donation.

MAKE A DONATION

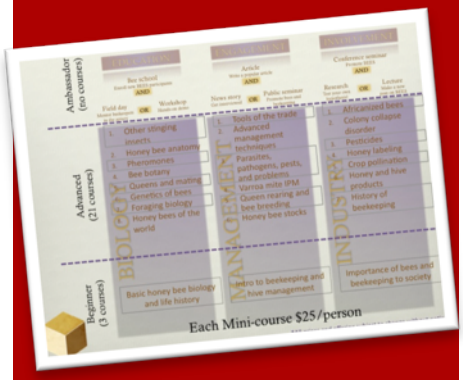
Make a gift toward emerging needs – Consider supporting the program with a gift that would go toward the current area of greatest importance. Flexible funding enables the Apiculture Program to address critical needs as they emerge, often enhancing the program beyond what would be possible through restricted grant funding. Funding of any amount, from $10 to $10,000, will be extremely helpful.

Make a gift-in-kind – The Apiculture program is always seeking creative solutions to its material needs. If you have surplus equipment or other non-monetary assets to give (e.g., gently used honey extractors, microscopes, even vehicles), please consider donating them to the program. You will receive credit for the monetary value of the gift and the gratitude of our faculty and students.

Make an estate gift – If you are interested in planning an estate gift to benefit Apiculture, please let us know! We can provide you with the tools you and your attorney will need to ensure that your wishes are fulfilled. Please click the link above for more information.

Check out our new website!

For the fourth time in 3 years, we have completely revamped our website, which is still located at https://ncsuapiculture.net. With a cleaner look and streamlined content, we hope this new look will be easier to navigate and utilize our many resources.



BEES network

Our online courses in the Beekeeper Education & Engagement System (BEES) are still up and running, although we have been continually delayed in creating new content. Enroll today at: go.ncsu.edu/BEES

Random notes

New publications

Guiffre, C., S. Lupkin, and D. R. Tarpy. (2019). Does viral load alter behavior of the bee parasite Varroa destructor? *PLoS ONE*, **14**: e0217975.

McAfee, A., J. S. Pettis, D. R. Tarpy, and L. Foster. (2019). Feminizer and doublesex knock-outs cause honey bees to switch sexes. *PLoS Biology*, **17**: e3000256.

de Souza, D. A., D. R. Tarpy, and K. H. Hartfelder. (2019). Effect of a juvenile hormone augmentation at reproductive framework of in vitro rearing honey bee queen. *Journal of Economic Entomology*. doi: 10.1093/jee/toz148.

Withrow, J. M., J. S. Pettis, and D. R. Tarpy. (2019). Effects of temperature during package transportation on queen establishment and survival in honey bees (*Apis mellifera*). *Journal of Economic Entomology*, **112**: 1043–1049.

Presentations

David provided a brief overview of the research program in the lab to the Wilson County Beekeepers association by webinar on June 6th, and he gave several presentations at the annual Young Harris Beekeeping Institute in GA in May. **Jennifer Keller** is currently attending the annual EAS convention in SC, and **Lauren Rusert** is attending as well since she won the 2019 EAS Student award. Lauren will also be the 2019 J. T. Ambrose Student Award winner for the NCSBA this year, where she will present her research to the state beekeepers in August.

Welcome aboard!

We were pleased to have hosted **Gabrielle Goldsworthy** in our lab for two weeks this summer. Gab is Bachelor of Animal Science student at Charles Sturt University in Australia, and her family is part of a large beekeeping operation there. Our collaborator Jeff Pettis help set up her visit to the US this summer to work with us as well as Steve Shepperd's lab at Washington State. Gab learned a lot during her short time here and helped out a lot of projects, so we appreciate her dedication. It was a pleasure having you and we appreciate your positive spirit and hard work!

…and sadly missed

We bid farewell to **Olivia Loyack, Nissa Coit (UNC), Will Fowler,** and **Zachary Everson**, all of whom either graduated or have moved on to other projects. In particular, Nissa has moved to Davis CA where she will be entering into graduate school studying honey bees at UCDavis. We appreciate all of their hard work as part of the program and wish them luck in their next ventures!

Congratulations!

Perhaps the biggest news that we've had in a while is that **Lauren Rusert** recently gave birth to her daughter, Maria, back in early May. Mother and daughter (and father!) are doing just great, and we adore having the little bundle of joy around the office these days!

Hannah Levenson was awarded a highly coveted CEFS graduate fellowship for her work on the pollinator communities on NC Ag Research Stations. The Center for Environmental Farming Systems (CEFS) NC State University Graduate Fellows Program was developed to provide financial support and recognition for the future leaders, researchers, and contributors to sustainable agriculture while they pursue academic research to further the field of study. The Fellowship offers a two-year, $5,000-per-year stipend for Doctoral students.

Teacher's corner:
Courses at NC State

This upcoming fall semester, our ENT 203 course, "An introduction to the honey bee and beekeeping", has regained traction and quickly hit the maximum enrollment of 180 students. It will be TA'd by another graduate student in the department (TBD), and Joe Milone, Hannah Levenson, and Lauren Rusert will assist for another year. This summer we have updated much of the content to make it more timely and relevant, and we look forward to what will surely be another successful and fun semester!

http://go.ncsu.edu/honeybees

Tarpy's back page

·B·E·E·S·
BEEKEEPERS EDUCATION AND ENGAGMENT SYSTEM
ACADEMY

With the increasing number of beekeepers, there is an increasing need for continued advancement and education about honey bee biology, their management, and the overall industry. To help meet this need, we are happy to announce yet another new initiative that targets existing beekeepers who wish to hone their skills and understanding of beekeeping at a more advanced level.

Our new '**BEES Academy**' will be introducing a novel delivery format of apiculture training by seamlessly incorporating online content from our Beekeeper Education & Engagement System (BEES), live video Q&A with instructors, traditional in-person lectures, and hands-on activities.

We are currently collaborating with various extension field faculty across the state who will host the first three, 2-day BEES Academies, all to be held late summer or early fall. Registration is now open, and with only 100 seat available at each they're filling up fast!

August 23-24: Caldwell County
September 6-7: Chatham County
October 4-5: Brunswick County

NC State University
A&T State University
COOPERATIVE EXTENSION
Empowering People · Providing Solutions