NC STATE UNIVERSITY

April 2019

Wolfpack's Waggle

April 2019 Newsletter

NC State Apiculture Program

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

Issue 2, April 2019

More inside

What have we been up to?

It's springtime, so we're wishing that we have 50 hours in a day right now! Jennifer's excellent beekeeping last fall resulted in us having terrific overwintering success (~8% loss) of over 70 colonies, so our research apiaries are looking really good right now. Brad and Joe have teamed up to investigate the effects of pesticides on drones, and Esmaeil, Ali, and Daiana are likely going to get some additional samples from those same colonies to investigate other hypotheses. Erin continues to have a lot of balls in the air wrapping up genetic analyses in the lab, with some very exciting preliminary results. Lauren continues to analyze her samples from Hawaii, although she's expecting any day now with her first-born! Hannah recently transitioned from a MS to a PhD program and will be conducting her fourth field season on studying the pollinator communities across NC. Sharon and Kirsten have teamed up to revamp our online offerings of the Beekeeper Education & Engagement System (BEES) in preparation for our initial offerings of our advanced BEES Academy this fall.

Three new papers in *Insects* special issue

Based on the presentations earlier this year at the ABRC, we have three published papers in a beekeeper-friendly venue, which helps bring the research and beekeeping communities together.

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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: Nissa Coit

We have collaborated with just under 100 undergraduate research assistants in our program, most at NCSU. A few, however, have been able to join us from other institutions. **Nissa Coit** is one such student, who will be graduating from UNC Chapel Hill this spring.

Nissa is one of the founding members of the UNC beekeeping club, and as such she wanted to participate in honey bee research. She has since helped out projects in our lab, including how colonies accept new queens and how pheromones alter their behavior.

We are very proud of Nissa, especially since she will soon be departing to CA, where she plans to enter into a graduate program at UCDavis to continue her research on apiculture. Thanks for all your help, Nissa, and we'll miss you!

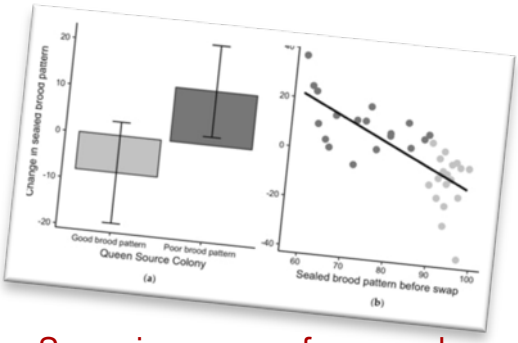
When faced with a choice of which population of workers a queen interacts with—virus infected or uninfected—queens spend more time with healthy workers, which might influence how virus spreads in a colony (Amiri et al., 2019).

Special issue of *Insects* on apiculture highlights three new studies on varied topics

Below are the published abstracts, available online and open-access, of three new papers that study very different aspects of bee health.

Queen loss or failure is an important cause of honey bee colony loss. A functional queen is essential to a colony, and the queen is predicted to be well protected by worker bees and other mechanisms of social immunity. Nevertheless, several honey bee pathogens (including viruses) can infect queens. Here, we report a series of experiments to test how virus infection influences queen–worker interactions and the consequences for virus transmission. We used Israeli acute paralysis virus (IAPV) as an experimental pathogen because it is relevant to bee health but is not omnipresent. Queens were observed spending 50% of their time with healthy workers, 32% with infected workers, and 18% without interaction. However, the overall bias toward healthy workers was not statistically significant, and there was considerable individual to individual variability. We found that physical contact between infected workers and queens leads to high queen infection in some cases, suggesting that IAPV infections also spread through close bodily contact. Across experiments, queens exhibited lower IAPV titers than surrounding workers. Thus, our results indicate that honey bee queens are better protected by individual and social immunity, but this protection is insufficient to prevent IAPV infections completely.

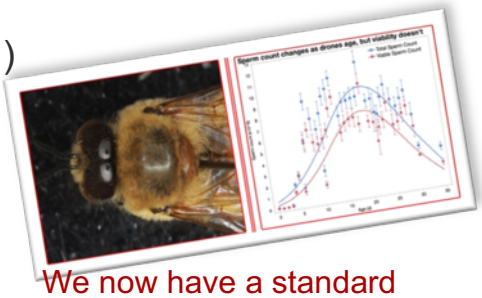
Failure of the queen is often identified as a leading cause of honey bee colony mortality. However, the factors that can contribute to “queen failure” are poorly defined and often misunderstood. We studied one specific sign attributed to queen failure: poor brood pattern. In 2016 and 2017, we identified pairs of colonies with “good” and “poor” brood patterns in commercial beekeeping operations and used standard metrics to assess queen and colony health. We found no queen quality measures reliably associated with poor-brood colonies. In the second year (2017), we exchanged queens between colony pairs (n = 21): a queen from a poor-brood colony was introduced into a good-brood colony and vice versa. We observed that brood patterns of queens originally from poor-brood colonies significantly improved after placement into a good-brood colony after 21 days, suggesting factors other than the queen contributed to brood pattern. Our study challenges the notion that brood pattern alone is sufficient to judge queen quality. Our results emphasize the challenges in determining the root source for problems related to the queen when assessing honey bee colony health.



Swapping queens from good and poor colonies demonstrates that it’s often the queen that gets blamed for a bad colony (Lee et al., 2019).

Insects abstracts (Continued)

In the face of high proportions of yearly colony losses, queen health and fecundity has been a major focus of industry and research. Much of the reproductive quality of the queen, though, is a function of the mating success and quality of the drones (males). Many environmental factors can negatively impact drone semen quality, but little is known about factors that impact the drones' ability to successfully mate and deliver that semen, or how widely drones vary. In our study, we observed the daily variation in honey bee drone reproductive quality over time, along with a number of morphological traits. Drones were reared in cages in bank colonies, and 20 individuals were dissected and measured daily. The number of viable spermatozoa in the seminal vesicles was zero at emergence and reached an average maximum of 7.39 ± 0.19 million around 20 days of life.



We now have a standard measuring stick of drone reproductive quality (Metz & Tarpy, 2019).

Decline in spermatozoa count occurred after day 30, though viability was constant throughout life, when controlling for count. Older drones had smaller wet weights, head widths, and wing lengths. We predict that this is likely due to sampling bias due to a differential lifespan among larger, more reproductively developed drones. Our study shows that drones are more highly variable than previously suggested and that they have a significant variation in reproductive physiology as a function of age.

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Support the NC State Apiculture Program!

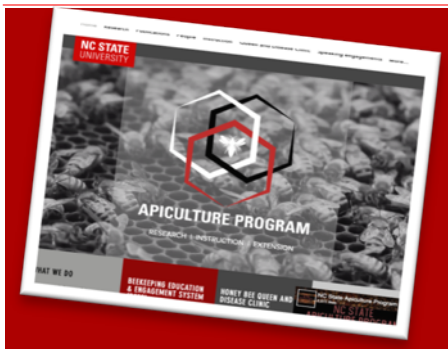
The Apiculture Science fund-raising efforts operate under the auspices of the North Carolina Agricultural Foundation, Inc. a 501(c)3 organization. You will receive an official receipt for your donation.

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.

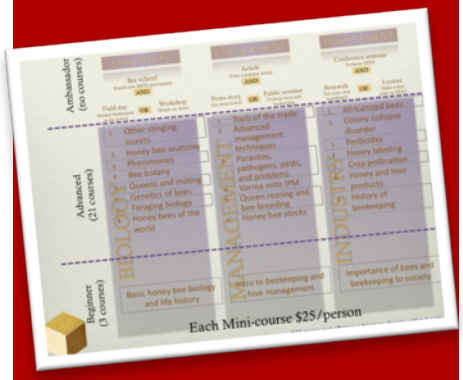
Make a gift-in-kind – The Apiculture program is always seeking creative solutions to its material needs. If you have surplus equipment or other non-monetary assets to give (e.g., gently used honey extractors, microscopes, even vehicles), please consider donating them to the program. You will receive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

de Souza, D., M. H. Huang, and D. R. Tarpy. (2019). Experimental improvement of honey bee (*Apis mellifera*) queen quality through nutritional and hormonal supplementation. *Apidologie*, **50**:14–27.

Withrow, J., 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*. doi: 10.1093/jee/toz003

Welcome aboard!

We've recently hired **Kirsten Benson** as our first 'Design Coordinator.' Kirsten recently received her Masters of Design here at NC State, where her thesis centered around a theoretical phone app that helped beekeepers and the public learn about the importance of bees and understand some of the important issues surrounding pollinators. Her amazing artistic flair and eye for design was something that we knew our program could benefit from, so we've been collaborating with her on any number of extension and research projects to, quite simply, make our deliverables more visually appealing and efficient. She has been a wonderful addition to our team and we look forward to working with her going forward!

We are also pleased to be joined by **April Sharp**. April has been taking ENT 201 this semester, and Hannah has recruited her to help her this summer to sample pollinator communities across the state. Great to have you!

We also will be bringing on two new students this summer through the BeeMORE internship program. **Kaya Hamilton** (Xavier) and **Lexi Gauger** (Kentucky) will both be studying bees and microbes but in different ways. Kaya will be helping Hannah's project on native bees and their pathogens, while Lexi will be working alongside Joe on how EFB infection interacts with pesticide exposure. Welcome aboard, we look forward to working with you!

Congratulations!

Hannah Levenson was awarded an honorable mention on her recent NSF Graduate Research Fellowship proposal and with it comes a great recognition of Hannah's work on pollinators, as these are among the most competitive grants in the nation.

Moreover, **Ali McAfee** received a full postdoctoral fellowship from NSERC (the Canadian version of NSF) for her work on the proteomics of honey bee reproductives, which will continue to fund her work for another 2 years! Additionally, she received the highly prestigious Faculty of Science Graduate Prize for the best graduating PhD student in the entire University of British Columbia! Terrific recognition for her great work, which comes to no surprise for any of us.

Teacher's corner:
Courses at NC State

We have been teaching ENT 601/801E this semester, which is a graduate seminar titled "Social Behavior of Insects." It is co-instructed by Bonnie Blaimer and Aram Mikaelyan, two relatively new faculty members in our department. Bonnie's main research is on the systematics and ecology of ants, and Aram's focus is on the gut microbes of termites. We have 11 participants in this year's seminar, and the discussions and presentations have been terrific. Moreover, our large section of ENT 203 for Fall 2019 has filled up in record time!

Also check out the new BeeID course that Hannah Levenson and Elsa Youngsteadt are offering on May 8th! Registration is limited.
https://commerce.cashnet.com/NCSUCALS?ITEMCODE=CALS-BEEDINC

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. Keep posted for further announcements and registration information!

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

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