

Wolfpack's Waggle

July 2018 Newsletter

NC State Apiculture Program

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

Issue 3, July 2018



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What have we been up to?

Summers are always a busy time of year, and this year is no different. James and Joe are busy with their second research seasons, building off of their findings from last year. James is quantifying what age queens lose their drive to fight each other (and thus what age they are willing to live together peacefully), and Joe is testing the effects of multiple pesticides on larval survival. Lauren has taken the lead on a side-project with several others in the lab to measure what happens when new queens are introduced to colonies. Hannah and her team (including Claire, Nicole, and Zachary) 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 keeping the bees happy. Esmaeil is busy with his many projects at UNCG (including those on egg size), and Dan came down from UPenn this spring to spearhead a project that took great advantage of many local beekeepers who helped tag and paint-mark workers for his observation hive experiments. Brad continues to expand the queen clinic in new directions, as well as conduct some follow-up studies on drone reproductive quality. We should have a lot to report come next fall!



New research published in *PLoS ONE*

James' first research publication demonstrates that queens mate more times than we have previously estimated, detected only because certain subfamilies are only represented among queen, not worker, offspring.

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Honey Bee Queen & Disease Clinic

Better Data, Better Bees



Quality Assurance

Troubleshooting

Customized Experimentation

Morphometric Analysis: 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

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

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

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

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

Contact us for more information & pricing

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

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

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: Marshaé Cappaninee and Nicole Hanselman

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

Marshaé Cappaninee is a premed student at the Univ. of Maryland. 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.

Nicole Hanselman is a junior at Elmira College in upstate NY. She is collaborating with Hannah on her project to quantify



how putative honey bee viruses might be infecting native bees across the state. Both Marshaé and Nicole have been fantastic additions to the lab this summer, and their time here has been all too short.



Queens that are raised by workers are not selected at random, as rare genotypes in the colony are preferentially chosen over those more common among workers

Our new paper on royal patriline shows that most queens derive from rare genotypes

Published in *PLoS ONE*, the findings suggest that—because some drone fathers are only seen in queens—mating numbers in queens are even higher than thought before

When honey bees need a new emergency queen, they forego the chance to promote members of their own worker subfamilies, opting instead to nurture larvae of “royal” subfamilies, according to a study published July 11 in the open-access journal *PLoS ONE* by James Withrow and David Tarpy of North Carolina State University in Raleigh.

When a queen suddenly dies, workers must select a group of larvae to raise as emergency queens, so the question arises whether workers tend to select larvae of their own subfamily over those of others, thus promoting their own genes at the expense of those from other subfamilies.

Here, the authors examined DNA from an average of 92 workers and 85 emergency queens from 6 different

colonies. They found that the number of subfamilies per colony ranged from 34 to 77, vastly outnumbering previous estimates. By comparing the DNA of the emergency queens to that of the colony’s subfamilies, they found that the majority of emergency queens were raised from subfamilies with very few members, which as a result have been largely overlooked in previous studies. Thus the authors argued, workers chose members of other “royal” subfamilies over their own “supersisters” to become new queens.

The characteristics that distinguish these lucky larvae from their hive mates are still unknown, as are many of the factors in play that override a possible “selfish gene” drive that might otherwise reward choosing one’s own family

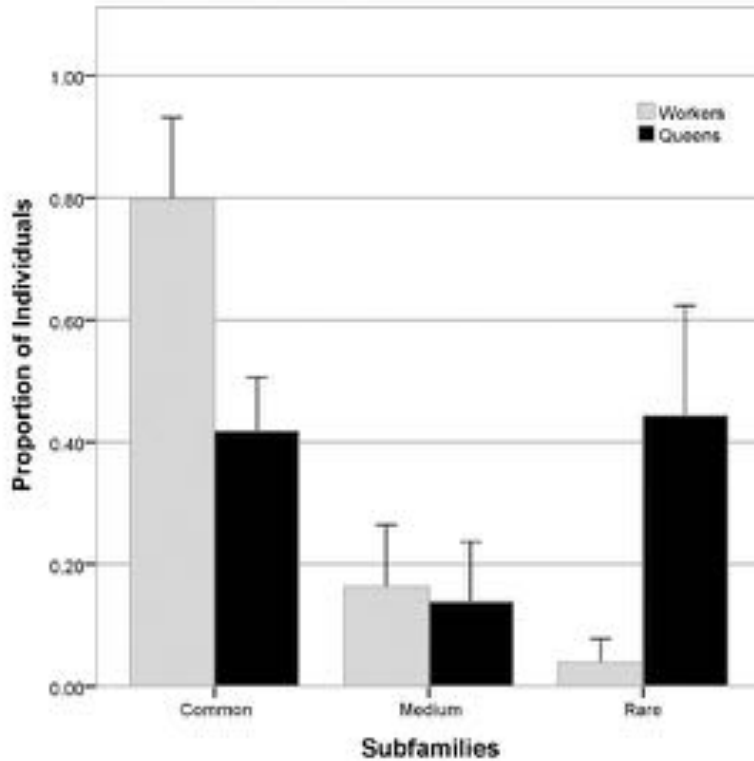


The new paper provides the highest sample size, and therefore best evidence, of royal subfamilies to date.

members for the royal treatment. “While many of the specific details and mechanisms are still to be determined,” Withrow said, “at this point we may safely conclude that, while inclusive fitness for nepotism may favor the individual level during emergency queen rearing, that advantage is profoundly overridden by opposing selective forces acting at multiple levels favoring cooperation and altruism.”

New *PLoS ONE* paper (Continued)

The study strengthens the evidence that “the good of the hive” overpowers the narrow genetically selfish interests of individual workers.



NC State Apiculture Program

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Brad Metz, Postdoctoral researcher
Daiana De Souza, Postdoctoral researcher

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

Undergraduate Researchers

Claire Collins (media intern), Carson Noel, Olivia Loyack, Nissa Coit (UNC), Ashley Rua, Will Fowler, Tess Wiegmann (artist-in-residence), Zachary Everson, Marshaé Cappaninee, Nicole Hanselman

Support the NC State Apiculture Program!

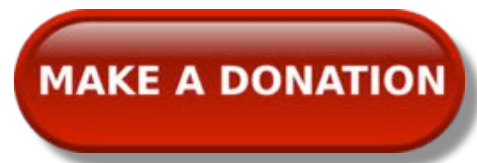
The Apiculture Science fund-raising efforts operate under the auspices of the North Carolina Agricultural Foundation, Inc. a 501(c)3 organization. You will receive an official receipt for your donation.

Make a 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.

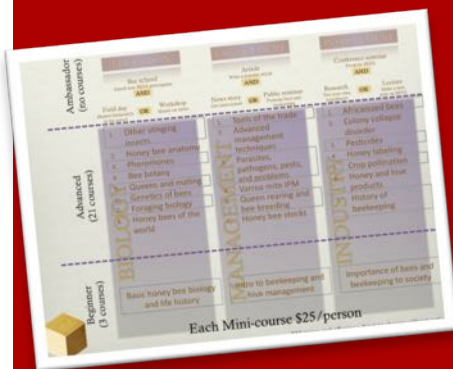


Make an estate gift – If you are interested in planning an estate gift to benefit Apiculture, please let us know! We can provide you with the tools you and your attorney will need to ensure that your wishes are fulfilled. Please click the link above for more information.



Check out our new website!

For the third 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 enable us to include regular blog posts.



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

Withrow, J. and D. R. Tarpy. (2018). "Royal" patriline bias in emergency queen rearing. *PLoS ONE*, **13**: e0199124.

Alburaki, M., D. Chen, J. A. Skinner, W. G. Meikle, D. R. Tarpy, J. Adamczyk, and S. D. Stewart. (2018). Honey bee survival and pathogen prevalence: from the perspective of landscape and exposure to pesticides. *Insects*, **9**: 65.

Presentations

David provided a brief overview of the citizen science project this season at the NCSBA Summer Conference, which Jennifer, Joe, James, and Nissa also attended. In fact, **Jennifer Keller** provided a mock swarm demonstration during a workshop at the meeting, which was very well attended. **Joe Milone** was also the 2018 J. T. Ambrose Student Award winner for the NCSBA this year, where he presented his research to the state beekeepers. Jennifer also gave a presentation to the Johnson County Beekeepers on honey harvesting, and **Dan Charbonneau** presented at the Caswell County Beekeepers about the division of labor in honey bee colonies.

Welcome aboard!

We are pleased to have **Will Fowler** and **Zachary Everson** in our lab. Will spent last summer doing an independent project as a newly graduated high school student (Cary Academy) developing a quick field test for Deformed Wing Virus (DWV). He has since been attending the University of Washington in Seattle, but we were lucky enough to bring him back during his summer break to help Erin process samples and crank through lab projects. Zachary is a rising sophomore at NC State, also from Cary, who has been

helping Hannah's project on the pollinator communities across the state. He has since been busy collecting samples and becoming adept at identifying specimens under the microscope.

...and sadly missed

We bid farewell to **Alex Fava**, **Liz de Jongh**, **Kim Rogers**, and **Jerry Oxendine**, all of whom either graduated or have moved on to other projects. We appreciate all of their hard work as part of the program and wish them luck in their next ventures!

Congratulations!

Joe Milone was awarded a highly coveted CEFS graduate fellowship for his work on testing the effects of pesticides on queens and colonies. 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 and local food systems 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.

Carson Noel was also awarded an NC State Undergraduate Research Grant (\$1,500) to conduct an independent research study. The project is similar to Joe's research on the cumulative effects of pesticides on bees, but whereas Joe's project focuses on the effects on larvae from different genotypes Carson's study is to test the effects on adults of the same genetic stocks.

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 Hannah Levenson and Lauren Rusert for the second time, and Joe Milone and James Withrow 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

I always tell beekeepers that even though Jennifer is the most modest person I've ever met, the universe is still in balance because I have the ego for the both of us. It therefore takes a lot to make me humble to the point of being speechless...

The generosity of the NCSBA this summer, however, has done just that. In lieu of a silent auction this year—the proceeds from which are typically donated to our Apiculture Science Fund—President Rick Coor and others solicited donations straight from the 77 county chapters of the state organization to help pay for our new bee truck. That effort has garnered over \$16,000, far exceeding what is typically raised by the silent auction. We can't thank everyone enough for their generosity and kindness.



There is ample precedent for commodity groups helping to pay for state vehicles. Here is a picture of another truck at NC State that was purchased by the Peanut Growers Association for a program in Plant Pathology. Our new truck is on back order, but once it comes in we hope to do something similar (using magnetic decals) to recognize the NCSBA for their generosity. With 23 people in the lab now, the timing is ideal to help keep up with the growth of our research and extension programs.

Sincerely, David