

Wolfpack's Waggle

NC State Apiculture Program Newsletter

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

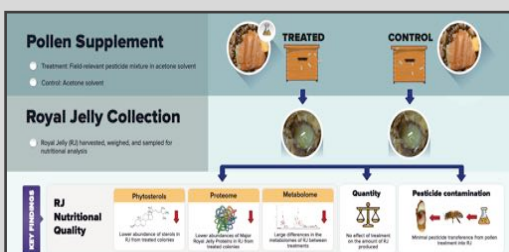
Issue 2 | Apr 2021

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What have we been up to?

Spring has sprung, so we just don't have enough time in the day this time of year. Jennifer is gearing up the apiary for a number of field projects this year, which has been unusually difficult because of the lack of help due to COVID restrictions. Erin is also spearheading a major field project this season on virus profiles of colonies, and Brad is conducting several experiments on drones and their reproductive capacity. Hannah will be defending her PhD dissertation in May and thus graduating, so she is busily writing up her thesis and submitting papers. Esmail is also writing papers from previous projects, but he hopes to accomplish some field experiments this summer at UNC Greensboro. Ali continues to crank out the publications, both scientific and popular, as she continues her work on queen reproduction. We're sorry to see Danyelle, April, and Rachael all leave the lab because of graduation, but we wish them nothing but success as they move forward and hope to bring on a new cohort of undergraduate researchers once we're fully able. No doubt it will be yet another busy spring!



Two of Joe Milone's papers provide novelty

Recently graduated PhD student, Dr. Joe Milone, had two of his thesis chapters published recently that provide important insights into how pesticides can affect honey bee queens. Short answer: it's not what you might think...





HONEY BEE QUEEN AND DISEASE CLINIC | BETTER DATA
BETTER BEES

Quality Assurance

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

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

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



Strong Research Foundations

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

Troubleshooting

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

Pathogen Screening: identification of presence and relative levels of ABPV, BQCV, DWV(A&B), IAPV, LSV, Trypanosomes, and both Nosema species. Additional and custom pathogen targets available upon request.

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

Custom Collaboration

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



Queen and Disease Clinic Pricing

Five Sample Minimum • Bulk Pricing Available

ANALYSIS	PRICING (per sample)	SAMPLES TESTED		
		QUEEN	DRONE	COLONY
Reproductive Quality	\$24.00	✓	✓	
Standard Pathogen Screen	\$55.00	✓	✓	✓
Apiary Pathogen Screen	*\$220.00	*\$10 to 20 colonies (max)		
Mitotyping (Africanization)	\$35.00	✓	✓	✓
Genotyping (Mating Number)	\$120.00			✓

Custom Disease Screening

Additional and custom pathogen targets available upon request.

Your Bees • Your Data

Any results or interpretations from our work is held in the strictest confidentiality and anonymity

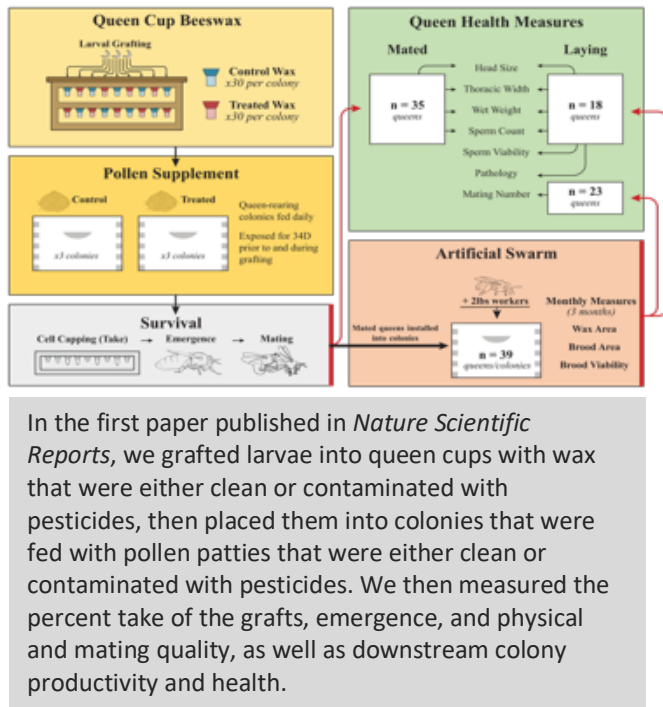
Lab Spotlight: Danyelle Reiskind

Danyelle has been an undergraduate researcher in the lab for several semesters now, with plans to attend vet school upon graduation. She has worked on numerous projects during her time in the lab, mostly doing anatomical dissections of queens and especially drones. She has also assisted in some data analysis work during the shut-down because of covid, which was not as fun but still very valuable to the project. Right now we're still in a holding pattern for research, but we have been collecting field samples of diutinus bees (the so-called "winter bees") to see if we really have physiologically different off-season workers here in North Carolina and in what percentage. Danyelle has been a positive and collegial member of the lab, and we wish her nothing but success in going forward!



Two new papers shed light on the effects of pesticides on queens

Recently graduated PhD student, Dr. Joe Milone, had two of his thesis chapters published in the last few months that provide important insights into how pesticides can affect honey bee queens. Short answer: it’s not what you might think...



Everyone knows that pesticides are a critical issue when it comes to honey bees and other pollinators, and so a lot of research is being done in this area (and a lot more is needed). When it comes to honey bees, much of this effort is focused on adult workers, since they are the ones that come into contact with environmental pesticides while foraging. Less attention has been paid on the reproductives in the colony, however, so it’s really important to understand how pesticides affect drones and especially queens.

While our program has not worked a lot on pesticides, we did have a recently graduated PhD student who was interested in toxicology (and who is now working for the EPA in Washington, DC). **Joe Milone** spearheaded several studies during his time in the lab, most of which are now getting published in the scientific literature. In his first study, he wanted to see how queen bees are affected by field-realistic mixtures of multiple pesticides simultaneously. Using previously published results, he created mixtures of 12 pesticides that are most common in beeswax as well as 9 different pesticides that are commonly found in beebread. Then, he grafted queen larvae into queen cups where the wax

was contaminated with pesticides (or not) and placed into colonies that were fed pollen patties contaminated with pesticide (or not). This way, we were able to determine which route of exposure—wax, diet, or both—is more important on how they affect queens.

What we found was that the “percent take” of the grafts (i.e., how many of the grafted larvae were successfully reared as queens) was affected by the wax contamination but not by the pollen contamination. However, for those reared to adulthood, queens from pollen-contaminated hives were of lower reproductive quality (having lower sperm viability and their colonies having lower brood viability) compared to those fed patties without pesticides, but that wax exposure didn’t have any measurable effects on the queens.

What was most interesting in this study is that we measured the actual pesticide residues in the wax, pollen patties, and royal jelly fed to the queens. While we found predictably high levels in the wax and pollen, we found hardly any significant levels of pesticides in the royal jelly. This begs the question: **how can pesticides be affecting queens in contaminated pollen without them being exposed in the royal jelly?!**

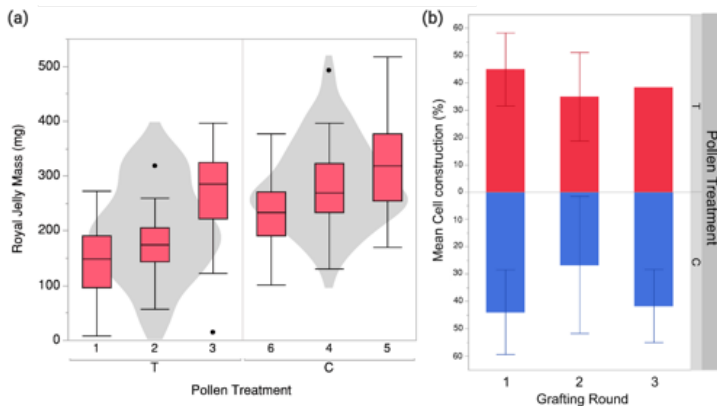
This prompted Joe to undertake a follow-up study, one that we didn’t plan but a good example of how science works by following the evidence. He repeated his experimental design by feeding colonies with pesticide-laden or pesticide-free pollen patties, but this time he measured the quantity and quality of the royal jelly. For the quantity, he grafted larvae into queen cups like before, but this time instead of rearing to adulthood he removed the royal jelly 3 days later and weighed how much was fed to each larva. We then sent the samples to colleagues at Oregon State University for them to perform proteomic analyses on the royal jelly—in essence to determine the “quality” by measuring the amount and types of proteins contained in each sample.



Queens and pesticides (Continued)

What we found was that, compared to pesticide-free hives, colonies fed contaminated pollen had lower amounts of royal jelly per queen cup (=lower quantity) *and*, more significantly, that royal jelly had lower levels of key proteins and nutrients such as major royal jelly proteins and 10-hydroxy-2-decenoic acid (=lower quality).

Together, these findings show that pesticide exposure can have significant effects on queens, but their effects are indirect (by affecting nurse bees provisioning less food of lower quality) rather than direct (toxic effects of pesticide exposure through brood food). These results demonstrate how beekeepers can avoid pesticide effects on queens by avoiding rearing them in exposed colonies.



The second study published in *Chemosphere* showed that the amount of royal jelly was slightly but significantly lower in pesticide-treated colonies, but more importantly the quality of that royal jelly was significantly lower because it was lowering in major RJ proteins and other nutrients. This shows that pesticides are affecting nurse bees, which indirectly affects queens, rather than directly affecting the queens themselves.

Current Lab Members

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Esmail Amiri - NRC Postdoctoral Fellow (UNCG)
Brad Metz - NC State Research Associate
Alison McAfee - NCERC Postdoctoral Fellow (UBC)

Hannan Levenson - PhD Candidate (Entomology and Evolution & Ecology)

Undergraduate Researchers
Danyelle Reiskind, April Sharp, Rachel Laminack

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.

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.

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.

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 go to our website for more information: www.ncsuapiculture.net

go.ncsu.edu/apiculture

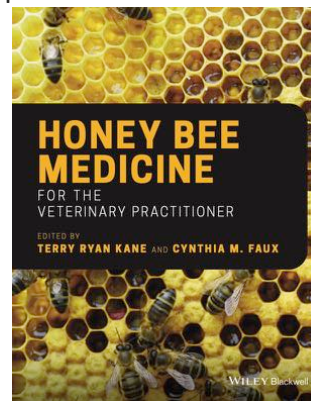


Random Notes

New Publications

Tarpy, D. R., E. Talley, and B. N. Metz. (2021). Influence of brood pheromone on honey bee colony establishment and queen replacement. *Journal of Apicultural Research*, **60**: 220-228.

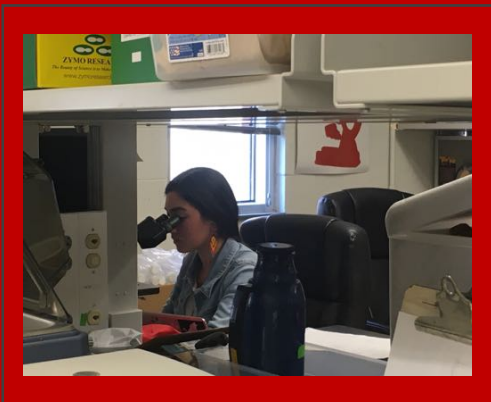
Also, check out the new edited book *Honey Bee Medicine for the Veterinary Practitioner*, which is available online and soon in print. **Esmail Amiri** has a chapter on honey bee viruses, but there are many other excellent chapters on bee health.



2021 speakers schedule

If your state or local club is interested in booking a presentation by one of the members of the NC State Apiculture Program, submit a request using our online form! If we cannot make a live webinar, we have many free recordings available on our YouTube channel.

<https://ncsuapiculture.net/speaking-engagements>



Congratulations April!

April Sharp, a graduating undergraduate student in the program, was recently awarded a highly prestigious NSF Predoctoral Fellowship to attend graduate school. She has chosen to stay close after graduation, where she will become a member of Dr. Becky Irwin’s lab here at NC State in the Applied Ecology Department. Congrats April!

Presentations

Because of COVID, we aren’t holding any face-to-face extension events. Instead, we’ve moved everything online through Zoom and other platforms. Importantly, we’re holding bi-weekly webinars called Apiculture Online—Hive Chat with NC State and posting their recordings on our YouTube channel. Between the live-stream and recordings, we’ve been averaging ~650 people and over 1,000 in some weeks.

Ali McAfee has been on a tear with webinars, giving presentations to the Somerset Beekeepers in the UK, a radio interview with Science Friday on NPR, the Forsyth County Beekeepers, the Alberta Tech-transfer team, the Langley Bee Club, and the British Columbia Honey Packers Association. **Jennifer Keller** also gave presentations to Wayne County, Orange County, and Alamance County bee clubs. In addition, **David Tarpy** has spoken to the Cambridge Beekeepers Association (UK), the South Carolina State Beekeepers winter meeting, the Yorkshire Beekeepers (UK), Orange County Bee School, and the Ontario Tech-transfer program breeding workshop, all via Zoom.



Teacher’s Corner: Courses at NC State

We do not have any formal courses for the Spring 2021 semester. This fall, we will hold another offering of ENT 203, *An Introduction to the Honey Bee and Beekeeping*, as we do every fall semester. Last fall, we moved the entire course to the Distance Education (DE) environment because of COVID, and it is unclear if we will continue offering a DE section of ENT 203 going forward. This fall may be the last time we offer this face-to-face course, so be sure to stay tuned.

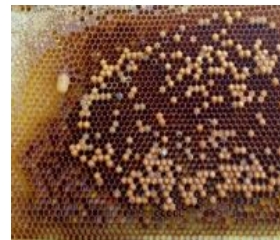


go.ncsu.edu/honeybees

Tarpy’s Back Page

We have some preliminary evidence to suggest that drone-laying queens can “recover” from their condition. This is curious, since it has always been believed that drone-laying queens have simply run out of viable sperm. We have been awarded funding by the North Carolina Department of Agriculture to conduct a full study on drone-laying queens. To that end, **we need your drone-layers!**

For our purposes, the drone-laying condition is defined as laying 90+% male eggs, preferably confirmed by photograph. Additionally, we would like as *much* information about the queens and colonies from which they came as you can provide (e.g., age, treatment and management history).



Our goal is to obtain at least 100 drone-laying queens. We will assess half of them for viable spermatozoa using our Queen & Disease Clinic. The other half we will install into colonies supported with brood to assess how many of them revert to laying fertilized eggs.

This study will only be successful with your help. We would appreciate your sending us any drone-laying queens (defined as laying 90+% male eggs) that you find as you inspect your colonies.

Your help is essential for the success of this study. Please email with any questions you might have to:

honeybeequeenclinic@ncsu.edu



Apiculture Program

