The effects of vibrational cues on physiological development in *Polistes fuscatus*

By Kate Hunter
Symposium on Undergraduate Research
The Paper Wasp and vibrational cues

- Ecological Role and their Social Behavior
- Description of Queen Antennal Drumming
- Hypotheses
- Methods
- Results
- Conclusion and Future Research
Why Paper wasps?

- Ecological Role
  - Pollinators
  - Eat Garden Pests
- Social Behavior
- Interesting Queen Vibrational Behavior
Caste development throughout the colony cycle

- Foundress begins drumming on nest
- Foundress builds nest and feeds brood on her own
- Presence of workers = reduced drumming
- Workers build nest and feed brood. Queen continues to lay eggs

Hunt et al. 2011; Pratte & Jeanne 1984; Suryanaryanan et al. 2011
Queen Antennal Drumming and Physiological Development

- Antennal Drumming occurs early in the season as workers develop (Suryanarayanan et al. 2011)
- Simulating drumming results in lower lipids (Suryanarayanan et al. 2011)
Nutrition and Deciding a Wasp’s Role

- Early-season wasps (workers) likely have worse nutrition.

Toth et al. 2009
Caste development throughout the colony cycle in Polistes

Hunt et al. 2011; Pratte & Jeanne 1984; Suryanaryanan et al. 2011
Hypotheses

1. Queen Antennal Drumming = Worker-like Wasps
   - Dominant Behavior
   - Larger Ovaries
   - Lower Amount of Fat

2. Lower Nutrition = Worker-like Wasps
   - Dominant Behavior
   - Larger Ovaries
   - Lower Amount of Fat
## Treatments

<table>
<thead>
<tr>
<th>Drumming</th>
<th>Nutrition Level</th>
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<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Worker-Like</td>
<td>In Between</td>
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<tr>
<td>On</td>
<td></td>
<td>In Between</td>
<td></td>
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<tr>
<td>Off</td>
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<td>Gyne-Like</td>
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Faking Queen Antennal Drumming

- Drumming device
- Program to vibrate at a frequency that mimics natural drumming
Changing Nutrition in the lab
Behavioral Assays
Ovary Dissections

- Ovaries were scored on a scale of 1-5
  - 1=Undeveloped, no oocytes
  - 5=Developed
Lipid Analyses

- Extract Lipids
- Quantified Lipids
Results-Behavior
Antennal Boxing

Antennal Boxing Frequency By Treatment

Frequency of Antennal Boxing

Drumming Treatment

On

Off

Nutrition Treatment

- Low
- High
Results-Behavior Mounting

Frequency of Mounting by Treatment

<table>
<thead>
<tr>
<th>Frequency of Mounting</th>
<th>Nutrition Treatment</th>
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<tbody>
<tr>
<td>On</td>
<td>Low</td>
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<tr>
<td>Off</td>
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Drumming Treatment
Results-Ovary

- No Effect of Treatments Seen on Ovary Score

Average Ovary Score of Drumming and Nutrition Treatments
Significant Effect of Drumming on Lipid % (p = 0.0405)
Hypotheses

- Drumming would correlate with worker-like
  - Behavior
  - Ovary size
  - Lipid %
  - Opposite

- Worse nutrition would correlate with worker-like
  - Behavior
  - Ovary size
  - Lipid %
Conclusions

- Queen Antennal Drumming appears to have an effect on the physiological development of her young, however not in the direction we thought.
Future Directions

- Lots of variation in behavior, ovary development and lipids, characterizing on a spectrum
- Potential correlations between the spectrum of worker-like to gyne-like and their gene expression
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