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Skin Lipids of the Striped Plateau Lizard (*Sceloporus virgatus*): Oleic and Stearic Acids as Potential Indicators of Mate Quality

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BACKGROUND

- Chemical signaling, in the form of pheromones, is an important mechanism of sexual selection in reptiles, as it provides a means of communicating mate receptivity and quality during the mating season (Martín and López 2011).
- Previous research on the chemical profile of Striped Plateau Lizard (*Sceloporus virgatus*) skin lipids found that lower levels of oleic and stearic acid in female skin lipids correlate with larger egg clutch sizes, suggesting that low levels of the fatty acids might be an attractive mating cue for males (Goldberg et al. submitted).
- If pheromones are able to communicate mate information, skin lipids sampled through chemosensory behaviors like nose taps, tongue flicks, and air tasting may be acting as an honest signal for mate quality. While not discussed in this poster, cloacal rub and chin rub behaviors are also seen and appear to be methods of depositing chemicals (Mason and Parker 2010).

RESEARCH OBJECTIVES

1) Determine if male *S. virgatus* lizards respond to manipulation of oleic and stearic acid levels, as well as between presence and absence of the fatty acids when presented as an isolated cue.

2) Investigate how altering the levels of the two fatty acids in the skin lipids of female lizards affects male courting behavior.



METHODS

S. virgatus lizards were captured by noose from the vicinity of the Southwestern Research Station (SWRS) of the American Museum of Natural History in Portal, AZ.

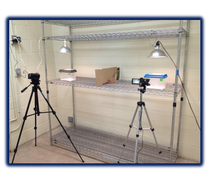
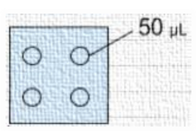
Male response to treated S. virgatus *females*

•In order to test for male response to manipulated female skin lipids, each male *S. virgatus* was observed in each of four tank treatments:

1) Control tank that had no female
2) High lipid ratio treated female tank (6 mg tristearin and 1 mg triolein/200 µL chloroform)
3) Solvent control treated female tank (200 µL of chloroform)
4) Un-manipulated female tank

•Females were treated by dripping the respective solution along the underside of the lizard. They were then placed individually into tanks lined with clean paper substrate where they lived for 24 hours before being removed for the beginning of trials.

•Each trial was filmed and began once the male lizard was placed inside the tank with the appropriate treatment. Chemosensory behaviors and escape behaviors (scurrying and jumping) were scored for 40 minutes of the trial using a tally sheet.

Male response to isolated chemical cues

•To explore how male *S. virgatus* respond to the manipulation of isolated fatty acid chemical cues, males were presented with each of three different tank treatments:

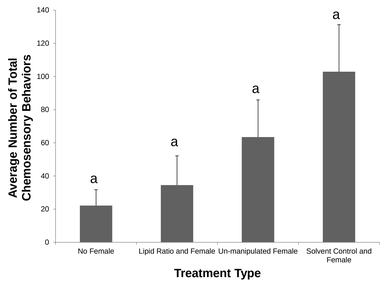
1) Tank with solvent control treated paper (200 µL of chloroform)
2) Tank with low 6:1 lipid solution treated paper (¼ dilution of 200 µL high 6:1 lipid stock solution)
3) Tank with the high 6:1 lipid solution treated paper

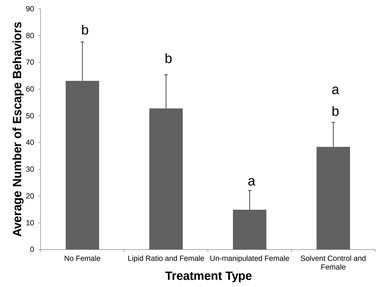
•Each treatment paper received 200 µL of solution that was applied to the square sheet through four equal dots.

•Male *S. virgatus* were then placed inside of the appropriate tank to begin the trial. The trial progressed in the same fashion as in the trials with the chemically manipulated females.

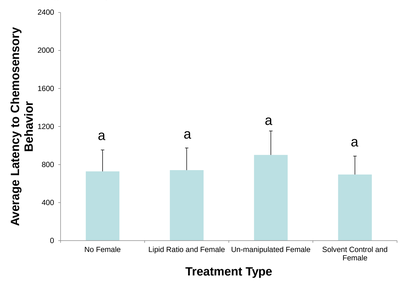
RESULTS I

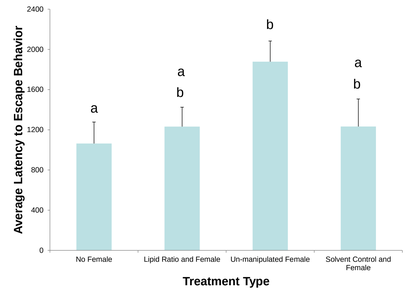
Male response to treated females





Female treatment type did not have a significant effect on male chemosensory behavior (p=0.069). Although males displayed more chemosensory behaviors in the "Solvent Control and Female" tanks than in the "No Female" tanks, this difference was only marginally significant (p=0.090). Female treatment type did play a role in male escape behavior. Significantly more escape behaviors were observed in the "No Female" tanks and "Lipid Ratio and Female" tanks than in the "Un-manipulated Female" tanks (p=0.019).

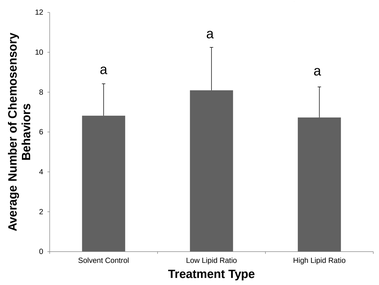


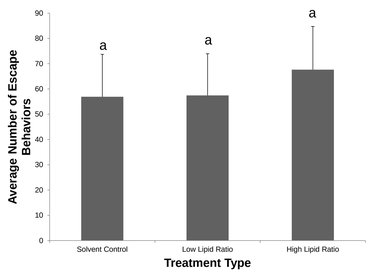


Female treatment type did not have a significant effect on the latency to male chemosensory behavior (time elapsed until the first chemosensory behavior was observed) (p=0.840). However, female treatment type did play a significant role in the latency to escape behavior, with males jumping and scurrying earlier in the "No Female" tanks than in the "Un-manipulated Female" tanks (p=0.021). Although only marginally significant, male lizards were also quicker to demonstrate escape behaviors in the "Lipid Ratio and Female" tanks (p=0.085) and the "Solvent Control and Female" tanks (p=0.086) than in the "Un-manipulated Female" tanks.

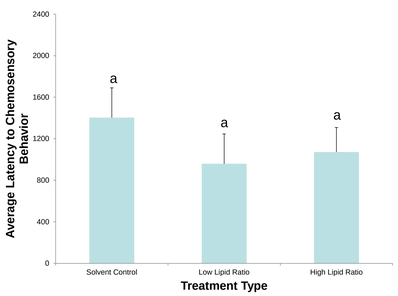
RESULTS II

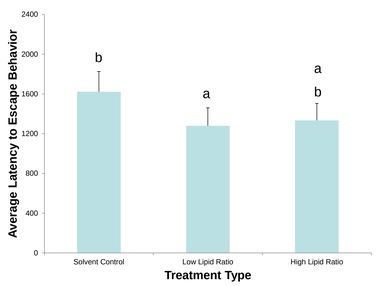
Male response to isolated chemical cues





When chemicals were presented in isolation, there was no significant effect on the number of male chemosensory (p=0.778) or escape (p=0.525) behaviors.





When chemicals were presented in isolation, there was no significant effect on the latency to male chemosensory behavior (p=0.348). However, males were quicker to demonstrate escape behaviors in the "Low Lipid Ratio" tanks than in the "Solvent Control" tanks (p=0.043). Males were also marginally quicker to jump or scurry in the "High Lipid Ratio" tanks than in the "Solvent Control" tanks (p=0.087).

DISCUSSION

- **RESULTS I:** It was predicted that male *S. virgatus* lizards would demonstrate the least amount of chemosensory behaviors and the most escape behaviors in the "No Female" tanks, due to the absence of any female-deposited chemical cues. The data did support this prediction in that males demonstrated significantly more escape behaviors—and were also quicker to do so—in the "No Female" tanks than in the "Un-manipulated Female" tanks.
- Next, if low levels of stearic and oleic acid in female skin lipids are an attractive mating cue for males, lizards in the spiked "Lipid Ratio and Female" tanks would be expected to have notably fewer chemosensory behaviors and demonstrate more escape behaviors than if they were in either the "Solvent Control and Female" or "Un-manipulated Female" tanks. Although our data show that males demonstrated more escape attempts when in the "Lipid Ratio and Female" tanks and the "Solvent Control and Female" than when in the "Un-manipulated Female" tanks, only the difference for the "Lipid Ratio and Female" tanks was significant. This does suggest that males were not as interested in the lipid ratio spiked females—possibly due to the unattractive nature of a high lipid ratio cue.
- Lastly, males were expected to demonstrate more sampling activity and fewer escape behaviors in the "Un-manipulated Female" tanks than in the "Solvent Control and Female" tanks since it was believed that the solvent (chloroform) might act as an unattractive cue for male lizards. Although the elevated activity in the "Solvent Control and Female" tanks when compared to the "Un-manipulated Female" tanks was not significant, it may be possible that males demonstrated the increased chemosensory behavior in response to the solvent control treated females in order to investigate the unusual stimulus present.

- **RESULTS II:** From the experimental trials involving male response to chemically treated females, it appeared that lipid ratio application had a significant effect on male escape behavior. To further explore how manipulation of the stearic and oleic lipid ratio impacted male chemosensory response, a high and low lipid ratio solution was introduced as treatments.
- Keeping with the idea that low levels of stearic and oleic acid in female skin lipids may be an attractive mating cue for males, it was predicted that the isolated treatments of the low lipid ratio would receive more male chemosensory response than the isolated treatments of the high lipid ratio. Although there was no significant difference in male chemosensory behavior and escape behavior between the low and high lipid ratio treatments after the trials, **the data from both Result I and Result II support that there is a difference between how the tested males responded to lipid ratio manipulated stimuli when compared to the other treatment groups.**

FUTURE DIRECTIONS

To continue along this research trajectory, I plan to explore if oleic and stearic acid are diverted from female *S. virgatus* skin lipids to their egg yolk contents. To address this research aim, skin lipids from the female lizards will be analyzed via Lipid Mass Spectrometry to determine their chemical profile. The composition of the females' egg yolks will also be analyzed in order to determine the amounts of oleic acid, stearic acid, and other compounds. It would then be possible to see the role that egg yolk composition plays in relation to skin lipid profile and egg clutch size.

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