Investigating the Origins of Niche Shift in Bagheera Kiplingi

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Background Information

- *Bagheera kiplingi* is the only known spider to have a herbivorous diet.
- Studies on the diet of *B. kiplingi*'s sister species, *B. prosper,* as well as a spider that inhabits the same acacias, *F. crocuta,* both reinforce the assertion that *B. kiplingi's* diet is unique.
- While *B. kiplingi* is mainly herbivorous, it does occasionally consume animals, most commonly the larvae of *Pseudomyrmex* ants.
- The optimal foraging theory (OFT) and the locomotor crossover hypothesis (LCH) are models for how an animal's diet affects its behavior and activity level.

Hypothesis

It is hypothesized that B. Kiplingi utilizes microbes obtained through the consumption of Pseudomyrmex ant larvae to maintain an herbivorous diet and that this diet altered its movements and behavior to be foraging-based.

Methods

DNA Analysis: DNA samples were collected from *B. kiplingi* adults and larvae, *P. peperi* adults and larvae, *B. prosper* adults, and *F. crocuta* adults. PCR targeting the *nifH* gene was performed and samples sent off site for sequencing.

Diet Analysis: In Akumal, Mexico, two ant-free controlled environments were set up in *B. kiplingi's* natural environment. In one group, only plants were left in the environment while in the second group, flies were provided as the only additional food source to plants.

Video Behavioral Analysis: Videos of *B. kiplingi*, *F. crocuta,* and *B. prosper* were used to analyze and compare their movements. Videos were split into 10 second intervals where 3 types of behaviors were documented: stationary (quiet), rotation without changing location (reorient), or changing location at a distance equal to or greater than one body length (move).

Results: DNA/Diet Analysis

nifH was successfully amplified in all samples of *B. kiplingi* and *P. peperi* but was not detected in any samples of *B. prosper* or *F. crocuta*

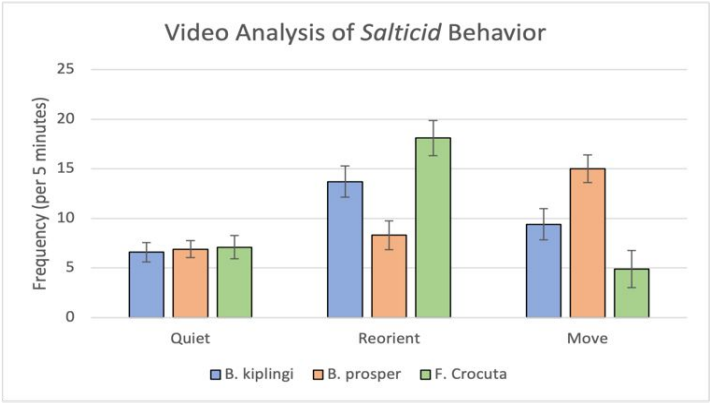
In the plants-only group, *B. kiplingi* were not observed to consume any Beltian bodies and all died within two weeks after the beginning of the experiment. In the flies group, *B. kiplingi* were also not observed to consume any Beltian bodies but were able to survive on a fly-only diet for up to 6 months.

Results: Video Behavioral Analysis

No difference was found in the occurrence of quiet behavior over the span of 5 minutes between *B. kiplingi, B. prosper,* and *F. crocuta.*

In terms of reorientation, *B. kiplingi* was found to reorient more than *B. prosper* but less than *F. crocuta* over 5 minutes.

The opposite was true for movement, with *B. kiplingi* moving more than *F. crocuta* but less than *B. prosper* over 5 minutes.



Significance

The DNA and diet analyses not only document the first confirmed presence of *nifH* in an arachnid, but it also supports the hypothesis that *B. kiplingi* require the presence of ants in order to feed on plant material.

- If confirmed in future studies, this would be the first instance of microbial transmission through a predator-prey relationship.

The behavioral analysis supports the validity of both the OFT and LCH. *B. kiplingi's* behaviors when compared to the predator, *F. crocuta* shows that being an herbivore has led it to move more to reach its food while reorient less due to a decreased need to search. Meanwhile, we can see the influence of hostile species on behavior as *B. kiplingi* reorients more than *B. prosper* to watch out for *Pseudomyrmex* ants while moving less to avoid detection.

Thanks!