The Dynamics of Prey Capture of the Colonial, Orb-Weaving Spider *Metabus gravidus* (Araneidae) in Monteverde, Costa Rica.

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ABSTRACT

Prey capture dynamics of the colonial, orb-weaving spider *Metabus gravidus* (Araneidae) are based on individuals. It is possible that prey caught in certain locations of the web will stimulate more reactions, and that different types of prey will stimulate variable reactions. Since the members of the colony live close to one another, it is also possible that spiders exhibit competition over prey. Different insects were dropped into various locations of individual orbs in order to observe reactions. The spiders did not seem to prefer whether prey was dropped closer or further from the center of the web (Chi-squared goodness of fit, $\lambda^2 = 0.684$, P = 0.710, DF = 2); number of captures did not depend on location either (Chi-squared goodness of fit, $\lambda^2 = 0.651$, P= 0.651, DF = 2). Grasshoppers generated medium-speed reactions, but overall the spiders preferred moths to grasshoppers or ants (chi-squared goodness of fit, $\lambda^2 =14.88$, P = 0.006, DF = 2). It seems that variation in prey stimulates different behaviors in *M. gravidus*.

RESUMEN

Las dinámicas de captura de presas en *Metabus gravdius* (Araneidae) depende de individuos, aunque vivan en colonias. Es posible que presas en diferentes lugares de la red provoquen reacciones diferentes. Debido a que los miembros viven en colonias, es posible que haya competencia por las presas. Se colocaron insectos en diferentes lugares en las telarañas y se observaron sus reacciones. Las arañas no tienen preferencia por la distancia de la presa al centro de la red (Chi-squared goodness of fit, $\lambda^2 = 0.684$, P = 0.710, DF = 2); Las capturas no dependen de lugares (Chi-squared goodness of fit, $\lambda^2 = 0.651$, P= 0.651, DF = 2). Los saltamontes ocasionaron reacciones de velocidad intermedia, pero las arañas prefieren más las mariposas que los saltamontes o las hormigas (chi-squared goodness of fit, $\lambda^2 =14.88$, P = 0.006, DF = 2). Parece que la variación en el tipo de presa estimula diferentes en comportamientos en *M. Gravidus.*

INTRODUCTION

The colonial, orb-weaving spider *Metabus gravidus* (Araneidae) can be found in riparian environments in the Central American tropics. These spiders suspend their orbs over flowing river water forming a community network of webs. Despite their intricate web system, they are not truly social as the individuals are merely tolerant of one another (Downes 1995). *Metabus gravidus* communities are usually found near gentle slopes or ledges and over a steady current. These diurnal spiders feed daily on a variety of insects including moths, flies, dragonflies and bees (Buskirk 1975b).

The communal web building of *M. gravidus* allows them to access a unique niche by bridging rivers. This niche is subject to a vast amount of insects that travel near the water, and though the spiders' webs are connected, prey capture is dependent upon the individual orb of each spider (Uetz 1986). *Metabus gravidus* usually sit in the center of the web while awaiting prey and it is reasonable to predict that insects landing in different parts of the web would stimulate different reactions. Previous studies have observed prey capture dynamics in regards to the dynamics of the colony as a whole (Buskirk 1975b), yet little has been documented about reactions to prey on an individual level.

I hypothesized that spiders would respond differently depending on where is prey is located within the web and what type of prey is caught in the web. I predicted that the spiders would respond quickest to prey dropped close to the center of the web and would prefer moths to grasshoppers or ants. Since *M. gravidus* live in colonies, I also expected to see some cases of competition over prey.

MATERIALS AND METHODS

The study site was along La Quebrada Máquina in the Monteverde Cloud forest of Costa Rica. The surrounding environment was dense forest with occasional light gaps and the river was narrow with a moderate flow. Ten different *M. gravidus* colonies were found along this river and labeled accordingly. The number of individuals per colony varied between one and twelve. The spiders were always found around congregations of logs and/or rocks that they used for anchoring their webs. Data collection with observations consisted of a three-day period, beginning each day at 9:00 and ending at 13:00.

Before experimentation could begin, three different types of prey were collected and held in their respective jars: ants, grasshoppers and moths. These insects would serve as prey variables. The ants had to be large enough to stick in the webs, while the grasshoppers and moths had to be small enough to avoid destroying the webs. Size of prey varied depending on the size of the spiders (small, medium or large), as the goal was to facilitate capture.

Experimentation began immediately upon encountering a new spider colony. Each colony was first labeled, and then dusted with baby powder for visibility purposes so that individuals could be identified and counted. Then, an individual was randomly chosen from within the colony to have an ant dropped into the web. Location of drop was relative to the center of the web, where the spider waits for prey, and included: close to center, middle from center, or far from center. A second random individual was then chosen to have a grasshopper dropped close, medium and far from the center of the web.

A third, and final, random individual was then chosen and the same process was used for the moth. Each type of prey, ant, grasshopper, and moth were dropped at each location for a total of three drops/insect/colony. A new prey was dropped into the webs every 15-25 minutes to allow a break between captures.

Prey type, distance of prey form center of web, and reaction of spider was recorded for each drop. Reactions included: no reaction, slow-speed reaction, medium-speed reaction, fast-speed reaction and retreating reaction (speeds based on relativity). Once these data were collected the materials were gathered and I continued to move down the river to the next colony; the same procedure was carried out for each. Upon returning to the station, data were analyzed using chi-squared contingency tables and goodness of fit tests statistics. The statistics compared location of prey drop and spider reaction, location of prey drop and successful captures, and type of prey and spider reaction. Type of prey and successful captures were also compared.

RESULTS

There was no trend in number of reactions compared to prey location within the web (Chi-squared goodness of fit, $\lambda^2 = 0.684$, P = 0.710, DF = 2). There was also no trend in number of successful captures compared to prey location within the web (Chi-squared goodness of fit, $\lambda^2 = 0.651$, P = 0.651, DF = 2).

Only one significant trend was found for prey type compared to spider reaction *(*Table 1). The only behavior that differs between types of prey was medium-speed reaction (Table 1). The spiders usually reacted at medium-speed when a grasshopper was dropped into the web (Figure 1). The final analysis compared prey type versus successful captures. Spiders captured more moths than any other insect (Figure 2).

DISCUSSION

Metabus gravidus show no preference for prey dropped in different parts of the web. The lack of preference for prey location could possibly be attributed to the quality of the webs and the spiders' sensitivity to vibrations throughout the entire web (Foelix 1996). The data show that the spiders recognized the vibrations both close and far from the center of the web. Another observation, which also ran counter to my original prediction, is that prey dropped close to the center often generated a retreating reaction instead of a quick capture.

Spiders tended to act at medium-speed when grasshoppers were dropped into the web. Perhaps because it is typical of spiders to spend a few moments tugging on the web to locate prey before they run out to catch it, a medium-speed reaction would then indicate that the spider had 'thought' about the prey before capture (Foelix, 1996). After detecting vibrations, spiders must have decided that grasshoppers were a 'good' prey.

Concerning prey preference, the original prediction was supported as *M. gravidus* preferred moths to grasshoppers or ants (Figure 2). Since *M. gravidus* build their webs over water, it was expected that prey with wings would be common prey within the webs and easily recognized by the spiders. Though the spiders often reacted quickly to ants they were rarely captured because the ants would readily defend themselves upon encounter. Also, the grasshoppers did not stick very easily in the webs and were often

able to break free. Though moths were captured more frequently than the other insects, *M. gravidus* usually attempted to capture whatever landed within the web, and location of drop did not seem to matter.

Although subsequent studies of *M. gravidus* have discovered cases of fighting and web take-over amongst members of a colony, there has been no documentation of one spider stealing another's prey (Buskirk 1975a). Throughout my observations, I did not see evidence of fighting, web take-over, or stealing of prey.

Further studies may want to observe the reactions of *M. gravidus* individuals to different sizes of prey or vary the type of prey used. Also, data may have yielded better results if more individuals per colony were tested. However, since prey capture is the reason that spiders build their elaborate webs, studies of prey capture dynamics are essential to understanding how they fit into the global ecosystem (Riechert 1984).

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Table 1: Chi-distribution and Probability Values for different reactions in *Metabus gravidus* spiders. These reactions were compared against three different types of prey, but a medium-speed reaction was the only on with a value that reveals a significant trend between prey type and reaction.

Reaction Type	λ^2	P Value
Overall	0.357	0.836
No reaction	0.230	0.883
Slow-speed reaction	2.20	0.247
Medium-speed reaction	5.20	0.074
Fast-speed reaction	4.12	0.127
Scared	1.60	0.449

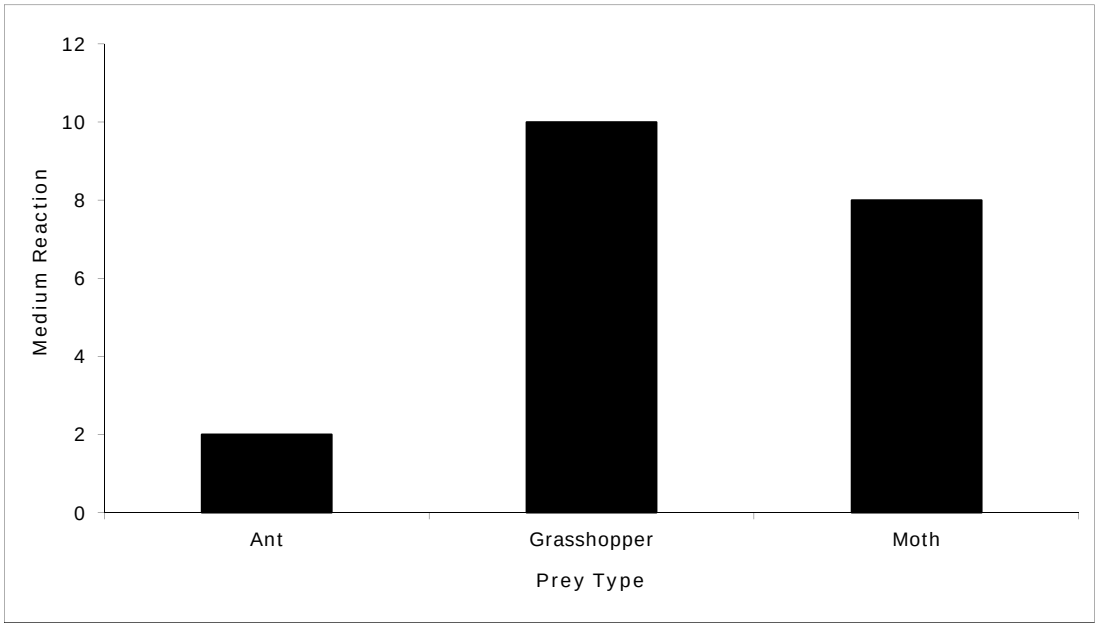

Figure 1. Chi-distribution statistics reveal a trend between prey type and spider (*Metabus gravidus*) reaction. Spiders tend to move at a medium-speed toward grasshoppers more frequently than they will towards ants or moths (Chi-squared goodness of fit, $\lambda^2 = 5.20$, P = 0.074, DF = 2).

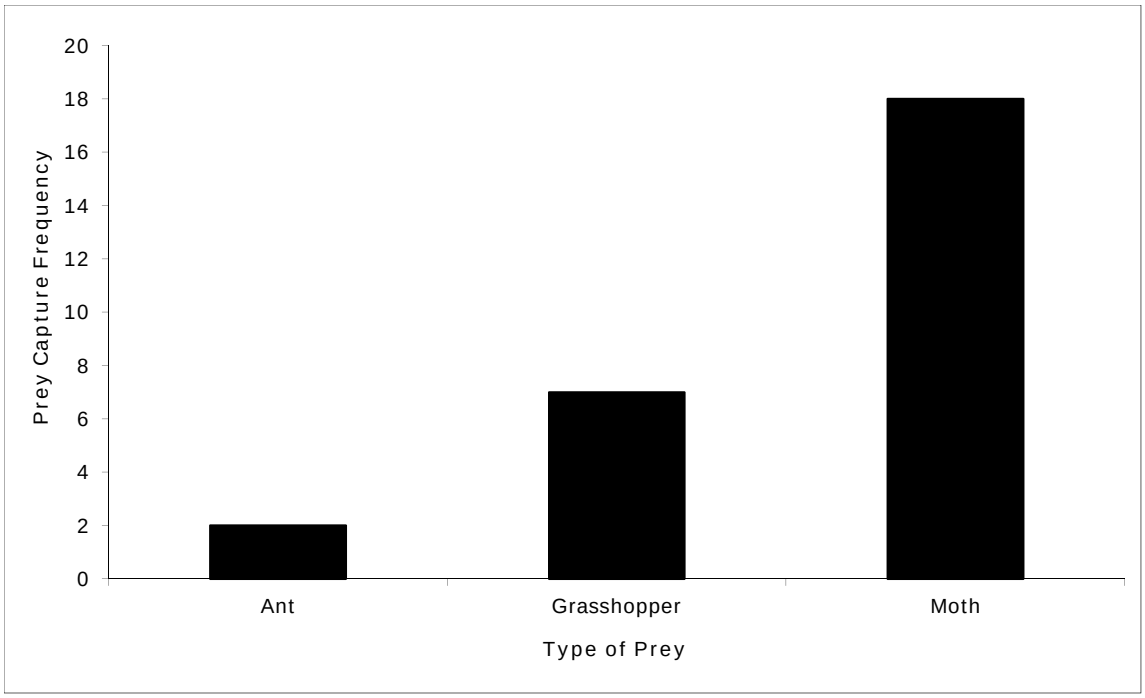

Figure 2. Chi-distribution statistics show trend between prey type and capture frequency for *Metabus gravidus* spiders (chi-squared goodness of fit, $\lambda^2 = 14.88$, P = 0.006, DF = 2). The spiders preferred moths (18 captures) to grasshoppers (7 captures) or ants (2 captures). They preferred ants the least out of the three prey types.