Foraging Habits of *Neoantistea magna* (Araneae: Hahniidae)

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Abstract

Neoantistea magna is a common ground dwelling spider in Beech Maple forest. Living as a vagrant web builder, little is known about its prey capture behavior, nor its preferred prey. We investigated the use of webs by *N. magna* in prey capture. Leaf litter samples were collected to identify potential prey items at Pierce Cedar Creek Institute. *Neoantistea magna* was fed *Collembola*, *Drosophila*, and pinhead crickets in the lab. No difference in average handling time between prey items was found. Similarly, *N. magna* showed no difference in the orientation (posterior vs. anterior) of prey (*Drosophila* and pinhead crickets) when spiders attacked. Although the web appeared to be a useful method for prey capture, it was not essential, as *N. magna* was able to easily catch its prey without the aid of the web.

Introduction

Neoantistea magna is a relatively small spider, approximately 3.6-4.5mm in total length (Opell and Beatty 1976; Bultman 1977, unpubl. data), that is numerically dominant in northern temperate forests (Bultman and Uetz 1982; Bultman et al. 1982). It is the most common ground dwelling spider in the dry-mesic forest at Pierce Cedar Creek Institute (PCCI) (Bultman and DeWitt, unpubl. data). Although it is numerically one of the most common spiders in such forests, little is known about its biology. Hahniid spiders are in the guild called vagrant web builders. Although small webs are made, the spiders are known to wander from them. Pitfall sampling, which is used to catch mobile invertebrates along the forest floor, indicates that *N. magna* spends a large amount of time away from its web (Bultman et al. 1982). Interestingly, female *N. magna* wander from their webs, and have been recorded much more frequently than males in pitfall traps (Bultman et al. 1982; Brady et al. 1991; Brady unpubl. data; Bultman and DeWitt, unpubl. data). This is opposite most species of spiders, where males spend much more time wandering (looking for females) than do females.

Spiders are obligate predators; they inject digestive juices into their prey after immobilizing them, and suck the digested fluid from their prey. Spiders seize their prey using their fanged chelicerae, which contain immobilizing venom. After feeding the exoskeleton is discarded and often can be identified. Many spiders use their webs in capturing prey, while others hunt their prey. *Neoantistea magna* may exercise both strategies by building small webs, but also wandering from them.

The prey capture methods of *N. magna* were investigated to better understand how it used its web. I investigated the techniques *N. magna* used to capture its prey by both observing it in a lab and in the field. Furthermore, with such a large variety of litter invertebrates present at PCCI (Bultman and DeWitt, unpubl. data), I was interested in what prey items were possible for *N. magna*.

Methods

Collecting N. magna

Pitfall traps were placed randomly at PCCI in the mesic deciduous forest (Bultman and DeWitt, unpubl. data) just south of the red trail. The pitfall traps were made of plastic cylinders (2000m^3), which were placed into the ground. Pitfalls were checked daily from May 8th, 2006 until May 21st, 2006 for *N. magna,* and to see if any prey items were present from feeding. Spiders were captured and placed in vials to be taken back to the lab.

Rearing N. magna

Neoantistea magna was placed in to small (12 cm diameter) cups, containing a substrate made of plaster and charcoal. In each cup was a small dish containing moistened cotton, which the spiders used for drinking. Spiders were kept in an environmental chamber at 25° C, 60% humidity, and a photoperiod of 14:10 (L:D).

Feeding N. magna

Collembola, pinhead crickets (Top Hat Cricket Farm, Portage, MI) and wingless *Drosophila* (Carolina Biological Supply Co.) were used to feed the spiders. Mature and penultimate spiders were fed daily, either 3 wingless *Drosophila* or 2 pinhead crickets. The crickets were used one out of every four weeks for feeding to add variety to the spider's diet. *Collembola* were used for feeding immature spiders, until they reached the penultimate stage. Spiders were fed in the environmental chamber in which they were reared. Prey items were added at random to the cups, with no regard for placement of webs.

Observation of Feeding

Neoantistea magna was starved for 24 hours before feeding observations were made. Once prey items were added to the cup, several characteristics were recorded. The time from which the spider first attacked and grasped the prey item to the time in which the spider released the prey was recorded as the handling time for the prey. The orientation of the prey during attack (anterior or posterior) was documented. I also recorded whether the prey was captured in the web or out of the web. Prey capture was only observed for pinhead crickets and *Drosophila*.

Leaf Litter Samples

Two leaf litter samples were taken from the area in which *N. magna* was sampled at PCCI. Samples ($0.1m^2$) were collected and placed in a Burlese funnel. The funnel was placed under a heat light, and arthropods were extracted into a jar of 70 % ethanol. The organisms were then counted and identified to order to create a list of potential prey items for *N. magna*.

<u>**Results**</u>

Collection of N. Magna

The first week of sampling resulted in only one immature spider collected at Hope College Nature Preserve (HCNP) from May 1st, 2006 to May 7th, 2006. At PCCI, 5 penultimate male *N. magna* were collected, from May 8th, 2006 to May 21st, 2006. Over the next 21 days, 10 penultimate males and one immature spider were collected from the HCNP. In the following 14 days, one immature, 31 penultimate males, one mature male *N. magna* were collected from the HCNP. Finally, the last 21 days of sampling ending on July 17th, 2006, 15 immatures, 4 penultimate males, 4 penultimate females and 37 mature males were collected at the HCNP. Additionally, many more mature males were collected in July and August, but discarded in the field.

Prey Capture Methods

Neoantistea magna showed little difference in prey capture methods between *Drosophila* and pinhead crickets. The average time the prey was handled was not statistically different between *Drosophila* (Mean: 37.2, SEM: 3.11) and pinhead crickets (Mean: 42.6, SEM: 3.74) (Fig 1). A contingency table analysis showed no difference in position of attack between the *Drosophila* and the pinhead crickets (Fig 2). With both types of prey the web was used more often than not (Fig 3).

Leaf Litter Samples

The *Acari* order numerically dominated the leaf litter of PCCI. The *Coleoptera*, *Diptera*, *Hymenoptera*, and *Collembola* orders also were quite abundant (Table 4).

Discussion

Neoantistea magna did not favor a specific method for capturing its prey. Both orientations of attack and handling time were similar between *Drosophila* and pinhead crickets, despite their difference in size. The web seemed to aid in prey capture, but was not essential. Although prey items would sometimes be immobilized by the web, *N. magna* was easily capable of attacking when prey was able to freely move. Therefore, the web can be used in prey capture, but does not appear to be essential. This suggests that in the field, *N. magna* would be able to forage on and outside its web.

Several prey items are available for *N. magna* at PCCI. Of the collected items from the leaf litter samples, only the *Collembola*, *Acari*, and *Diptera* seem to be possible prey items due to their size relative to *N. magna*. Possible prey items for *N. magna* should be smaller in size than the spider itself. *Drosophila* was considerably smaller than the spider, while pinhead crickets offered a larger prey type, but still only half the size of the spider. *Neoantistea magna* had little difficulty catching any of its prey as it would immediately chase after its prey upon visually recognizing it. If the prey climbed onto *N. magna*'s web, the spider appeared to feel the vibrations from the movement in the web. I would suspect that this may lead to favoring web use for capturing prey, if possible. Once the spider caught its prey, it would rear up its front legs and grasp the prey with its chelicerae. The spider injected venom into the prey with its fangs, which took less than a minute to immobilize the prey.

Neoantistea magna is an efficient hunter. With its ability to quickly attack and immobilize its prey, it's no wonder that it is one of the dominant predators in mesic forests.

The collection data of *N. magna* showed that males were more frequently caught in the early part of the summer. Penultimate male and immature *N. magna* were observed and collected more commonly in first seven weeks, from May 1st, 2006 to June 18th, 2006. This was opposite to what had been previously, in that females had been the more active of the two sexes, given that they fell in to pitfall traps more frequently observed (Bultman et al. 1982; Brady et al. 1991; Brady unpubl. data; Bultman and DeWitt, unpubl. data). From June 19th to July 17th mature male *N. magna* were observed most frequently because the penultimates had molted into the mature stage. A small number of females were observed during this time period, which may suggest that females are more active and/or common towards the middle of the summer.

Future Work

The results are preliminary observations of *N. magna*'s predatory habits. Further study could be conducted using other prey items, both larger and smaller to test for size limits of prey. Also, further studies in the field could help understand what *N. magna* actually preys on in the field. Finally, both sexes of *N. magna* could be studied to see if differences in predation habits exist.

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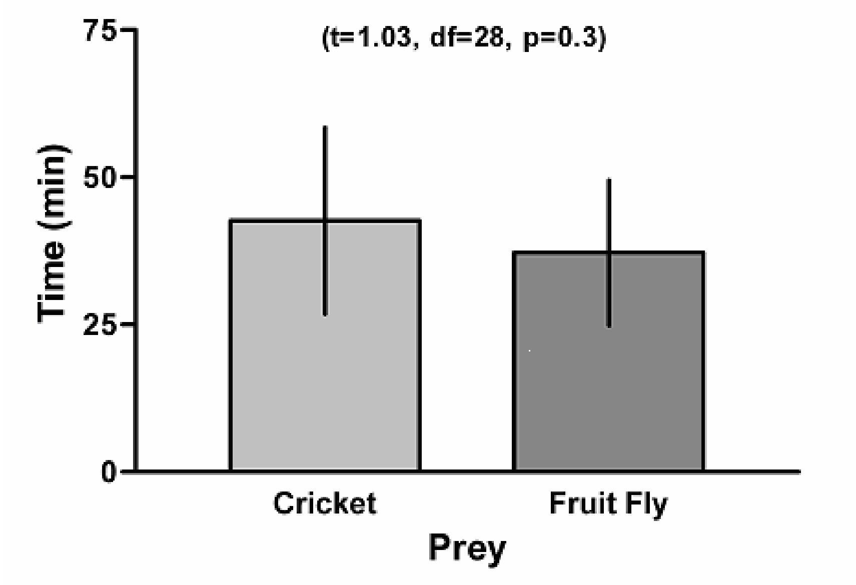


Figure 1-Average time handled for prey items observed in the lab.

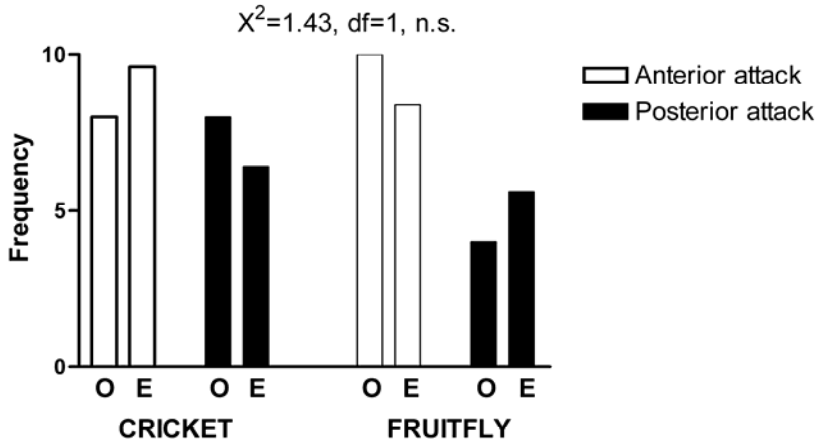
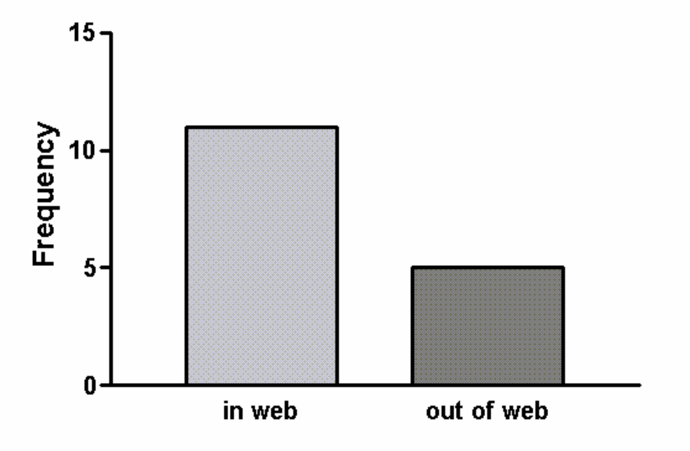


Figure 2-Contingency Table Analysis of position of attack in both *Drosophila* and pinhead Crickets. Frequency represents the number of times each attack occurred at each position. O= observed, E=expected.

A.



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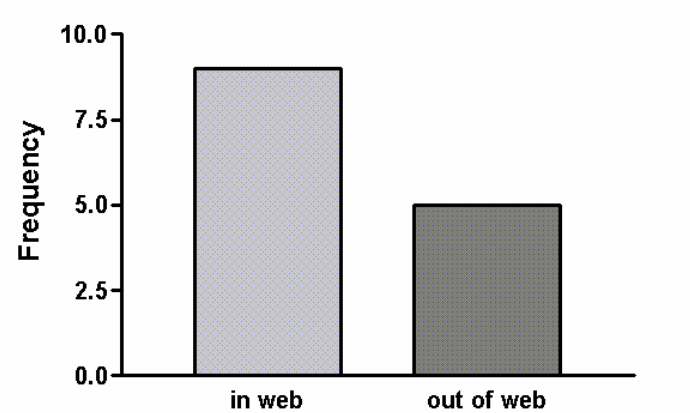

Figure 3-Frequency that the attack on prey items took place in web. A. Represents data for pinhead crickets. B. Represents data for *Drosophila*.

	Number of Prey Items Collected
Diplopoda	5
Chilopoda	4
Opiliones	3
Hymenoptera	13
Coleoptera	95
Collembola	8
Acari	1167
Araneae	4
Dermaptera	1
Diptera	24

Table-The number of prey items collected in leaf litter sampling at PCCI on 5/12/06. Prey items identified by order.