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Growth and Development in Wolf Spiders

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ABSTRACT

Nutrition and wellness in Arachnids is thought to affect the growth patterns and their activity. Wolf spiders use a resource bank of energy to store, or output energy in activities such as, catching prey, spinning webs, or mating. One of the highest energy consuming activity goes into the molting process (growing stages). Wolf spiders don't use their energy on "useless things", they stay dormant until they need to move. Due to the wolf spiders diet it is related to the growth of the Wolf spider. Based on a high diet or a low diet, that can determine whether the spider molts more often or less often. As well as quicker results in growth and for how long they stay that size, before having to molt again.

Keywords: *Growth, Molts, Nutrition, Spiders*

INTRODUCTION

Spiders, like other types of arthropods grow by a series of molting throughout their life. There are several factors that may affect the patterns of molting and growth. Such as the amount of nutrition, stress on the body due to nutrition, and how much nutrition received in a given time. One of these factors is how much the spider receives in its diet. The spiders eating pattern directly can affect the molt rate pattern of growth.

A spider's condition is an estimate of the amount of energy they have in reserve from the nutrients they consume. An organism's condition affects their growth patterns or activity (Linden E. Higgins & Mary Ann Rankin 1995). Several studies have shown that the more spiders eat, the larger they grow (Vollrath, F. (1987) pp357-370. Springer-Verlag, Berlin) (Wilgers & Hebets 2012).

Because molting is such a costly activity (Wilgers & Hebets 2012), spiders in good condition could follow several different patterns of growth that results in them growing larger than poor condition spiders. Spiders may adjust how often they molt, or even how big of a jump they make in growth after molting (Biology of Spiders, Rainer F. Foelixg 213-220). For example, a spider i on a high diet, the spider will have enough energy to molt often. Rather a spider on a low diet, will have less energy, and won't be able to molt as often. Based off of the diet these jumps could be large or small according to the diet type the spider is on.

Which brings up to my question, how does diet affect growth patterns and development in wolf spiders?

My hypothesis is that the wolf spiders that have been fed more, will molt more often than the wolf spiders that were feed less. The more energy the spider has the more often it can molt. So with a high diet I expect the high diet molts to molt quicker than the spiders with a low diet. Another prediction is, both spiders on the high diet and the low diet will get bigger than where they started at. Although both will be growing when they molt. The higher diet molt will have a larger increase in jump compared to the low diet spider molt.

MATERIALS AND METHODS

In order to find out how nutrition effects the development and growth in wolf spiders, I'll be conducting a series of measurements on tibia segment of the front leg of the spider's molts.

The spiders were collected in Lancaster County, NE in 2010. The spiders were housed individually and fed one of two diet treatments that differed in amount of food. Some of the wolf spiders were fed 2 crickets every week (high diet), and other spiders were fed 2 crickets every other week (low diet). Each spider was checked 2-3 times a week for molts.

Every time a spider had molted, it was collected placed and taped flat into a composition notebook, with the spiders ID, date it molted, and the diet it was on.

Using a computer to take digital photographs through a microscope, I measured the length of the tibia on each of the spider molts using the software on the computer called "Topview". This program allowed me to measure each of the legs in the picture and standardize the length using the grid on the paper the molts were taped to.

After the length of each tibia was measured. I calculated the difference in length between each of the successive molts to compare the jump size between the diet treatments.

Another data set I compared was the amount of times each the high diet and the low diet molted. So by having the number of molts overall from both the high diet and low diet. I used nonparametric Mann-Whitney U-test to compare the length difference between molts in (mm), time difference between molts, and the number of molts. All the tests are comparing the high diet (H) vs. the low diet (L).

RESULTS

With the results from the data collected I found that, the spiders that received a higher diet, made larger jumps in their first molt in than the spiders that were fed a low diet

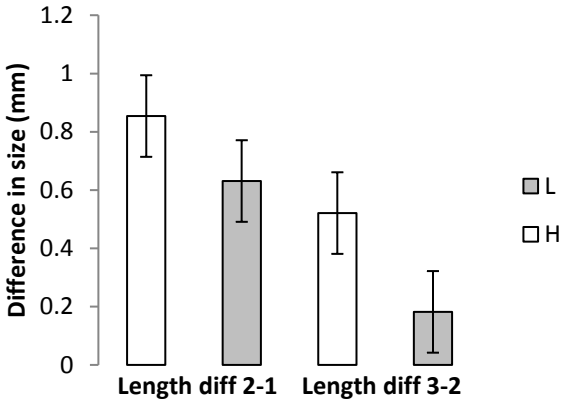

Figure 1 (Mann Whitney=2762.0, P=0.043, df =147). The same pattern was observed for the jump between the second and third molt, but the difference wasn't significant (Mann Whitney= 43.00, df= -, p=0.18)

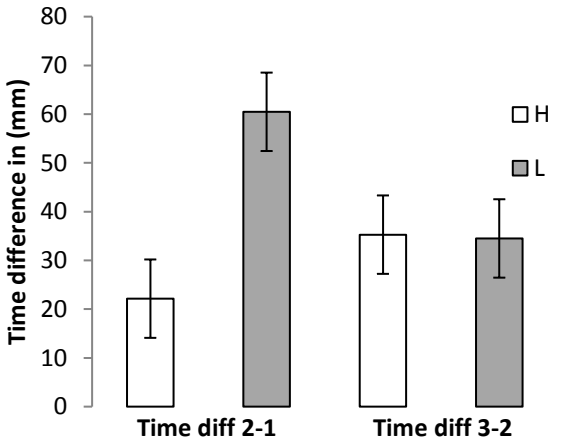

Figure 2 The data also showed that the high diet spider used less time to molt than the spiders on the low diet. (Mann Whitney=1488.0, df=175.00, p<.001)

DISCUSSION

The patterns that were seen from the data were that the high diet spiders molted more often. Rather than the low diet spiders that molted less often.

The higher the spiders diet is, the faster it will molt, and grow bigger. Than the spider that is eating a lower diet. The difference between the molts was the amount of growth they went through from molt one to two. As Spiders may go through a phase of stress, due to the lack of nutrition in their diet. (L.B. Jespersen, S. Toft,

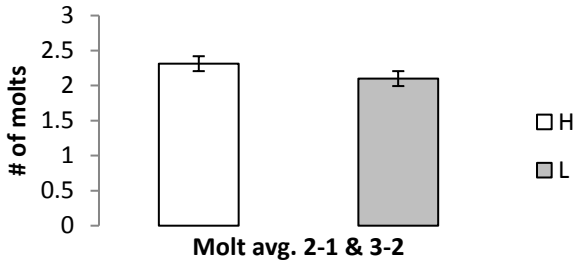

Figure 3 High diet spiders molted more times than low diet spiders in order to mature/ grow (Mann Whitney=2.608, df= 176.00, p=0.010)

11 December 2003). The lack of prey correlates to the nutrition the wolf spider receives as well as the amount of energy they can use/ have. Energy is a primary source that goes into the molting process, without it the spider can't molt efficiently. Or the molts won't have a large increase in size. Due to the lack of nutrition and energy that will go into molting.

If there is nutritional stress early in the spider's life, for example from their first molt to second molt, it may affect the parameter of development. In another paper named (Schaefer 1987) they did something similar, instead of measuring legs or parts of the spider, they measured the spider by weight. They found that after a 70 day research period that the spiders fed more, survived longer, as well as weighed more. The spiders that were fed less, were smaller than the spiders that were fed a high diet and weighed less. Although from the beginning of the research, the spiders that died early on, either on high diet or low diet, there was little to no difference in size and weight.

I found this to be helpful in my research, although the weight of a spider may not directly correlate to size of tibia on a spider leg. It still is doing research on a high diet and a low diet in the spider, looking at a different perspective of the data. Which brings some answers to my data on why some of the spider molts may look smaller on their molting jumps. Compared to a spider that was on a high diet that made large jumps in a short period of time. This could answer why the molt of the spiders/ size of tibia were significantly different between jumps.

The importance to this study is to understand how spiders, and possibly other arthropods live in the environment they're in. Also answers the flexibility and adaption that these spiders can do, based on their nutritional diet. Whether it be in storing energy, and how they use that energy for molting more often, with a higher diet. Rather than molting less often with smaller jumps if there nutrition is lower. This can also look at a survivorship curve of these spiders, as well as other arthropods based on their diet.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Beck, J.B & Toft, S. (2000) Artificial selection for aphid tolerance in the polyphagous predator Lepthyphantes tenuis. Journal of Applied Ecology 37, 547-556.

Dustin J Wilgers & Eileen A. Hebets “Age-related female mating decisions are condition dependent in wolf spiders”

Linden E. Higgins and Mary Ann Rankin (March 13, 1995), Different Pathways In Arthropod Postembryonic Developement

Mayntz, D. & Toft, S. (2001) Nutrient composition of the prey’s diet affects growth and survivorship of a generalist predator. 127, 207-213 CrossRef,

Rainer F. Foelix, Biology of Spiders, Second Edition. (pg. 38, pg 213)

Vollrath, F. (1987) Growth, foraging and reproductive success. Ecophysiology of spiders (ed. W. Nentwig), pp 357-370. Springer-Verlag, Berlin. CrossRef

Werner E.E & Anholt, B.R. (1993) Ecological of the trade-off between growth and mortality rates mediated by foraging activity. American Naturalist 142,242-272.