Beetle Diversity at Various Heights in the Canopies

Alex Vilaythong

Dominica Study Abroad 2001

Dr. Thomas Lacher

Dr. Bob Wharton

June 6, 2001

Beetle Diversity at Various Heights in the Canopies

Alex Vilaythong

Abstract

This study examined the beetle diversity at various heights in the canopies of a fig tree near the Springfield Plantation. It was assumed that since most beetles are terrestrial, there might be a more diverse beetle population near the ground and less near the top of the canopies. Using aerial malaise traps and a Lindren funnel to capture the beetles, the results from the Shannon-Weiner Index indicated that at greater heights, there is a decrease in beetle diversity.

Introduction

The order Coleoptera, the largest order of insects, has an estimated 350,000 species of beetles that are classified into 160 families (Elzinga, 1992). These insects, with their thick and tough forewings, or *elytra*, have adapted to various habitats from aquatic to soil, to trees, foliage, and other aerial surfaces. They can range in size from 1 mm to approximately 75 mm in length (Borror, Triplehorn, & Johnson, 1989). This study examined the diversity of beetles found at various heights surrounding a fig tree (Ficus insipida) on a property near the Springfield Plantation. According to Elzinga (1992), most beetles are terrestrial. This study sought to determine whether differences exist among beetle diversity at greater heights in the canopies.

Materials and Methods

Aerial Malaise Traps
Lindren Funnel
85 percent Ethanol
Stereo microscope

The site of interest was a fig tree (Ficus insipida) near the property of Springfield Center for Environmental Policy, Teaching, Research and Education. The elevation of the site is 315 meters at a latitude of 15^{o} 20’ 46 N and a longitude of 61^{o} 22’ 24 W. The fig tree selected is approximately 30 meters high by 10 meters in diameter. The area surrounding the tree is transitional deciduous rainforest with shrubs, ferns, and a thick

layer of plant debris on the ground. The area has also been disturbed by fire and by people clearing the land.

The beetles were collected using four groups of aerial malaise traps and a Lindren funnel. The first aerial malaise trap was set up along the tree trunk approximately 1.5 meters above the ground, the second at 6 meters, and the third trap at 10 meters. The fourth aerial trap was situated 10 meters from the base of the tree on a branch and at 6 meters high. The Lindren funnel was also suspended 6 meters above the ground along the tree trunk. This was set up to see how the funnel trap works and to see what other possible types of beetles that it may capture along with the aerial malaise traps. Each of the traps were deployed for 10 days, except for the aerial trap that is 10 meters high and situated along the trunk of the tree, which was only deployed for 7 days. Eighty-five percent alcohol was placed in each of the traps to kill the captured insects. These insects were then taken to the lab and the beetles were separated and identified according to family using the sixth edition of *An Introduction to the Study of Insects* by Borror et al. (1989). The number of beetles in each family was summed and the Shannon-Weiner Index was used to calculate the diversity, or richness and evenness of beetles at the family level.

Results

Group 1: 1.5 meters

Family	# of beetles	pi	ln(pi)	pi*ln(pi)
Anobiidae	5	.15	-1.92	-.28
Anthribidae	2	.06	-2.83	-.17
Buprestidae	1	.03	-3.53	-.10
Cantharidae	1	.03	-3.53	-.10
Carabidae	1	.03	-3.53	-.10
Cerambycidae	2	.06	-2.83	-.17
Chrysomelidae	15	.44	-.82	-.36
Cleridae	0			
Coccinellidae	1	.03	-3.53	-.10
Elateridae	2	.06	-2.83	-.17
Nitidulidae	1	.03	-3.53	-.10
Salpingidae	0			
Scolytidae	3	.09	-2.43	-.21
Tenebrionidae	0			

Total Specimens: 34 H'max = 2.40
Total Families: 11 H'max – H' = .54
H' = 1.86

Group 2: 6 meters

Family	# of beetles	pi	ln(pi)	pi*ln(pi)
Anobiidae	1	.07	-2.71	-.18
Anthribidae	0			
Bupresidae	0			
Cantharidae	0			
Carabidae	0			
Cerambycidae	1	.07	-2.71	-.18
Chrysomelidae	4	.27	-1.32	-.35
Cleridae	0			
Coccinellidae	0			
Elateridae	4	.27	-1.32	-.35
Nitidalidae	1	.07	-2.71	-.18
Salpingidae	0			
Scolytidae	3	.2	-1.61	-.32
Tenebrionidae	1	.07	-2.71	-.18

Total Specimens = 15
Total Families = 7
H’ = 1.74
H’max = 1.95
H’max – H’ = .21

Group 3: 10 meters

Family	# of beetles	pi	ln(pi)	pi*ln(pi)
Anobiidae	0			
Anthribidae	2	.25	-1.39	-.35
Bupresidae	0			
Cantharidae	0			
Carabidae	0			
Cerambycidae	2	.25	-1.39	-.35
Chrysomelidae	0			
Cleridae	0			
Coccinellidae	0			
Elateridae	2	.25	-1.39	-.35
Nitidalidae	0			
Salpingidae	0			
Scolytidae	0			
Tenebrionidae	1	.13	-2.08	-.26
Unknown	1	.13	-2.08	-.26

Total Specimens = 8
Total Families = 5
H’ = 1.57
H’max = 1.61
H’max – H’ = .04

Group 4: 6 meters high by 10 meters from trunk

Family	# of beetles	pi	ln(pi)	pi*ln(pi)
Anobiidae	1	.11	-2.20	-.24
Anthribidae	0			
Bupresidae	0			
Cantharidae	0			
Carabidae	0			
Cleridae	1	.11	-2.20	-.24
Cerambycidae	2	.22	-1.5	-.33
Chrysomelidae	3	.33	-1.10	-.37
Coccinellidae	0			
Elateridae	2	.22	-1.5	-.33
Nitidalidae	0			
Salpingidae	0			
Scolytidae	0			
Tenebrionidae	0			

Total Specimens = 9
Total Families = 5
H’ = 1.51
H’max = 1.61
H’max – H’ = .10

Group 5: Lindren Funnel at 6 meters

Family	# of beetles	pi	ln(pi)	pi*ln(pi)
Anobiidae	0			
Anthribidae	0			
Bupresidae	0			
Cantharidae	0			
Carabidae	1	.06	-2.83	-.17
Cleridae	0			
Cerambycidae	2	.06	-2.14	-.25
Chrysomelidae	0			
Coccinellidae	0			
Elateridae	0			
Nitidalidae	0			
Salpingidae	1	.06	-2.83	-.17
Scolytidae	13	.76	-.27	-.21
Tenebrionidae	0			

Total Specimens = 17
Total Families = 4
H’ = .80
H’max = 1.39
H’max – H’ = .59

Discussion

At the 1.5-meter height (group 1), the aerial trap captured 11 families, including Buprestidae, Cantharidae, Coccinellidae, and Nitidulidae not found in other groups. Group 1 also had the highest diversity index of 1.86, capturing a total of 34 beetles, the most out of all the groups deployed. Since a large number of beetles are terrestrial and live in dead tree bark and other debris, it is not surprising that the diversity index is the highest at the 1.5-meter height then other groups deployed higher in the canopies.

The second highest diversity index was 1.74 for the aerial traps deployed at 6 meters (group 2). In group 2, there were a total of 15 specimens captured that belonged to 7 different families of beetles, which included the families Anobiidae, Cerambycidae, Chrysomelidae, Elateridae, Nitidulidae, Scolytidae, and Tenebrionidae. Although it was deployed at the height of 6 meters, the same as in group 4, it was along the trunk of the tree instead of in the outer branches. This resulted in a higher diversity index than group 4, indicating that beetle diversity is greater near the tree than further out in the branches of the tree.

In group 3, there was a total of 8 beetles captured that belonged to 5 different families. These included Anthribidae, Cerambycidae, Elateridae, Tenebrionidae, and an unknown. The diversity index calculated was 1.57, a lesser value than at the height of 1.5 meters as in group 1. This may be a possible indication that beetle diversity is less near the top of the canopies than closer to the ground. Since group 3 was only deployed for 7 days instead of the 10 days, further study is needed to warrant a firmer conclusion.

In group 4, the diversity index was 1.51, and I captured 9 beetles that were classified into 5 families. These families included Anobiidae, Cerambycidae, Chrysomelidae, Elateridae, and Cleridae. The Cleridae was only observed in group 4.

Using the Lindren funnel in group 5, it captured 17 beetles that were classified into 4 families: Carabidae, Cerambycidae, Salpingidae, and Scolytidae. With 13 specimens, the family Scolytidae was most commonly found in this trap. Salpingidae was observed only in group 5. The Lindren funnel also captured much debris, such as leaves due to its stacked cone-like design.

Based on these results, it can be concluded that beetle diversity may be dependent on the heights of the canopy. Further studies, such as a longer deployment time for the aerial traps and the Lindren funnel are needed to arrive at a firmer conclusion. In addition, different vicinities should be utilized, as well as deploying the traps at a much greater height than those used in this study.

Acknowledgments

I would like to thank Dr. Wharton for helping me deploy the traps and for his assistance in identifying the beetles. I would also like to thank Tasha Bedgood for letting me use her laptop and Jessica Weems for her help at the site.

References

Borror, Donald J., Triplehorn, Charles A., and Johnson, Norman F. 1989. *AnIntroduction to the Study of Insects: Sixth Edition.* Chicago: Saunders College Publishing.

Elzinga, Richard J. 1992. *Fundamentals of Entomology: Fourth Edition.* New Jersey: Prentice Hall.