

Surveying the microhabitat of larvae in *Heliconia caribaea* and *Glomeropitcairnia penduliflora* at different elevations

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Abstract

Heliconia caribaea (*Heliconia*) and *Glomeropitcairnia penduliflora* (bromeliad) are found in the tropics, often in disturbed areas. Both of these plants have the ability to hold water which in turn provides a suitable habitat for semiaquatic insects. I used a pipet and forceps to remove specimens of immature insects from the plants, and evaluated low, medium, and high elevations along with a comparison of *Heliconia* and bromeliads. I found a total of 18 different morphospecies: 2 Chironomidae, 1 Plecoptera, 7 Syrphidae, 2 Stratiomyidae, 2 Tipulidae, 2 mosquito species, an unidentifiable white maggot, and an unidentifiable beetle larva. Overall, there was more species richness in *Heliconia* than in bromeliads at all elevations.

Introduction

Heliconia caribaea (*Heliconia*) and *Glomeropitcairnia penduliflora* (bromeliad) are plants that can be found growing in the tropics and they are used as ornamental decorations in gardens and landscapes. Both of these plants have the ability to hold water within them which make them suitable habitat for semiaquatic and aquatic insect larvae. There are multiple common names that may be associated with *Heliconia* plants such as “lobster claws” or “parrot flowers” due to the multitude of colors on their bract which encases the flower (Rainforest Alliance 2015). The bracts of the *Heliconia* are held in an upright position and collect water in their bracts. They grow from a stalk and have an arrangement of bracts protruding from them. These plants are most common in disturbed regions on the island of Dominica (Lack et al. 1997). As for bromeliads these are located on the sides of trees or even on the ground. The leaves of the bromeliad are arranged in a spiral which are sometimes called a “rosette” (Bromeliad Society International 2012). The leaves in the rosette may overlap tightly to form a water reservoir which can be a potential habitat for insects and other organisms. Some bromeliads that are not water

reservoirs and rely heavily on their roots to get the water they need. Bromeliads can grow on the sides of trees keeping off the ground while others occur on the ground. Water samples were taken from bromeliads and *Heliconia* to analyze the insect larvae residing within the plants. I compared the insect fauna found in plants in a high, medium, and low elevations and also compared *Heliconia* and bromeliads at these three elevation ranges. I cross evaluated both plant types at all elevations. I hypothesized that there would be more diversity within the plants located at lower elevation, and that more insect larvae will be in the bromeliads because there is more space for the adults to oviposit.

Material and Methods

Water samples were collected on hiking trails on the island of Dominica. Selection of plants were based on the distance off the trail ranging between 0 and 20 meters. This was done to maintain a set maximum distance from the trail for all samples, I selected a minimum of three samples total at three different elevation ranges: 200m -500m, 501m-800m, and 801m-1000m. The water samples from bromeliads were collected using a turkey baster and a plastic pipet to collect standing water from each pool. Additional water was used to flush out any other organisms living in the plant. Water samples collected were placed in a plastic conical centrifuge tube with seal cap and taken back to be analyzed. This method only collected a small percentage of the organisms that were living in the *Heliconia* due to the flower encased in the bract giving many places for insect larvae to hide. *Heliconia* flowers were cut from the stalk and taken back to the field station where they were placed in a tray with water and torn apart taking out any insect larvae that were visible using a pipet and fine tip forceps. Each apparent specimen was then and placed into a mosquito rearing container. One specimen from each morphotype was identified to family and used as a reference specimen. Due to the repetition of several

morphotypes in each family and the inability to identify specimens more specifically without adults, different morphotypes in each family were labeled 1, 2, 3... etc. and a description of each was made and used to compare across water samples. The occurrence of each taxa was recorded and placed in to an Excel file.

Results

There were a total of 18 different morphospecies containing representatives in 8 families. Fourteen water samples were collected from both *Heliconia* and bromeliad: 2 mosquito specimens, 2 Chironomidae, 1 Plecoptera, 7 Syrphidae (rat-tailed maggots), 2 Stratiomyidae, 2 Tipulidae, an unidentifiable white maggot, and an unidentifiable beetle larva. [Figure 6]

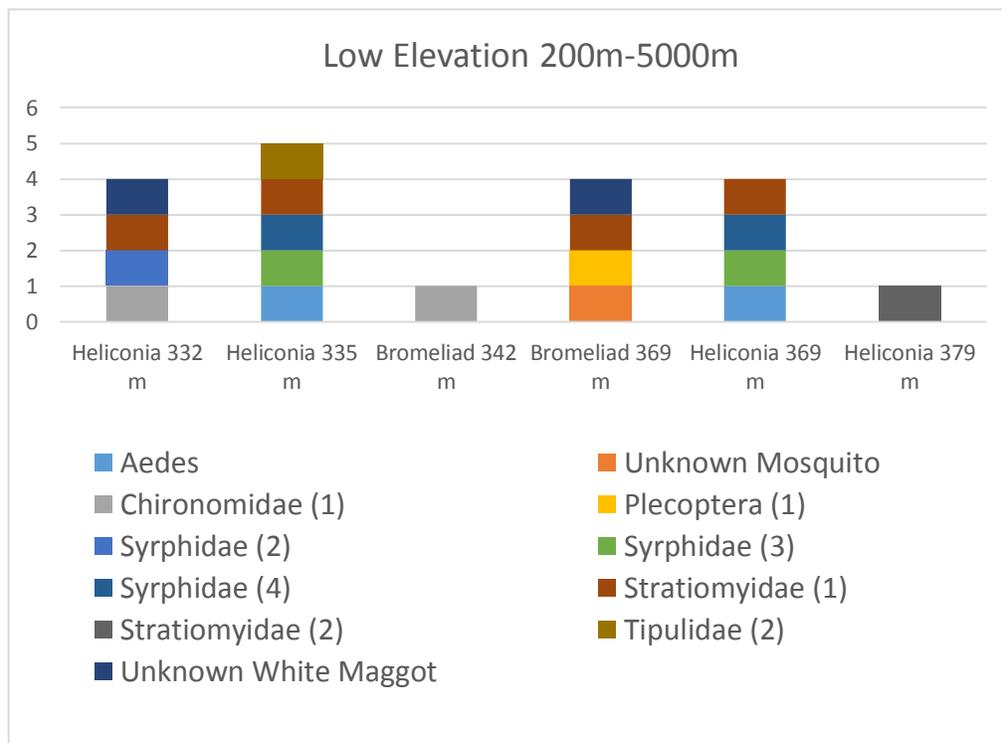


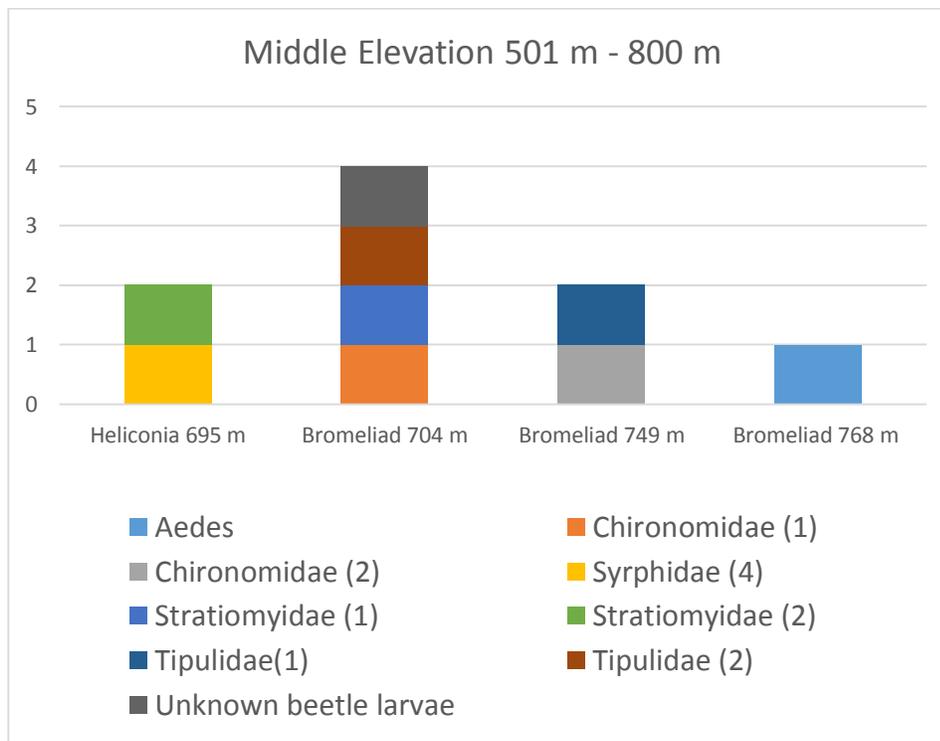
Figure 1: Taxa in bromeliads and *Heliconia* at lower elevation. The number of species in each plant is on the left axis. Each color is an indicator of a different taxon present in the plant.

At a low elevation, 200m – 500m above sea level, [figure 1] there were more insect larvae taxa recorded in the *Heliconia* than the bromeliads. The most morphospecies identified

was 5 in a single stalk of *Heliconia* and the most species identified were 4 from the bromeliad. The fewest morphospecies identified in *Heliconia* was 1, while the least number of morphospecies in a bromeliad was also 1. The order Plecoptera was only found in bromeliads and the family Syrphidae was only found in *Heliconia*. There was a total of 11 different morphospecies identified at this elevation level.

Looking at the middle elevation 501m-800m [figure 2] more samples of *Heliconia* were taken than bromeliads. There was also a wider range of morphospecies collected from the bromeliads than the heliconias. The most morphospecies collected from a bromeliad was 4 and the least 1, while *Heliconia* it was 2. The family Syrphidae was still not present in the bromeliad samples. There was a total of 9 different taxa collected from this range of elevations.

Figure 2: Taxa from the middle elevation from the set of samples ranging from 501m – 800m. The number of taxa collected from the plants sampled is on the left.



Lastly, the high elevation, 801m – 1000m, shown in figure 3 showed that there was more diversity in *Heliconia* than in bromeliads. The most taxa collected in *Heliconia* water samples was 7 and the least was 4. In bromeliads the most diverse was 3 taxa and the least was 2. The order Plecoptera made another appearance in the bromeliad, while the family Syrphidae was not present. There were 10 different morphospecies collected at this range of elevations.

The *Heliconia* samples contained: Chironomidae species 1 and 2, Syrphidae species 1-7, Stratiomyidae species 1 and 2, along with Tipulidae species 1 and 2, *Aedes* sp., and the unidentifiable maggot. The taxa diversity was 15 total morphospecies. [Figure 4]

The bromeliad samples were limited to 10 different morphospecies and did not have any members of the family Syrphidae in any of the collections. The order Plecoptera was identified in one of the samples along with both representatives of Chironomidae and Tipulidae. [Figure 5]

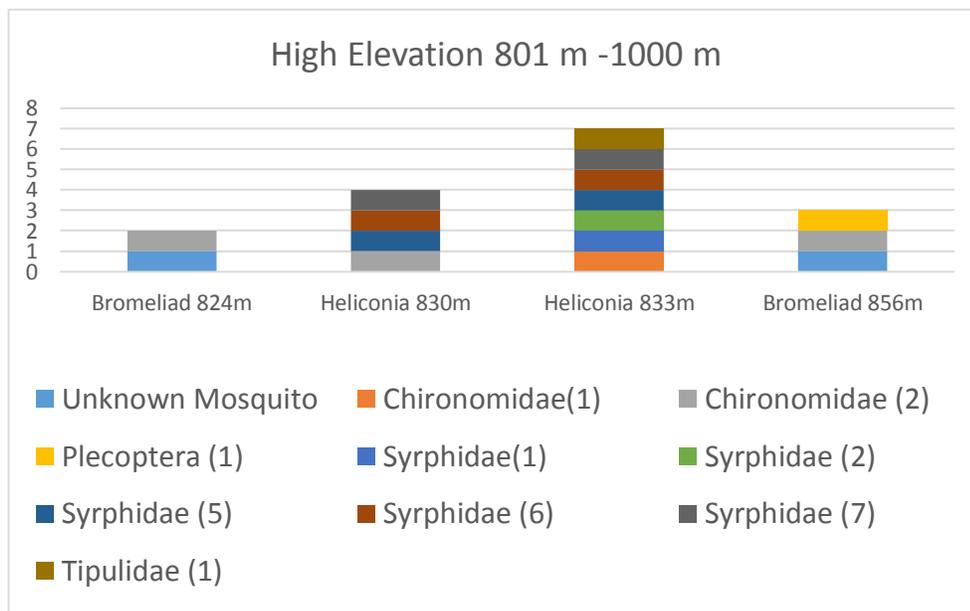


Figure 3: Taxa from the high elevation of the samples taken. Each color is represents a different morphospecies identified.

All of the taxa of Syrphidae were found in *Heliconia* while there were none found in bromeliads. The only group not found in *Heliconia* bracts were Plecoptera, an unknown beetle larvae, and the unknown mosquito larvae. Bromeliads were not as diverse in morphospecies as the *Heliconia*. There were more morphospecies residing in the *Heliconia* bracts versus the bromeliad plants. There was also more diversity found in a *Heliconia* at one time than there were found in bromeliads.

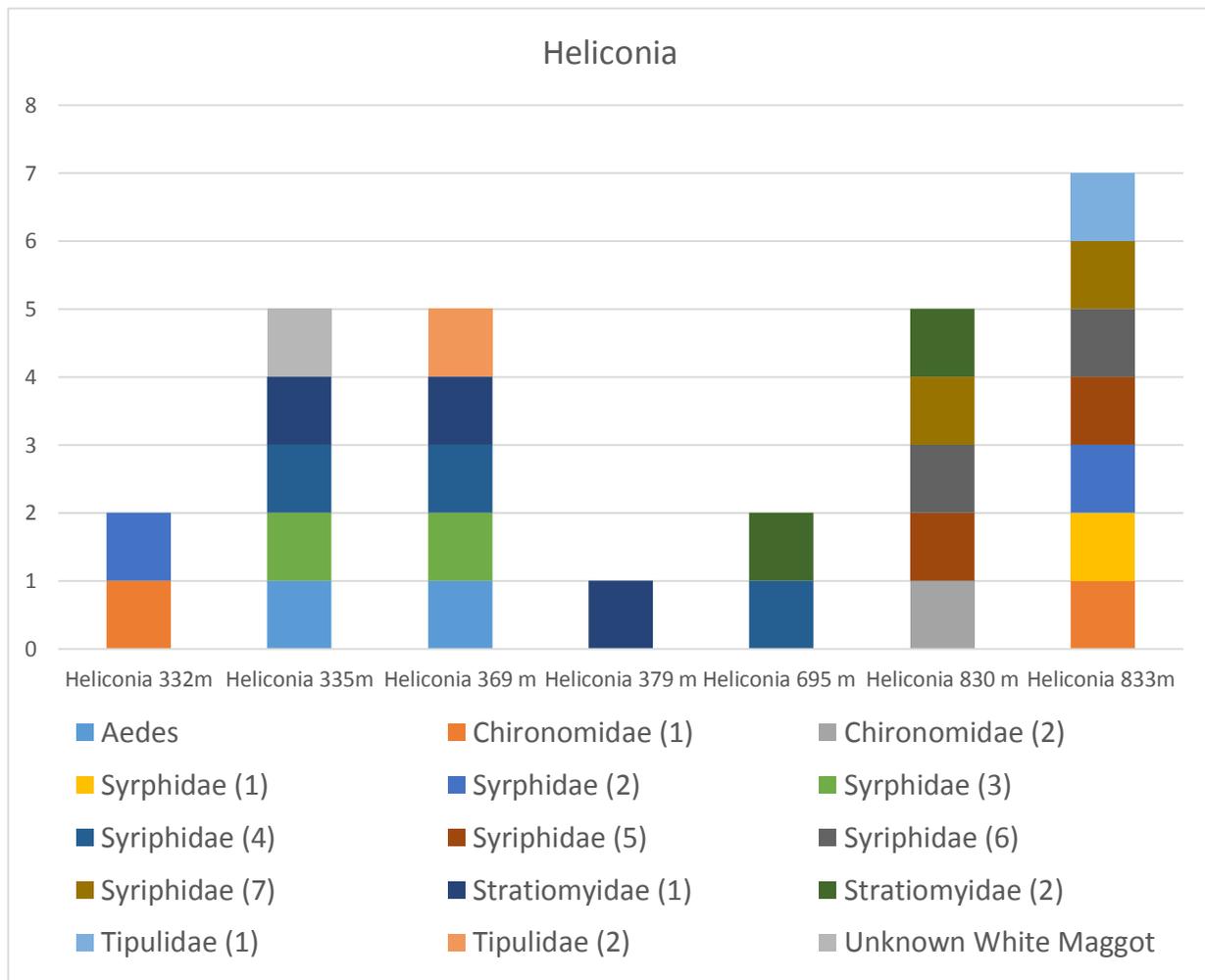


Figure 4: *Heliconia* samples at all elevations.

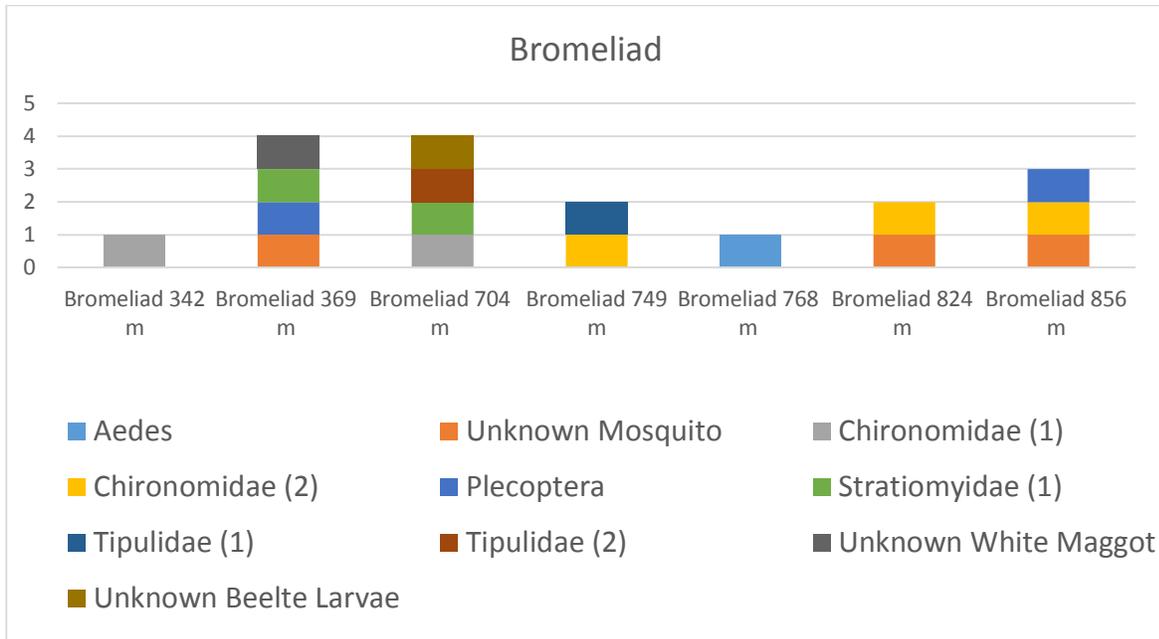


Figure 5: Bromeliad samples at all elevations.

[See appendix attached for comparison of all *Heliconia* and bromeliad]

Conclusion

An evaluation of the data appeared to show there was lower diversity in the samples collected from bromeliads than *Heliconia* at all levels of elevation. Although there was more space in the bromeliads to support more organisms, the *Heliconia* offered more protection and resources such as food from the flowers in the bracts to support organisms. Overall, the *Heliconia* was the plant of choice for the Syrphidae. In the sample taken from the *Heliconia* at 833m, there were 5 of the 7 morphotypes being represented. Within that sample of *Heliconia* was also the most taxa being represented in a single sample at 7 morphotypes. The least number of morphospecies found within a *Heliconia* was one. This morphotype was identified as Stratiomyidae which was located at a low elevation, 379 meters. Plecoptera seemed to prefer to oviposit in bromeliads. The most taxa identified in bromeliads was 4 and it occurred in two different samples. The only morphotype that was represented in both samples was Stratiomyidae (1.) The least number of taxa found in a bromeliad was one, which occurred in two samples.

(The only taxa represented in both samples was not similar). At the lower elevation, 342m, the morphotype Chironomidae (1) was represented, and in the middle elevation, 768 m, *Aedes* was represented.

Both *Heliconia* and bromeliads were active breeding sites for Chironomidae 1 and 2, Tipulidae 1 and 2, and also for Stratiomyidae 1. When comparing the total number of taxa per elevation range the most diversity occurred in the lower elevation which were 19 different morphotypes. While the medium elevation had the least morphotypes. This difference may be because of the limitation of *Heliconia* collected at this elevation level.

Discussion

There are many future projects that can be based from this. Having the ability to tear open the bromeliads to have a better look inside of them adds a new dimension. There are many ways to improve and expand on this project for possibly more accurate results, for example more samples, and better keys to genus and species. Also, getting the same number of *Heliconia* and bromeliads per elevation level would provide more comparable data.

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Thank you Dr. J. Woolley for taking the photographs and helping identify insect larvae along with helping with data collection and being the chaperone for the trip to Dominica. I would also like to thank Dr. T. Lacher for being a chaperone and informing us about the vegetation around the island helping with the idea for this project. I would also like to thank Nancy Osler and the staff at ATREC for their generosity and kindness throughout our stay in Springfield and Texas A&M University for helping me fund my trip here.

Figure 6: Identification of morphotypes found within the bromeliads and *Heliconia*

Morphospecies	Pictures
<i>Ades</i> - Short stubby syphon, has a saddle	
Unknown mosquito- very long syphon, four times longer than it is wide	
<i>Chironomidae</i> (1) reddish head/body, short rounded head	
<i>Chironomidae</i> (2) white, long head 3x longer than broad, ventral proleg at first thoracic segment	

<p><i>Plecoptera (1)</i> flattened, long filiform antennae, jointed thoracic legs</p>	<p>Dorsal side</p>  <p>Ventral side</p> 
<p><i>Syrphidae (1)</i> white, long syphon, 2 lateral ears at head</p>	
<p><i>Syrphidae (2)</i> tan color, rough skin, dark syphon, 2 pairs of lateral appendages at apex of syphon</p>	
<p><i>Syrphidae (3)</i> white, 3 pairs of thoracic prolegs, pair of ventral legs at apex of abdomen as long a syphon</p>	
<p><i>Syrphidae (4)</i> white, dark syphon, long mouth hooks, 8 pairs of lateral appendages</p>	

<p><i>Syrphidae (5)</i> tan to brown, head dark, syphon dark, ventral gills on abdomen, 2 pairs of lateral appendages at apex of abdomen</p>		
<p><i>Syrphidae (6)</i> mostly white, dark gray/black syphon and posterior part of abdomen, 6 abdominal segments expanded and pad-like</p>		
<p><i>Syrphidae (7)</i> light tan, skin smooth, 2 segmented syphon, darker at apex, 1 pair of lateral appendages at base of syphon</p>		
<p><i>Stratiomyidae (1)</i> tan, head and apex darker, crown of setae at apex abdomen, each segment anterior ring of dark bumps.</p>		
<p><i>Stratiomyidae (2)</i> white, tan/brown head, black terminal abdominal segment</p>		
<p><i>Tipulidae (1)</i> sclerotized head capsule, large mandibles</p>		

<p><i>Tipulidae</i> (2) dark sclerotized head, furry body, horizontal mandibles</p>	
<p><i>Unidentifiable White maggot</i>- Large, white with</p>	
<p>Unidentifiable beetle larva cylindrical sclerotized head, three jointed thoracic legs, with a hook at apex of abdomen</p>	

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Larvae in <i>Heliconia</i> and <i>Bromeliad</i>																					
	Plant Type	Elevation in Meters	Ades short stubby syphon, saddle	Unknown Mosquito (1)	Chironomidae (1) reddish head/body	Chironomidae (2) white, long head 3x longer than broad, ventral proleg at first thoracic segment	Plecoptera (1) flattened, long filiform antennae, jointed thoracic legs	Syrphidae (1) white, long syphon, 2 lateral ears at head	Syrphidae (2) tan color, rough skin, dark syphon, 2 pairs of lateral appendages at apex of syphon	Syrphidae (3) white, 3 pairs of thoracic prolegs, pair of ventral legs at apex of abdomen as long a syphon	Syrphidae (4) white, dark syphon, long mouth hooks, 8 pairs of lateral appendages	Syrphidae (5) tan to brown, head dark, syphon dark, ventral gills on abdomen, 2 pairs of lateral appendages at apex of	Syrphidae (6) mostly white, dark gray/black syphon and posterior part of abdomen, 6 abdominal segments expanded and	Syrphidae (7) light tan, skin smooth, 2 segmented syphon, darker at apex, 1 pair of lateral appendages at base of syphon	Stratiomyidae (1) tan, head and apex darker, crown of setae at apex abdomen, each segment anterior ring of dark bumps,	Stratiomyidae (2) white, tan/brown head, black terminal abdominal segment	Tipulidae (1) sclerotized head capsule, large mandibles,	Tipulidae (2) dark sclerotized head, furry body	Unknown White maggot	Unknown beetle Larvae cylindrical sclerotized head, three jointed thoracic legs, with a hook at apex of abdomen	
Low Elevation	<i>Heliconia</i>	332 M			X			X							X				X		4
	<i>Heliconia</i>	335 M	X						X	X					X						5
	<i>Bromeliad</i>	342.29 M			X																1
	<i>Bromeliad</i>	369.11 M		X			X								X				X		4
	<i>Heliconia</i>	369.72 M	X						X	X					X						4
<i>Heliconia</i>	379.17 M														X					1	
			2	1	2	0	1	0	1	2	2	0	0	0	4	1	0	2	2	0	
Middle Elevation	<i>Heliconia</i>	695.25 M									X					X					2
	<i>Bromeliad</i>	704.39 M			X										X					X	4
	<i>Bromeliad</i>	749 M				X											X				2
	<i>Bromeliad</i>	768 M	X																		1
			1	0	1	1	0	0	0	0	1	0	0	0	1	1	1	1	0	1	
High Elevation	<i>Bromeliad</i>	824 M		X		X															2
	<i>Heliconia</i>	830 M				X						X	X	X							1
	<i>Heliconia</i>	833 M			X		X	X	X	X	X	X	X	X			X				7
	<i>Bromeliad</i>	856M		X		X	X														3
Total			0	2	1	3	1	1	1	0	0	2	2	2	0	0	1	0	0	0	
			3	3	4	4	2	1	2	2	2	2	2	2	5	2	2	2	2	1	
	<i>Heliconia</i>	332 M			X				X						X				X		4
	<i>Heliconia</i>	335 M	X							X	X				X						5
	<i>Heliconia</i>	369.72 M	X							X	X				X						4
	<i>Heliconia</i>	379.17 M														X					1
	<i>Heliconia</i>	695.25 M				X					X	X	X	X		X					2
	<i>Heliconia</i>	830 M			X			X	X		X	X	X	X			X				4
	<i>Heliconia</i>	833 M			X		X	X			X	X	X	X							7
Total			2	0	2	1	0	1	2	2	3	2	2	2	3	2	1	1	1	0	
	<i>Bromeliad</i>	342.29 M			X																1
	<i>Bromeliad</i>	369.11 M		X			X								X				X		4
	<i>Bromeliad</i>	704.39 M			X										X					X	4
	<i>Bromeliad</i>	749 M				X															2
	<i>Bromeliad</i>	768 M	X														X				2
	<i>Bromeliad</i>	824 M		X		X															1
	<i>Bromeliad</i>	856M		X		X		X													2
Total			1	3	2	3	2	0	0	0	0	0	0	0	2	0	1	1	1	1	