

Survey of Auchenorryncha Found in Malaise Traps

on the Island of Dominica

Jessica Weizer, Devin Beach, , Lorilyn Seyler, Amanda Tinder, Thea Martinez

Dominica 2012

Dr. James Woolley, Dr. Thomas Lacher

Department of Entomology

Texas A&M University, College Station, TX, USA 77843

Abstract

The objective of this research was to collect insects from different locations on the island of Dominica using both aerial and ground Malaise traps. The Malaise traps were placed in dry forest (Cabrits National Park), Tropical Rainforest (Middleham Falls Trail), and transitional and primary forest. Once the traps were collected they were examined carefully and the specimens of the suborder Auchenorrhyncha of the order of insects Hemiptera were identified. The three families of Auchenorrhyncha that were identified were the Cicadellidae, Cercopidae, and the superfamily Fulgoroidea. The overall conclusions were the aerial Malaise traps worked the best for collecting these insects. The aerial trap located on The Massacre trail (at ATREC) yielded the highest numbers of Auchenorrhyncha. The majority of the Auchenorrhyncha that were identified were the Cicadellidae, and the least identified were of the super family Fulgoroidea. The traps placed at the Cabrits National Park yielded the least number of the super family Fulgoroidea.

Keywords: Dominica, Auchenorrhyncha, Hemiptera, Malaise trap

Introduction

The order Hemiptera includes three suborders: Heteroptera, Sternorrhyncha, and Auchenorrhyncha. The suborder Auchenorrhyncha is further broken into Cicadellidae, Cicadidae, Psyllidae, Cercopidae, and several other families. These insects are commonly known as leafhoppers, froghoppers, and planthoppers. The most unifying feature of this suborder is the downward-facing haustellate mouthparts. The proboscis is tucked in between the first pair of thoracic legs forming the downward-facing mouthparts (Triplehorn, 2005). They feed on the phloem of plants and are known vectors in dispersing viral and fungal diseases among plants. Other identifying features include the anteriorly triangular-formation ocelli (simple eyes that help insects detect light and darkness), the spination of their legs, and the downward position of their head.

The family Cicadellidae, the superfamily Fulgoroidea, which includes the family Cixiidae, and the family Cercopidae were identified in the Malaise traps and are the focus of this survey. Cicadellidae, also known as leafhoppers, have large hind limbs made for jumping, with a row of spines on the femur. This helps distinguish them from Cercopidae, which are similar in appearance. Cercopidae differ due to the fact they only have two or three spines on their hind femur. Fulgaroids exhibit a unique head shape and detailed, ornamental spotted wings. These insects are mostly herbivores, although some have been known to consume smaller insects. Larvae can be found either on plant substrates or in leaf litter and all members are paurometabolous meaning they have incomplete metamorphosis (Triplehorn, 2005).

This project seeks to expand on two previous projects: “A Survey of Hemiptera Fauna on the Island of Dominica,” by Cassandra Garcia, and “An Initial Survey of the Heteropteran and

Auchenorrhynchan Fauna of ATREC and Surrounding Areas” by Brendan Morris. This project in particular aims to survey the presence of the suborder Auchenorrhyncha on the island of Dominica, to see which locations caught the most specimens, and which type of Malaise traps, ground or aerial, were more proficient at collecting specimens .

Methods and Materials

The materials used for this project include seven ground and six aerial malaise traps. Of the aerial Malaise traps one had two bottles (one at the top and the bottom) while the remaining were just single bottle, top Malaise traps. Each of the Malaise trap bottles were filled approximately halfway with 95% ethyl alcohol. For each of the ground Malaise traps seven stakes were used to anchor the trap firmly into the ground. To hang the aerial Malaise traps, a slingshot was used to get the string over the branches of tall trees allowing for insect collecting in the tree canopy. Also used in the task of setting up aerial Malaise traps were eight pieces of plastic PVC® pipe used to hold the tent-like shape. In the case of the aerial trap with two bottles, on the top and bottom, sixteen pieces of plastic PVC® pipe were used. Approximately one hundred feet of clothes line string as well as fishing line were used interchangeably to hang aerial traps. Clothes string was used primarily in securing the ground Malaise traps to adjacent trees and red flagging tape was used to mark the location of the trail. Other materials used were thirteen glass vials to contain collected specimens after sorting through the Malaise traps. Two pairs of fine forceps, two pairs of soft BioQuip® forceps, four Leica EZ4® microscopes for identification, and a copy of *Borror and DeLong’s Introduction to the Study of Insects*. 7th edition textbook were used to sort and identify the Auchenorrhyncha. Two small square ridged trays, two Petri dishes and two buckets were used when sorting through the Malaise trap bottles that were

filled with 95% ethyl alcohol. A Garmin *GPSmap 76®* was used to take the coordinates of the location of where the traps were set.

Ground and aerial Malaise traps were placed at the locations of the top, middle, and base of Mount Joy, the field north of the Bee House, the fig tree located on the Massacre Trail, the trailhead of Middleham Falls, and at Fort Shirley-Douglas Bay. The traps were hung for approximately a week and then taken down with the exception of the traps on the top, middle, and base of Mount Joy. These were changed out and kept hanging for an additional few days before being taken down.

To hang the aerial Malaise traps the first step was to find an ideal location where there would be a sturdy branch and minimal branches or trees in the way, hindering insects being attracted to the traps. Once a branch was located, the slingshot with a weight or lock was tied to a piece of fishing line or clothes line, thrown over a branch, and tied to the top of the malaise trap. Once the plastic PVC® pipes were inserted and the bottles filled halfway with 95% ethanol the trap was raised carefully into the tree. When the trap was pulled as high as possible in the tree the bottom and top lines were tied securely to a different tree. To take them down the top line was untied and the trap was lowered slowly. The alcohol bottles with specimens were interchanged with an empty bottle to prepare for future use. When the alcohol bottles that contained the captured insects were exchanged, a label with the locality information (written on Resistall® paper with a Pigma Micron® pen) was placed in the bottle in order to keep them organized. The trap was then folded up and tied until arriving back at Springfield Station where it was then laid out for drying before being refolded and placed back into storage.

To hang the ground traps a good location was first selected. The best locations to hang these types of traps are in the middle or edge of the forest or in areas that act as a funnel to draw in the insects. Once a location was found it took two people to hold the trap so that the top portion could be tied to the tree. It was important to keep the bottom of the trap close and level with the ground. Next, the sides of the traps were tied to nearby trees using a hitch knot. Once the tops and sides of the trap were secured the bottom of the trap was then secured with the use of eight stakes that were pushed firmly into the ground. The last step was to fill the plastic bottles halfway with 95% ethanol. It was important in the hanging of both traps that the top was not twisted around the alcohol bottle, which would prevent them from being collected. When taking the trap down, the first step was to remove the alcohol bottles and insert a piece Resistall® paper with the locality information. Next the stakes were removed and the knots untied. The trap was then folded up and tied until arriving back at Springfield Station, where it was then laid out for drying before being refolded and placed into storage.

Using one of the small square ridged trays a small amount of the alcohol was poured into it and then inspected under the microscope. Any family that had been keyed out and belonged in the suborder Auchenorrryncha was taken out using the fine tipped forceps. The insects were then placed in clean glass vials filled halfway with 95% ethanol and the tops were labeled to its corresponding plastic bottle. This step was repeated until the last of the contents of the plastic bottle had been sorted through. The label information was recorded onto a smaller piece of Resistall® paper with a Pigma Micron® pen with the information coinciding with the bottle and trap's location. When finished all the contents in the plastic bottles that were not of the suborder Auchenorrryncha were then repoured into the original plastic bottle for future use.

Once every Malaise trap had been sorted through, each of the new vials that only contained specimens from the suborder Auchenorrhyncha were poured individually into a Petri® dish. Using a Leica EZ4® microscope different families were identified, counted, and recorded.

Data

Three families of Auchenorrhyncha were identified. All Auchenorrhyncha are easily identifiable by their haustellate mouthparts (sucking/piercing) emerging from the back of the head. Cicadellidae, Cixiidae, and Cercopidae were the three families identified in this survey. Each have separate individual characteristics that are easily identifiable. Voucher specimens of all species of Hemiptera collected were deposited in the insect collections at Archbold Tropical Research and Education Centre (ATREC) and Texas A&M University.

Cicadellidae (leafhoppers) are distinguished by their hind tibia which contains numerous spines as well as transverse coxae. Their frontal sutures located on their face extend past the margin to the head and almost reach their ocelli (Triplehorn, 2005). They also may have distinctive patterns and colors such as brown, yellow, green, or red.

Family Cixiidae, in the superfamily Fulgoroidea (planthoppers), can be recognized by their hyaline wings. Another characteristic is that the front portion of their eyes are enlarged, and their ocelli are located directly in front of their eyes on the sides of their head (Triplehorn, 2005). Many Cixiidae have spots along the veins of their wings. The most characteristic feature of the super family Fulgoroidea is their snout like head and only a few large spines on the hind tibiae. The characteristic placement of ocelli and antennae are located right below the eyes (Triplehorn, 2005).

The family Cercopidae (froghoppers) is characterized by a slanting backward face and hind tibia containing one or two spines. Another characteristic found in both the Cicadellidae and Cercopidae is their antennae arises just below their compound eyes. Cercopidae can vary in coloration but are usually brown and yellow, or black and red spotted in coloration and pattern (Triplehorn, 2005).

Dominica Malaise Traps							
Trap Number	Label	Parish	Location	Lat/Long	Elevation (ft)	Date	Type of Trap
1	2012/001	St. Paul	ATREC-Middle of Mount Joy Road	15° 20' 56.6"N 61° 21' 51.7"W	N/A	27 May 2012	Aerial
2	2012/003	St. Paul	ATREC-Base of Mount Joy Road	15° 20' 51.8"N 61° 21' 05.2"W	1229	27 May 2012	Ground
3	2012/003	St. Paul	ATREC-Base of Mount Joy Road	15° 20' 51.8"N 61° 21' 05.2"W	1229	27 May 2012	Ground
4	2012/002	St. Paul	ATREC-Top of Mount Joy road	15.351741°N 61.363255°W	1432	25 May 2012	Ground
5	2012/005	St. Paul	ATREC-Field near bee house	15.347757°N 61.367445°W	1183	27 May 2012	Ground
6	2012/008	St. Paul	Morne Trois Pitons National Park-Beginning of Middleham Falls	15.349075°N 61.344122°W	2251	28 May 2012	Aerial-Top
7	2012/008	St. Paul	Morne Trois Pitons National Park-Beginning of Middleham Falls	15.349075°N 61.344122°W	2251	28 May 2012	Aerial-Top
8	2012/007	St. Paul	Morne Trois Pitons National Park-Trailhead of Middleham Falls	N/A	N/A	28 May 2012	Ground
9	2012/009	St. Andrew's	Cabrits National Park-Ft. Shirley Douglas Bay	15.587505°N 61.472608°W	161	29 May 2012	Ground
10	2012/010	St. Andrew's	Cabrits National Park-Ft. Shirley Douglas Bay	15° 20' 46.0"N 061° 22' 24.0"W	N/A	29 May 2012	Aerial-Top
11	2012/005	St. Paul	ATREC-Fig Tree Massacre Trail	15° 20' 46.0"N 061° 22' 24.0"W	N/A	28 May 2012	Aerial-Top
12	2012/006	St. Paul	ATREC-Fig Tree Massacre Trail	15° 20' 46.0"N 061° 22' 24.0"W	N/A	28 May 2012	Aerial-Top
13	2012/006	St. Paul	ATREC-Fig Tree Massacre Trail	15° 20' 46.0"N 061° 22' 24.0"W	N/A	28 May 2012	Aerial-Bottom

Table 2-Data collected for the locations where the Malaise traps were placed for collection

Trap Number	Cicadellidae	Cixiidae	Cercopidae	Total
2012/001	10	6	0	16
2012/003	48	17	0	65
2012/003	28	14	0	42
2012/002	40	13	0	53
2012/005	49	13	2	64
2012/008	5	2	0	7
2012/008	7	2	0	9
2012/007	63	33	11	107
2012/009	216	29	8	253
2012/010	585	74	0	659
2012/005	25	34	0	59
2012/006	732	69	16	817
2012/006	23	1	1	25

Table 1-The number of individuals in each family of Auchenorrhyncha found on the Malaise traps in Dominica

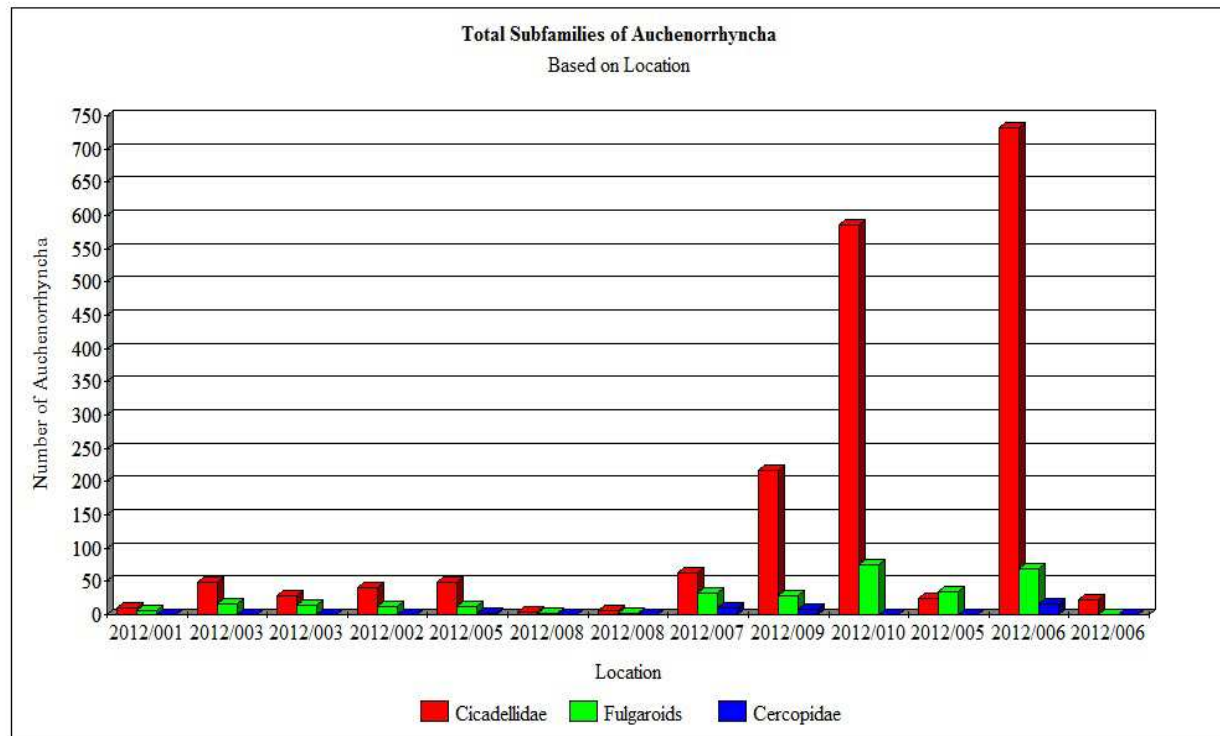


Figure 1-Depiction of the different Auchenorrhyncha families collected from the aerial and ground Malaise traps on the island of Dominica

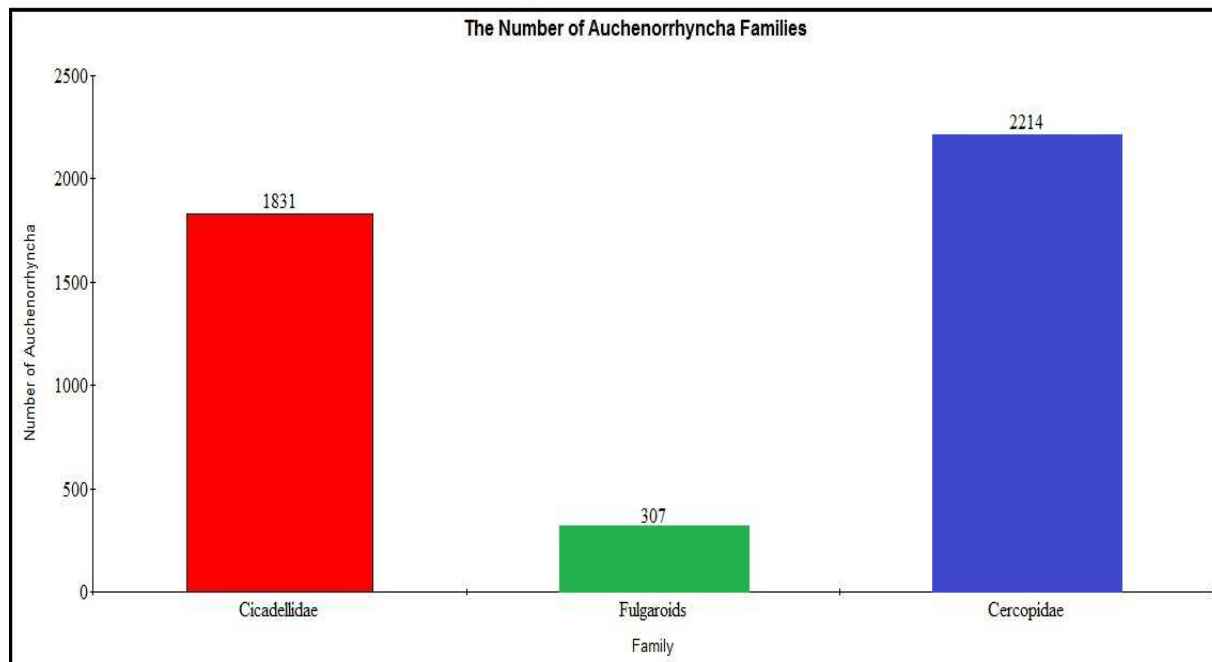


Figure 2- Total number of Auchenorrhyncha families identifies overall in the Malaise traps

Discussion

There was a total of 1,831 Cicadellidae, 307 Cixiidae, and 38 Cercopidae collected from all of the Malaise traps (Fig 2). It was determined that the top bottle (Vial 12) of the fig tree, located on the Massacre Trail on ATREC (Archbold Tropical Research and Education Centre), yielded the highest quantity of Auchenorrhyncha. The Auchenorrhyncha may have been attracted to this particular Malaise trap due to the highly disturbed secondary forest, as well as abandoned orchards and cocoa trees surrounding the aerial trap. The other locations of the Malaise traps were near or adjacent to a trail or path.

1,592 Auchenorrhyncha were collected from the aerial Malaise traps, while 584 were collected from the ground Malaise traps (Fig 1). When comparing the aerial and ground Malaise traps the aerial traps yielded the greatest number of Auchenorrhyncha. This could be a result of Auchenorrhyncha being more prone to flying at a higher altitude, and results in encountering the aerial Malaise trap. They may not be as likely to encounter the ground trap because of this mode of transportation.

At Cabrits National Park the number of Fulgoroidea may have not been as abundant due to the incorrect environmental conditions of the dry forest. For example, there were fewer sources of food, as well as a lack of necessary habitat conditions. When these conditions were present in other forest types (secondary forest, tropical rainforest, and transitional forest) more of them were collected and identified.

Other reasons why the not all of the families were identified in each of the aerial and Malaise traps could be due to locations of where the traps were placed, human error of misidentifying the specimens collected, as well as the time of year. Another reason could be due to the habitat the

Malaise traps were placed in and the climate conditions of the area.

Two aerial Malaise traps near the beginning of Middleham Falls and the beginning of the Morne Trois Pitons National Park had the least amount of Auchenorrhyncha collected. The aerial malaise trap near the beginning of Middleham Falls, along with the trap placed at the beginning of the Morne Trois Pitons National park collected the least number of specimens.

The collecting trap located on Massacre trail, with top and bottom bottles, caught significantly fewer Auchenorrhyncha in the bottom than that of the top. This is evidence that a top collecting trap is a more effective way of catching Auchenorrhyncha than a bottom.

To expand on this project the number of species in the Malaise traps could be identified or one location could be chosen to determine if one specific species was more likely to be caught in an aerial or ground Malaise traps.

Acknowledgements

We would like to thank Dr. Woolley and Dr. Lacher for the opportunity to conduct our research in Dominica. A sincere special thanks to Dr. Woolley for all of his patience and assistance in setting up the ground and aerial traps as well as giving us guidance and advice on our group project when needed. We would also like to thank Alan Garcia for using the slingshot and helping us hang our aerial traps. As well as a special thanks to everyone that helped with both the setup and take down of the Malaise traps.

References

Garcia, C. 2011. A Survey of the Hemiptera Fauna on the Island of Dominica.

Morris, B. 2008. An Initial Survey of the Heteropteran and auchenorrhynchan Fauna of ARTEX and Surrounding Areas.

Triplehorn, Charles A. and Norman F. Johnson. *Borror and DeLong's Introduction to the Study of Insects*. 7th ed. Belmont: Brooks/Cole, 2005.