Comparison of Culicidae Present in Phytotelmata versus Stream Pools and General Survey of Culicidae at Springfield Station

Anchal Thomas

Texas A&M University Dominica Study Abroad 2017

Dr. Woolley

Dr. Lacher

Dr. Brundage

Abstract

Mosquito borne diseases are proliferating all around the world. Mosquito habitats can be categorized into temporary and standing pools, both of which influence human health. To understand the extent of their presence in Dominica, a survey of mosquitoes was conducted by observing phytotelmata (plant-held water) and pools in streams present at the Archbold Tropical Research and Education Center (ATREC) in Dominica, West Indies from May 23rd, 2017 to June 14th, 2017. Along with this survey, an additional general survey was conducted using BG Sentinel traps to observe which species of adult mosquitoes were present around the station. BG Sentinel traps were set in four different areas at the station and all specimens collected were identified. For the survey testing phytotelmata and pool stream habitats, samples were collected from different water holding plants and standing pools in various areas surrounding the station. The larvae obtained from these samples were then reared and identified. Fifteen total mosquitoes were collected from the BG sentinel traps, fifteen mosquitoes were reared from pool streams, and twenty-seven mosquitoes were reared from phytotelmata. The species *Aedes buscki* was found to be the most common in phytotelmata and *Culex quinquefasciatus* was most common in pool streams. According to the general survey, *C. quinquefasciatus* was also found to be the most common around ATREC. Past research suggested that *A. buscki* was the only species found in phytotelmata. However, *Culex inflictus* was also found to inhabit water-holding plants.

Keywords: Dominica, Culicidae, *Culex quinquefasciatus*, *Aedes buscki*, phytotelmata, pool streams

Mosquito borne diseases are becoming more prevalent in the world (Tolle 2009). In Dominica, Zika and Chikungunya have recently made an appearance (Fischer and Staples 2014; Gulland 2016). Several research projects have been conducted in Dominica to explore the diversity of mosquitoes that are present. It has been shown that twenty-four species of mosquitoes are present on the island (Brown et al. 2007). To understand the diversity of species present, two surveys were conducted around ATREC. The first survey was conducted to understand which adult mosquitoes are present around ATREC, while the second survey was conducted to observe the mosquito species present in phytotelmata versus pool streams.

The most common genera of mosquitoes that are responsible for vector borne pathogens are *Culex, Aedes*, and *Anopheles,* with *Culex* and *Aedes* being the common genera present in Dominica (Brown et al. 2007). *Aedes aegypti* is a known vector of Zika, therefore this general survey was primarily conducted to determine if this species is present at ATREC, and if additional measures need to be taken for its prevention. Past research indicated that *A. aegypti* is mostly found in urban environments and since it cannot travel more than 100 m, it was unlikely that *A. aegypti* would be found around the station (Hemme 2010).

In 2007, a comprehensive survey (Brown et al. 2007) was completed in Dominica to determine every species of mosquito present. From the ornamental Bromeliads and *Heliconia caribaea* which were tested, four species of mosquitoes were identified; *Culex bisulcatus, Isostomyia perturbans, Toxorhynchites portoricensis,* and *Wyeomyia grayii* (Brown et al. 2007). However, research previously performed on phytotelmata in 2014 observed that *A. buscki* are the only species of mosquito that prefer phytotelmata at ATREC(Bowman 2014).

Previous reports have explained that *C. quinquefasciatus* are common in Dominica (Brown et al. 2007), however the larval habitats were unknown. A recent study explained that *C.*

quinquefasciatus typically prefer waters with high organic content (Cabi 2016). Due to fluctuation in species diversity in phytotelmata, this survey was conducted again to observe if additional species, such as *C. quinquefasciatus*, might have presented themselves.

Materials and Methods

To perform the general survey, four BG Sentinel Traps were assembled and set around the station to capture adult mosquitoes present around ATREC. The BG Sentinel traps capture mosquitoes by sucking them in with the use of a fan and human lure (Biogents Sweetcent) (Maciel-de-Freitas et al. 2006). They were placed in areas based on where more human activity and vegetation was present. One was placed on the west side of ATREC facing the Atlantic, a second was placed on the north end of ATREC, and the final two were placed on the second floor of ATREC in front of the men's and women's dorms. These traps were checked twice a day and best specimens of each species were point mounted and labeled.

It has been previously found that *A. buscki* are common in phytotelmata (Bowman 2014), therefore phytotelmata was explored again to see if *C. quinquefasciatus* has made an appearance. Water was also collected from rock pools in streams, which contained stagnant, discolored water to observe the species present.

Samples were collected from *Heliconia caribea* and ornamental Bromeliads around the station. They were found in the north and west sides of ATREC, and from areas around the Checkhall River. Four samples were collected from pool streams present at the station. A turkey baster was used to collect the water and then it was poured into the plate to identify if mosquito larvae were present. If larvae were present, the sample was transferred into a sample collecting bottle and the date and location was recorded. When collecting samples from phytotelmata, the turkey baster was placed at the root of the plant in order to obtain more larvae. The samples were transferred to rearing containers

and the larvae were preliminarily identified using the key in Mosquitoes of Dominica (Brown et al. 2007). Some larvae were reared and others were killed using isopropyl alcohol and placed in a vial. Once reared, the adult mosquitoes were identified using the key in Mosquitoes of Dominica (Brown et al. 2007). A total of ten rearing containers were used and each container received fish food (Imam 2014) to feed the larvae. When adults emerged, they were captured with an aspirator and placed in the freezer and ethyl acetate killing jar. After approximately five minutes, they were taken out, point mounted, and identified.

Results

Location	Preliminary Identification and Number of Specimens	Total Specimens	Specimens Identified after Point Mounting
Ornamental Bromeliad	*1- C. quinquefasciatus*	1	*A. buscki*
Heliconia caribaea	*1- C. quinquefasciatus, 1- A. buscki*	20	*A. buscki*
Pool Streams	Unknown	0	*N/A*
Ornamental Bromeliad	*3- A. buscki*	1	*A. buscki*
Pool Streams	*2-* Unknown, *2- A. buscki*	13	*1- A. buscki, 7- C. quinquefasciatus; 3- A. buscki, 4- C. quinquefasciatus*
Pool Streams	*Culex, 1st instars*	2	*C. quinquefasciatus*
Heliconia caribaea	*1- C. quinquefasciatus*	1	*A. buscki*
Ornamental Bromeliad	*1- Culex 1- Aedes*	4	*C. inflictus*
Heliconia caribaea	*2- Culex*	0	*N/A*
Pool Stream	*1- Culex*	0	*N/A*

Table 1: Sample locations, the preliminary identifications, the total specimens collected from each container, and their final identifications. All of the samples obtained were reared.

Date	Number of Specimens	Identification and Number of Specimens
May 30th	2	*1- A. buscki, C. quinquefasciatus*
May 31st	3	*1- A. buscki, 2-C. quinquefasciatus*
June 1st	2	*2- C. quinquefasciatus*
June 2nd	3	*1- A. aegypti, 2- C. quinquefasciatus*
June 5th	3	*1-C. secutor, 2- C. quinquefasciatus*

Table 2: The total number of mosquitoes collected from the BG Sentinel traps.

	Brown et al. (2007)		**Bowman (2014)**		**Current Study (2017)**	
	Bromeliad	Heliconia caribaea	Bromeliad	Heliconia caribaea	Bromeliad	Heliconia caribaea
A. buscki			x	x	x	x
C. inflictus					x	
Is. perturbans		x				
C. bisulcatus	x					
Toxorhynchites portoricensis		x				
Wyeomyia grayii	x					

Table 3: The various species found in phytotelmata from 2007 to 2017.

Figure 1: Female *Aedes buscki.* The distinctive golden dorsocentral lines are present on the mesoscutum.

Figure 2: Male *Aedes buscki.* Note the patches of bright scales on the pleuron and abdomen.

Figure 3: Female *Culex quinquefasciatus*; dorsal view.

Figure 4: *Culex quinquefasciatus;* lateral view, note light bands on anterior margins of abdominal tergites.

Figure 5: Male *Culex inflictus;* dorsal view.

Figure 6 & 7: Female *Culex inflictus;* dorsolateral and lateral views, note the dark dark curved setae on mesoscutum and abdominal tergites without light bands.

Discussion

Both of the objectives of the research conducted in Dominica were successful. The BG Sentinel traps helped to identify which adult mosquitoes are present on the station, with *C. quinquefasciatus* being the most common. One mosquito found in the BG Sentinel traps was tentatively identified as *A. aegypti* but this could not be confirmed due to the missing hind legs and poor condition of the specimen. *Culex secutor* was also identified in the BG sentinel traps. A total of fifteen mosquitoes were identified in the BG Sentinel traps.

The larval sampling from phytotelmata and pool streams water helped to identify the larval habitats of *C. quinquefasciatus* present at the station. According to the data presented, *C. quinquefasciatus* was found in stagnant, discolored water. Further research should be conducted on the *C. quinquefasciatus* habitat on the rest of the island. The larval rearing demonstrated that *A. buscki* inhabit phytotelmata, however *C. inflictus* was also reared from this habitat. Previous research only

found four species inhabiting water-holding plants and *C. inflictus* was not collected (Brown et al. 2007).

Culex inflictus inhabits areas such as crab holes and hollow logs, therefore research should be conducted on the species and the species should be explored for their correlation with water holding plants (Dunn, 1934.)

Acknowledgements

I would like to thank Dr. Woolley, Dr. Lacher, and Dr. Brundage for giving me the opportunity to come on this study abroad. Dr. Woolley played a huge role in helping me identify the mosquitoes collected from the BG Sentinel traps and from the mosquito rearing containers. He was also essential in obtaining the pictures used for this study. I am very appreciative to the professors and fellow students for being patient with me and for answering all of my questions. This project would not have been a success without you all.

References

Bowman, Amanda, “Survey of Mosquito Population of Dominica by Use of Larval Rearing,” 2014

Brown, Heidi, Thomas Zavortink, and Durland Fish. "The Mosquitoes of Dominica.” 2007.

"Culex Quinquefasciatus (Southern House Mosquito)". *Cabi.org*. N.p., 2016.

Dunn, Lawrence H. "Entomological Investigations In The Chiriqui Region Of Panama". *Psyche: A Journal of Entomology* 41.3 (1934): 166-183.

Fischer MD, Marc, and Staples MD, Erin. "Notes From The Field: Chikungunya Virus Spreads In The Americas—Caribbean And South America, 2013–2014". *Annals of Emergency Medicine* 64.5 (2014): 552-553.

Gulland, Anne. "WHO’S Chan Warns Over Spread Of Zika Virus Beyond Latin America".

Hemme, Ryan R. et al. "Influence Of Urban Landscapes On Population Dynamics In A Short-Distance Migrant Mosquito: Evidence For The Dengue Vector Aedes Aegypti". N.p., 2010.

Imam, Hashmat et al. "The Basic Rules And Methods Of Mosquito Rearing (Aedes Aegypti)". *Tropical Parasitology* 4.1 (2014): 53.

Maciel-de-Freitas, Rafael, Álvaro Eduardo Eiras, and Ricardo Lourenço-de-Oliveira. "Field Evaluation Of Effectiveness Of The BG-Sentinel, A New Trap For Capturing Adult Aedes Aegypti (Diptera: Culicidae)". *Memórias do Instituto Oswaldo Cruz* 101.3 (2006): 321-325.

Tolle, Michael A. "Mosquito-Borne Diseases". *Current Problems in Pediatric and Adolescent Health Care* 39.4 (2009): 97-140

BMJ (2016): i1739.