A Survey of Mosquito Populations in the Bryan-College Station Area

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Abstract: Some species of mosquitos can be vectors of serious diseases that can not only cause death, but a significant amount of monetary lost. This survey was performed with the goal of discovering which species of mosquitoes are present in the Bryan-College Station area so that knowledge could be gained on potential disease vectors in the community. This survey was accomplished through frequent larvae sampling from pools of water in various locations. Samples of larvae were collected using plastic bottles and adults were collected using an insect net. Larvae were reared into adults using a mosquito breeder. These adults were then placed into a kill jar to allow proper identification. Based on previous studies, it was expected that there would be a number of medically important mosquito species which vector common diseases that are prevalent in this part of the country. The conducted survey found two common genera from the collected larvae and adult mosquitoes: Aedes and Culex. Specifically, Aedes aegypti (L.) (Diptera: Culicidae) was found to be the most prominent species in the Bryan-College Station area. It is important to understand that our results could have been affected by the low temperatures and drought experienced this year.

Kewords: *Aedes aegypti*, *Culex salinarius*, mosquitoes, disease, vectors

The information gained by this survey is valuable in order to have an accurate account of the potential disease vectors that may be in the community and how their population numbers may be affected in the future by climate changes. Based on previously conducted surveys from the same area, it was believed that species in the genera Aedes, Culex, and, Anopheles would frequently be collected. The warm weather that is usually experienced all year in this area may also lead to the collection of species, which are not as medically important, in the genera Psorophora, Toxorhynchites, and Culiseta.

Mosquitoes are of the order Diptera in the family Culicidae. They feed on the blood of some vertebrates and invertebrates, which can cause discomfort to the host. Many mosquitoes are competent vectors for various diseases: yellow fever, dengue fever, malaria, West Nile virus, and encephalitis. Mosquitoes can be divided into two major types of lifecycles: floodwater and permanent water. This differentiation refers to the types of areas where the adult females lay their eggs and the habitat in which the larvae and pupae mature. Floodwater mosquitoes lay their eggs on the ground in areas that are known to flood in times of rain, such as floodplains and roadside ditches. The eggs are laid individually, and when the water and temperature rise high enough, the eggs hatch within a couple of days. These eggs can be resistant to desiccation for up to a year, which can make it difficult to effectively administer certain vector control measures for these kind of mosquitoes. Permanent water mosquitoes lay their eggs in a variety of environments:

small standing pools of water in tree-holes, flower pots, ponds, or streams. The method in which they lay eggs depends on the species, the eggs can be laid either individually or in a raft. For both classifications of mosquitoes the requirement of at least a thin film of water being present for the entire maturation period from egg to adult, which is one to three days, is shared amongst all species (Adler et al. 2009).

The prevalence of a disease is directly correlated to the abundance of a vector's preferred host and the time of year. This relates to both the temperature of the environment and stage of lifecycle that the mosquito is in. This relationship can be seen clearly in the case of Culex pipiens (L.) (Diptera: Culicidae). Culex pipiens is a major vector of the West Nile virus in North America. A correlation has been found between a significant rise in West Nile virus cases during the late summer and early fall months and the dispersal of C. pipiens' preferred avian hosts. The decrease of bird populations in the area forces the mosquitoes to find blood meals elsewhere, mainly humans, transporting the virus with them as they do (Daszak, Jones, Kilpatrick, Kramer, and Marra 2006). The time of year is also important with regards to disease occurrence because the lifecycle of mosquitoes depends on the climate. For instance, Aedes aegypti (L.) (Diptera: Culicidae), the primary vector of Yellow Fever and Dengue Fever, is a warm weather species found primarily in southeastern portions of the United States. However, there is speculation that they could be the cause of outbreaks of Yellow Fever in the peak of summer as far north as New York (Eisen and Moore 2013).

Determining which species of mosquitoes are in an area allows medical professionals to more accurately predict the occurrence of a disease. This can be done by having knowledge on the disease vector's lifecycle and the behaviors of any reservoir hosts associated with a mosquito disease vector. A major reason for determining which species of mosquitoes populate the Bryan-College Station area is to be more aware of the potential disease vectors in the community.

Materials and Methods

The mosquitoes were collected from 27 March 2014 to 23 April 2014. Clear plastic bottles were used to collect larvae from the pools of water. The larvae were collected with the uncapped clear plastic bottles, which were either fully submerged into the pool of water or skimmed across the surface. Once the larvae were collected the bottles were sealed with caps. Sample vials (BioQuip, Rancho Dominguez, California, U.S.A.) were prepared with ethanol (Decon Labs, King of Prussia, Pennsylvania, U.S.A.) and water so that the larvae could be preserved for later identification. The larvae were then extracted from the plastic bottles using pipettes (Fisher Scientific, Pittsburgh, Pennsylvania, U.S.A.) and transferred to the prepared sample vials.

A sweep net (BioQuip, Rancho Dominguez, California, U.S.A.) was used to collect adult mosquitoes in a field of grass and brush during the evening. The sweep net was swept back and forth though and above the vegetation in a figure eight pattern. The sweep net collecting was done while standing in place and while walking at a slow pace at regular intervals. The net was then flipped over the rim so that the hoop opening is

covered. The end of the net that was flipped was tied closed with a ribbon to prevent collected mosquitoes from escaping. A kill jar was made from a clean and empty glass pasta sauce jar that had a cotton ball (Curad, Mundelein, Illinois, U.S.A.) soaked in acetone (Fisher Chemical, Pittsburgh, Pennsylvania, U.S.A.) at the bottom. The kill jar was then placed at the closed end of the net and the ribbon was removed. The tapered end of the net was then gently shaken to move the mosquitoes into the kill jar. The collected specimen were left in the kill jar for a day. The dead mosquitoes were then transferred into sample vials.

Some of the collected larvae were reared into adults using two different types of mosquito breeders. The first mosquito breeder was constructed using two 2 liter bottles, tape, and scissors (Figure 1). The narrow end where the bottles open was cut off. The collected larvae in the plastic bottles were then transferred, along with some water, to the base of one 2 liter bottle. One of the narrow ends that was cut off was then placed into the base of one of the bottles and taped together. The base of the second bottle was then placed over the taped first bottle. This was done to allow eclosing mosquito pupae to fly out of the base that had water, through the funnel, and into an area without the potential risk of drowning. The second type of mosquito breeder used was a purchased industrial mosquito breeder (BioQuip, Rancho Dominguez, California, U.S.A.) (Figure 1). A water sample with larvae was placed in the bottom of the jar and a funnel allowed the emerging adults to move into the upper portion. The adult mosquitoes were removed from both types of breeders by placing the entire container in the freezer for a short period of time. The mosquitoes were then transferred to a kill jar once enough time had elapsed to immobilize them.

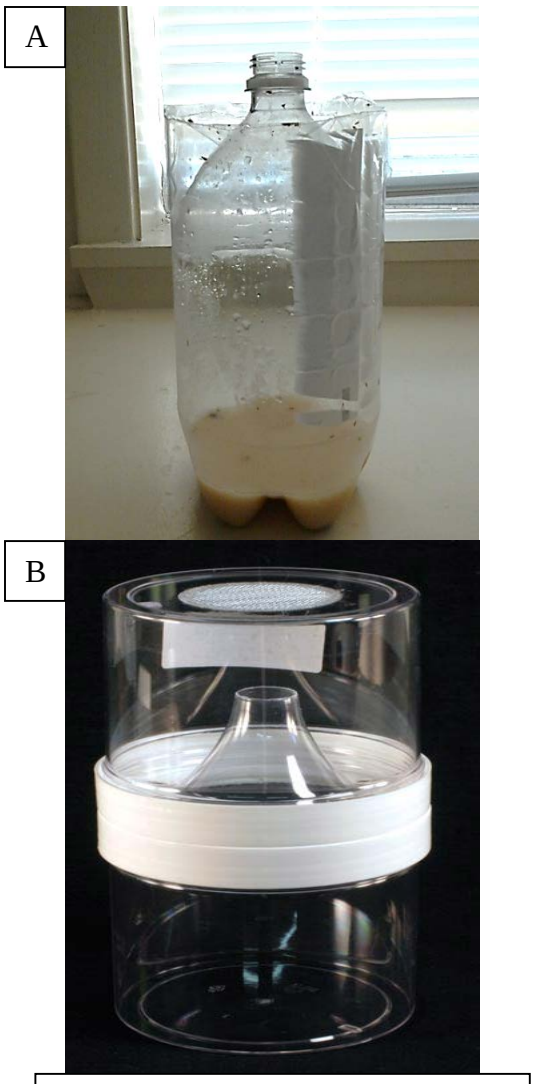

Figure 1. A) Homemade mosquito breeder; B) Industrial mosquito breeder purchased from Bioquip

Various locations throughout the Bryan-College Station area were sampled to get a relatively accurate representation of the local mosquito population. Samples were taken from a puddle of standing water surrounded by trees and brush at Lick Creek Park in College Station, Texas. Samples were also collected from a water meter box at 1406 Village Drive in Bryan, Texas. At 1104 Dominik Drive in College Station, Texas, samples were collected from a pool of water inside a tire that had trees and grass

surrounding it. The samples taken at The Quad located at Texas A&M University in College Station, Texas were obtained from a pool of water inside of a tire. At the Edelweiss Gartens Park in College Station, Texas, samples were taken from the tall grass and bushes surrounding the area.

Results

After identifying the collected larvae, two mosquito genera were collected: Aedes and Culex. A total of 13 larvae were collected. Six larvae were identified as Aedes, and the remaining seven larvae were identified as Culex. All six of the Aedes mosquitoes were found to be Aedes aegypti (Table 1).

From the seven Culex larvae three different species were found in varying numbers: three Culex quinquefasciatus (Say) (Diptera: Culicidae), two Culex salinarius (Coquillett) (Diptera: Culicidae), and two Culex restuans (Theobald) (Diptera: Culicidae) (Table 1).

A total of 22 adult mosquitoes were collected. Out of the 22 adult mosquitoes both of the genera Aedes and Culex were attained. Out of the collected adults, 18 were found to be Aedes, and four as Culex. All of the specimens from the genus Aedes were identified to be Aedes aegypti (Table 1). The four from the genus Culex were identified as Culex salinarius (Table 1). From both adults and larvae a total of 35 were collected: 24 Aedes aegypti, two Culex restuans, six Culex salinarius, and three Culex quinquefasciatus.

Table 1. Identifications of Collected Mosquito Larvae and Adults

Date	Location (Latitude, Longitude)	Number of larvae	Larvae identification	Number of adults	Adults identification
3/27	Lick Creek Park (30.571485, -96.218755)	2	*Aedes aegypti*	15	*Aedes aegypti*
3/31	1406 Village Drive (-30.658305, -96.34549)	4	*Aedes aegypti*	1	*Aedes aegypti*
4/7	1104 Dominik Drive (30.628269, -95.311336)	2	*Culex restuans*	0	N/A
4/15	The Quad (30.613216, -96.336566)	5	*Culex salinarius* *Culex quinquefasciatus*	4	*Culex salinarius*
4/18	Edelweiss Gartens (30.564903, -96.295552)	0	N/A	2	*Aedes aegypti*

Discussion

The results showed a prevalence of the genera *Aedes* in the Bryan-College Station area, with *A. aegypti* being the most prevalent species (Figure 2). All of the species that were found are of medical importance in the veterinary and medical fields. *Aedes aegypti*, which is known to be a vector of many diseases, is seen to predominantly vector dengue fever (Monath 1994). Dengue fever cases can be fatal and are becoming more common in Texas. The next most prominent species found by the survey was *C. salinarius* (Figure 2). This particular species of mosquito is seen to be a major vector of West Nile virus (Dohm, O'Guinn, Turell, and Sardelis 2001). *Culex restuans* is one of the two mosquito species that had the lowest prevalence in the Bryan-College Station area. The mosquito *C. restuans* is also known to be

a vector of West Nile virus (Dohm, O'Guinn, Turell, and Sardelis 2001). The second mosquito species that had the lowest abundance in the Bryan-College Station area was *Culex quinquefasciatus*, which is also a vector of West Nile virus (Andreadis, Armstrong, Bueno Jr, Dennett, Molaei, Tesh, and Real 2007). The species collected indicates that we have possible vectors of serious diseases, such as dengue fever and West Nile virus. Knowing which species in our community might possibly be a threat to our health is a major benefit in the medical field. Having information on the location of mosquito species in town can help eliminate any breeding sites that might become problematic for public health. A factor that might have affected the results is the lower temperatures that were experienced this year. Mosquitoes prefer higher temperatures with around 75°F being ideal for mosquito development. The average temperature for the collecting period was 37°F. The average temperature that occurred during collecting is far below the ideal temperature, which could be huge factor as to why there were so few mosquito species collected. The research that was conducted could be expanded on in the future by conducting a similar survey during a warmer time of the year and by surveying more places in the Bryan-College Station area.

From the data that was gained it can be seen that some of species of mosquitoes in our community are those that are vectors of serious diseases. Since this information has been acquired it can be used so that local mosquito populations are regularly monitored so that possible dangers associated with these mosquitoes could be stopped.

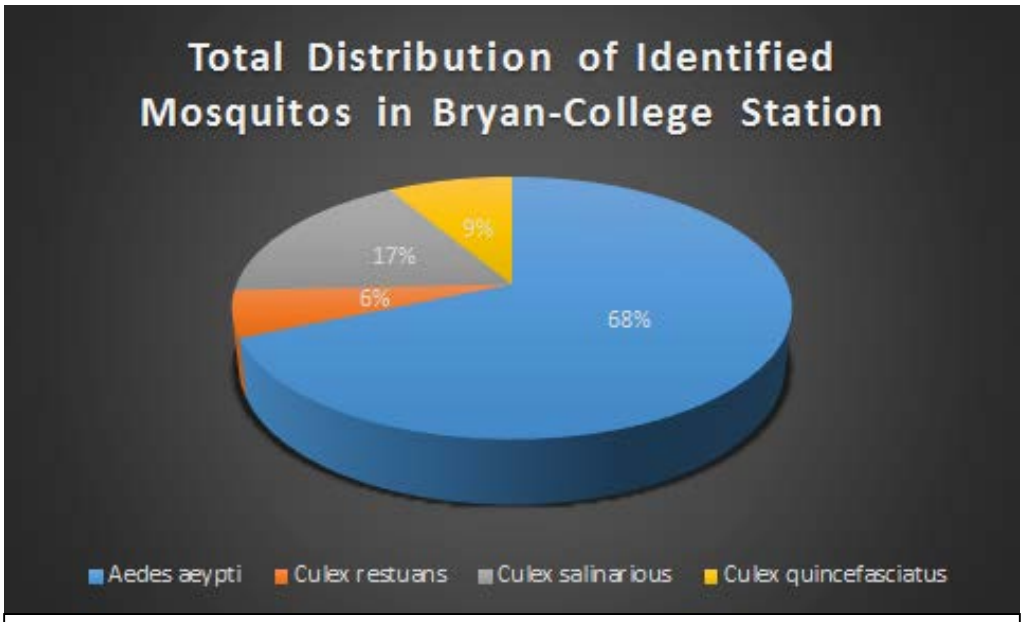

Figure 2. The total distribution of the identified mosquito genera and species found in the Bryan-College Station area.

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