

The Impact of College Station, Texas Weather Trends on Mosquito Populations

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Abstract: Mosquitoes pose a significant threat to human society medically, as a competent vector of diseases such as Malaria and Yellow fever, and economically by vectoring diseases to commercial domestic animals that harm and may lead to death, dealing great losses to such companies. With such importance, the need for greater knowledge on the life cycles of mosquitoes is invaluable in the fight to eradicate and control mosquitoes. The goal of this study was to survey the College Station landscape and area surrounding Texas A&M University to determine the species and genus of mosquitoes found to inhabit the area as well as the weather trends during the time of mosquito collection to observe the effects such trends may have on the mosquito populations. During the period of February-March this year, the average temperature was lower than what was seen in previous years. Furthermore, during the month of April lower temperatures had continued to sporadically occur, which led to the disruption in the abundance of mosquitoes seen around this time in previous years. Due to the abnormal weather patterns that were experienced in this region of Texas this year, the mosquito population has been greatly lacking in numbers up until late April. During our survey and collection the largest number of individuals were of the *Culex* genus, with several *Culiseta* species also found.

Keywords: temperature, behavior, mound, environment

Mosquitoes (Diptera: Culicidae) are an often pest-defined, medically-relevant family of insects that are known vectors of numerous zoonotic pathogens and diseases that has led to vast amounts of resources being poured into mosquito research and control to prevent and reduce health issues and mortality. Mosquitoes are competent vectors of diseases including Malaria, Yellow Fever, Western & Eastern Encephalitis, and Chikungunya that annually cause millions of infections and deaths in

humans and a number of domesticated species globally, with billions being spent each year for disease prevention, control, and treatment of symptoms as well as the amount lost commercially from animals lost to mosquito-borne diseases. To understand, and eventually prevent the spread of these diseases, the life cycles of those species of mosquitoes responsible for vectoring these diseases needs to be well understood. A significant aspect of such research is the effect weather trends have on these species,

which may affect how effective they are at spreading diseases.

Mosquito species have varying life cycles that have different morphology (egg composition, larvae shape, etc.) and behavior (feeding preference for time and host, larvae response to agitation, reproduction methods, etc.) that can all be affected by the weather trends of a specific area and changing the species richness and density of that area. Thus, we looked at the landscape of College Station, Texas, in particular the surrounding areas of Texas A&M University, for mosquito populations and weather trends. Observations and collections were made to determine the species that were found, the density of the species found, and the weather during the time period of mosquito collection.

Materials and Methods

Collection of mosquitoes involved the collecting of larvae that were gathered using a plastic cup, following by identification of species (Stojanovich and Pratt) and then placed within a mason jar. The mason jars were used to rear the mosquito larvae until they reached adulthood. A small hole was cut into the mason jar lid and a plastic cup was flipped upside down and attached to the lid so adults were allowed to enter the cup following pupae ecdysis. Larvae were allowed to pupate and hatch into adults, where after the adults were removed for identification (Stojanovich). Collection of mosquito populations were made at three

sites in the area, the first being at John Crompton Park (201 Holleman Dr. W), the second being Research Park at Texas A&M (Research Pkwy), and lastly at the National Center for Theapeutics Manufacturing on campus of Texas A&M (Discovery Dr.). Three collections were to be completed for each site, but a third was not done at John Crompton Park and Research Park. Weather trends were observed by local weather stations, with average temperature and precipitation as well as temperature and dew point fluctuations observed over the time period of our research.

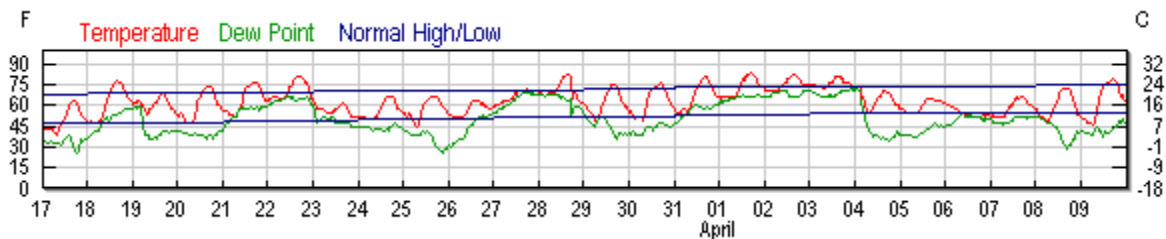
Results

Of the three sites collected from, only the second collection of our third collecting site was found to have a mosquito population, with mosquito larvae of *Culex tarsalis* (Coquillett), *Culex quinquefasciatus* (Say), *Culex peus* (Speiser), *Culiseta incidens* (Thompson), *Culiseta melanura* (Coquillett) and *Culiseta inornata* (Williston) found and reared. Six individuals were reared to adulthood, with only four were in adequate shape for identification (two *C. melanura*, one *C. tarsalis*, and one *C. inornata*). Weather trends were observed from March 17th to April 9th, with an average minimum temperature of 53°F, an average maximum temperature of 85°F, and a total precipitation accumulation of 0.63 inches.

Table 2: Weather data during period of study observation. Collection dates highlighted in yellow.

MARCH				
Date:		Avg. Temperature (Deg. F)	Low Temperature	Precipitation (Yes/No)
17		62	39	N
18		60	47	N
19		61	51	N
20		60	45	N
21		65	51	N
22		71	60	N
23		57	51	N
24		60	50	N
25		57	45	N
26		57	49	N
27		66	60	N
28		72	60	Y
29		63	49	N
30		62	47	N
31		67	54	N
APRIL				
1		75	44	N
2		77	57	N
3		77	72	N
4		64	55	Y
5		60	54	N
6		56	52	Y
7		59	51	N
8		61	49	N
9		62	44	N

Figure 1: Temperature Fluctuations from March 17th-April 9th, 2014



Discussion

On the date of March 22, 2014, our group set out to perform our first mosquito survey, but unfortunately we were not able to locate any larvae at any of the three locations. We attributed this to the consistent cold fronts that were brought into the region the week prior as the low temperatures ranged from the mid 30's to the low 50's. Along with the fact that there was no rainfall the week before, the chances of having found larvae were greatly diminished. One week later on our second

survey, the weather trends did not change significantly in that the low temperatures were only slightly increased and when it did rain it only rained two days before the collection. In the two sites that we did not locate any specimens (John Crompton Park and Research Park), we concluded that it could also be due to the fact that there were not many hosts present that could provide blood meals on a consistent basis, as in colder temperatures humans are generally not found outside at parks in large numbers. However, the one successful collection that we were

able to perform was in front of the National Center for Therapeutics Manufacturing (NCTM). Near the front of the building, a corner of the parking lot was roped off due to a break in one of the water pipes that had leaked out, created a large standing puddle - the perfect setting for female mosquitoes to oviposit their eggs. After noticing that the puddle was there for several days throughout the week we decided to investigate and upon inspection there were numerous larvae floating around. In this collection we were able to retrieve larvae of the species *Culex tarsalis*, *Culex quinquefasciatus*, *Culex peus*, *Culiseta incidens* and *Culiseta inornata*. From our larvae, we were able to rear 6 adults, but unfortunately 2 of the samples were not in viable condition to be identified in the lab. Out of the four adults we had remaining, one of them we ID'ed as *Culex tarsalis*, another was *Culex inornata*, and the other two were both found to be *Culiseta melanura*. The month of April brought higher temperatures overall, but at inconsistent intervals. After three days (April 1-3) of temperatures in the mid 70's, there was a considerable drop to the low 60's, and by the end of the week, temperatures were once again in the 50's. Despite more favorable conditions at the start of the period in between the second and third survey for mosquitoes, the random days of declining temperatures combined with a lack of heavy rainfall were conditions not favorable for mosquito oviposition.

While *Culiseta* species are more prevalently found in coastal regions such as California, they can also be found in various areas in the southern part of the country, to include Texas. All of the genera and species we collected have been previously found in

Texas, including a very prevalent number of *Culex* species. The types of habitats that the larvae can be found in vary. Most *Culiseta* species are cold-adapted, allowing their eggs to be able to hatch during colder parts of the year. This may explain why we found three species from this genus in our collection, since we have been experiencing a significant number of cold fronts during the spring of 2014. The first *Culiseta* species we found was *Culiseta incidens*. This species typically appears during the cooler months, in larval habitats such as isolated pools, hoof prints, and rain barrels. They are known to prefer domestic mammals as a host and will feed on humans. *Culiseta inornata* is found primarily in late fall through spring. Larval habitats are varied and can include temporary or semi-permanent woodland pools, seepages, rain pools, ditches, and canals; during their adult stage is when they overwinter. They are known to bite humans, but their preferred hosts are large domestic animals. The other genus we found was *Culex*, with one of the species we found being *Culex peus*. The larval habitats for this species include foul and slightly foul water from natural and artificial pools, catch basins, pastures, and man-made containers. They overwinter in stumps and burrows, which could be found in the area of our collection site. We also identified *Culex quinquefasciatus* in our collection. *Culex quinquefasciatus* is found in the lower latitudes of temperate regions, so it makes sense for us to find this species in College Station, Texas. This species oviposits in wastewater areas, birdbaths, old tires and other containers that hold water. The most common species found was that of *Culex tarsalis*. Larval habitats are abundant in

most hot valley areas with agricultural usage of water and in freshwater sources that do not reside in tree holes. The adults rest by day in man made shelters, animal burrows, and tree holes, which can all be found in the area of our collection site. *Culex tarsalis* blood feeds a significant amount on avian hosts (Reisen et al. 2002), which is possible as there is an abundant wild bird population in the College Station area.

Our study was hampered by the low number of samples we could collect from all three sites, which is possibly due to the significantly lower temperatures than past year averages that may have led to a poor environment for which mosquitoes could grow and oviposit. More research of the area

through yearly observations of mosquito populations would provide additional information for a complete identification of mosquito species inhabiting College Station, and more information on the weather trends that could be correlated with any changes in mosquito populations. With the information gathered during our research and further studies, we will be better able to understand the species of mosquito that vector pathogens which inhabit the area, and give us the ability to create control and eradication programs to prevent possible disease occurrences.

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