Comparison of Mosquito Population Between Urban Area of College Station, TX and Rural Area of Snook, TX

Garrett Jackson, Andrew Kim, Cristobal Lopez, Janelle McMahan
Texas A&M University, Department of Entomology

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Abstract: In order to determine where to better allocate resources and pest management, we compared the mosquito population between urban and rural areas. We sampled adult mosquitoes and larvae in College Station and Snook as our representative populations. Our methods included a mosquito trap built from PVC and fine mesh for the adult mosquitoes, and a dipper to sample the larval population. Our results showed inconclusive data for the adults due to malfunction of the mosquito trap. The data for the larvae showed a higher density in urban populations however, this data maybe be deceiving due to the timing of the collection of larvae in the rural area. The rural population makeup was dominated by the *Psorophora* (Fabricius) (Diptera: Culicidae) species. On the other hand the urban population makeup consisted of *Aedes vexans* (Meigen) (Diptera: Culicidae) and *Culex quinquefasciatus* (Say) (Diptera: Culicidae). We believe that the *Psorophora* eliminated the other competition due to its carnivorous nature and is the reason for the lack of variation of species in the rural population. In regards to population density comparison, our results proved to be inconclusive due to factors unaccounted for. Although, we believe our data regarding population makeup is accurate and the data can be used to analyze the effectiveness of the integrated vector manage of the College Station area nearing the winter months.

Keywords: College Station, Snook, urban, rural, Mosquito Population

Each mosquito listed is among the twenty most common species of mosquitoes found in Texas (Jackman and Olson 2015). *Aedes albopictus* (Skuse) (Diptera: Culicidae) mosquito is known for being cold-hardy and develops among rain and hand-filled containers (Mullen and Durden 2009). It's prevalent in the southern United States in suburban as well as rural areas and its flight range is within 200 yards (Mullen and Durden 2009). The *Aedes vexans* (Meigen) (Diptera: Culicidae), a daytime feeder, is a floodwater mosquito. Its habitats are floodplains like low-laying depressions, lakes, and prairie potholes. Its flight range can be ten to twenty-five miles distance (Valent 2015). The eggs of the floodwater mosquito are able to survive hot and cold climates and hatch when the area is flooded. The *Psorophora columbiae* (Dyar and Knab) (Diptera: Culicidae) is also a floodwater mosquito and its larval habitat is large pastures and grass fields subject to flooding. It feeds at night and its flight range can be between five to ten miles (UF 2015). *Psorophora ferox* (Van Humboldt) (Diptera: Culicidae) is also a nighttime feeder and it prefers pools in woodland environments. It is prevalent in southeastern United States and can travel up to two miles (Holderman and Connelly 2015). *Culex quinquefasciatus* (Say) (Diptera: Culicidae), the southern house mosquito, normally flies in the night

and lays its eggs at standing bodies of waste water. Its flight range is a .25-.5 mile distance (Hill and Connelly 2015). These mosquitoes, being prevalent to the College Station and Snook areas while being able to vector diseases such as West Nile, have become a serious problem. With this experiment, we attempted to compare the mosquito populations in urban and rural environments of the College Station and Snook areas. This information can prove to be valuable in knowing where to allocate pest management efforts and resources. This same concept can be applied to the distribution of vaccines of mosquito vectored diseases. We hypothesized a larger population density in the rural area of Snook, TX due to less maintenance and quality control of the environment leading to a more suitable breeding ground for mosquitoes. We believe that the makeup of the population should be similar due to the close proximity of the designated locations.

Materials and Methods

Methods for capture and curation of adult mosquitos.

In order to capture adult mosquitoes, a trap needed to be built. PVC couplings were attached to a fine mesh via duct tape to form an enclosed cylindrical container. One end of the trap was kept open to allow the entry of mosquitoes. A paper funnel was then added to the interior of the same end to prevent the escape of mosquitoes. A small mini fan, powered by an external battery pack, was also attached to the same end to force entry of the mosquitoes into the container. Strings were attached to the same end as the fan in order to hang it from various locations. A light source was also attached to the strings to draw the mosquitoes towards the fan. One pound of dry ice was placed in a styrofoam coolers. Holes were poked in the styrofoam coolers and were suspended in a tree above the trap via duct tape in order to draw mosquitoes to the general vicinity. The traps, set at the locations described in the results sections, were set after sundown because that is when most mosquitoes are active. The traps were collected after 12 hours. Upon retrieval, the traps containing the mosquitoes were placed in a freezer for 30 minutes to kill them. The mosquitoes were then collected, counted, and placed in vials containing an alcohol based hand sanitizer.

Methods for capture and curation of larvae.

To collect larvae, bodies of stagnant freshwater or pools created as a result of rain were sought out (collected at the locations described in the results section). Tupperware was used as a dipper to sample the larval population in the bodies of water. Approximately 1500 mL of water containing larvae was collected as a representation of the population. Several bodies of water were sampled in both urban and rural settings. A hole was cut into the bottom of a red solo cup and a small coffee filter was placed on the top end held by a rubber band. The Tupperware containing the water samples was poured into a one liter measuring cup in order to record the volume of the water samples. In order to cure the larvae they must be cured with boiling water. A pot of water was boiled to a low simmer. While the water boiled excess water was removed from the measuring cup leaving a low water level and the larvae. Once the water was ready it was ladled into the Tupperware containing the larvae. They were left to cure for approximately thirty seconds. The water was then poured through the cup and filter to separate the larvae. The filter containing the larvae was removed from the cup and spread out on a table to count the larvae with ease. Once the larvae were counted they were

picked with tweezers and stored in vials filled with ethanol.

Results

Urban Areas

Research Park

Coordinates: (30.6018392, -96.3600326

Date 28-X-15
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Date: 17-XI-15
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Wolf Pen Creek

Coordinates: (30.618863, -96.309701)

Date: 17-XI-15
Water Volume: N/A
Adult Count: 0
Larval Count: 0
Extra Description: Sampled from stagnant pond

North Point Crossing

Coordinates: (30.627788, -96.337353)

Date: 2-XI-15
Water Volume: 1490 mL
Adult Count: 0
Larval Count: 30 *Culex quinquefasciatus*
Pupae Count: 4 *Culex quinquefasciatus*
Extra Description: Sampled from stagnant water in an empty plant pot

205B Sterling St.

Coordinates: (30.614324, -96.311494)

Date: 17-XI-15
Water Volume: 1370 mL
Adult Count: 0
Larval Count: 66 *Aedes vexans*
Extra Description: Sampled from the backyard of this address

Rural Areas

West Villa Maria Road

Coordinates: (30.614936,-96.401103)

Date 28-X-15
Water Volume: N/A
Adult Count: 0
Larval Count: 0
Extra Description: Sampled from tree line near a creek at the back of the school; 15mph winds

Date: 17-XI-15
Water Volume: N/A
Adult Count: 1 *Aedes Albopictus*
Adult Count: 2 *Psorophora*
Larval Count: 0
Extra Description: Sampled from tree line near a creek at the back of the school; light precipitation 0.50 inches, 9mph winds

Snook Texas

Coordinates 1: (30.498868, -96.469814)

Date: 06-XI-15
Water Volume: 1200 mL
Adult Count: 0
Larval Count: 5 *Psorophora*
Pupae Count: 2 *Psorophora*
Extra Description: Sampled from ditch water in front of house

Coordinates 2: (30.496028, -96.472952)

Water Volume: N/A
Adult Count: 0
Larval Count: 1 *Psorophora*
Extra Description: Sampled from pool of water next to the side of the road

Coordinates 3: (30.502483, -96.463759)
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Coordinates 4: (30.499978, -96.460787)
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Coordinates 5: (30.502047, -96.472101)
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Coordinates 6: (30.492231, -96.468329)
Water Volume: N/A
Adult Count: 0
Larval Count: 0

Discussion

The data show a significant skew in population toward the urban areas for larval collection, while the opposite was true for rural areas, with the adult collection being higher. Our hypothesis stated that the mosquito population density would be higher in rural areas due to the less regulated pest control. Solely in terms of numbers, the urban areas would seem to be the most densely populated of two regions totaling 96 larvae. Ultimately, our results remain inconclusive due to a number of confounding variables.

The main factor that may have led to the lack of adults in the urban area is competing light sources. Many of the urban areas were surrounding highly populated areas which were well lit for the majority of the time. The rural areas showed a predominance in the *Psorophora* genera. A possible explanation for this could be the fact that *Psorophora* lay their eggs in dry areas susceptible to flooding. Thus their eggs are highly resistant to desiccation and may even require multiple immersions in water to hatch. In addition, *Psorophora* larvae are carnivorous. Their consumption of other larvae could explain the lack of other genera that also tend hatch in potential flood areas such as *Aedes*. A possible explanation for the low number of larvae collected in the rural area is that the time of the collection was after most of the larvae and pupae had molted.

A major confounding variable to our data is the weather patterns during our collection days. A few days exhibited high winds and light storms that may have reduced the effectiveness of the adult traps. In addition, drastic fluctuations and drops in the temperature occurred during the time we chose to set up the traps. The level of precipitation was 0.50-1.00 inches the days of collection in the urban areas. The highs and lows of each of the days ranged near 20-25 degrees of high 70s in the afternoons and high 50s to low 60s by dusk. There was also an increased wind speed with an average of 9 to 15 miles per hour during the collection times of one of the urban locations.

The aim of our experiment was to contribute to data used to analyze the effectiveness of the integrated vector management (IVM) of the College Station area nearing the winter months decrease in strict regulation compared to the summer months. Due to the drastic fluctuations in temperature and weather patterns no causative factors could be established

between the number of mosquitoes found and the IVM methods employed by College Station.

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