Scientific Note

Diel patterns of *Aedes aegypti* (Diptera: Culicidae) after resurgence in St. Augustine, Florida as collected by a mechanical rotator trap

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In 2016, *Aedes aegypti* mosquitoes exhibited a significant resurgence in St. Augustine, Florida. The population focus established itself in downtown St. Augustine, an urban tourist destination with millions of visitors annually. *Aedes aegypti* is of particular concern, being the primary vector of Zika, dengue, chikungunya, and yellow fever. The reintroduction of *Ae. aegypti* to high traffic areas of St. Augustine presents an unwelcome risk to the local population, supporting the need for further research into more effective ways to control this species and mitigate its ability to spread disease to the public.

An understanding of the host-seeking diel patterns of mosquitoes could contribute to their control. According to Leming et al. (2014), there are physiological processes and behaviors that are regulated by the biological rhythms of mosquitoes. These processes and behaviors play a large role in the transmission of many mosquito-borne diseases. A study focusing on dengue vectors (*Ae. aegypti* and *Ae. albopictus*) stated how influential the activity rhythms are to understanding not only the mosquito species and their behaviors but also the characteristics of their virus transmission (Lima-Camara 2010). Due to this direct connection between biological rhythms, such as diel patterns, and disease transmission, a more sound understanding of these patterns will increase the success of our integrated mosquito control practices.

To our knowledge, the diel patterns of *Ae. aegypti* have principally been evaluated by human landing rates. These diel patterns have been documented in Tanzania occurring between 06:00 to 07:00 and again between 17:00 to 19:00 (Trpis et al. 1973). A study conducted in Trinidad found similar morning and afternoon peak time periods, including 07:00 and 17:00. However, this study did show a variation as a third peak of activity was found at 11:00 (Chadee and Martinez 2000). This presented a trimodal pattern of activity as opposed to the bimodal pattern recorded in Tanzania. According to their results, 90% of females in urban areas were recorded during daylight and twilight time periods and 10% were recorded during the nighttime period. In contrast, no nocturnal activity was recorded in rural areas. (Chadee and Martinez 2000).

These peak periods can only be used as a reference for beginning to understand *Ae. aegypti* in Saint Augustine, FL. The local *Ae. aegypti* have varying characteristics and behaviors that need to be analyzed to determine the most efficient control measures. Using a mechanical trap design provides multiple advantages when compared to human landing rate counts. The most notable advantage is elimination of the risk of pathogen transmission, such as Zika, to human subjects. Another advantage is consistent data collection, as traps are not threatened by the natural variability among human attractiveness and implementation of landing rate protocols.

While using a mechanical trap does increase efficiency and safety, it may track mosquito abundance less dramatically, since it does not possess as many attractive qualities as a live host. However, the deployment of a mechanical rotator mosquito trap to analyze the host-seeking diel patterns of *Ae. aegypti* in St. Augustine would allow a reproducible understanding of the host-seeking behaviors of *Ae. aegypti*. Additionally, it is an opportunity to judge the concept of using mechanical rotator traps to assess the diel activity patterns of mosquitoes despite human competition in the target habitat. It is predicted that the host-seeking diel patterns of *Ae. aegypti* in St. Augustine will be similar to the biomodal patterns of activity recorded in Tanzania, but due to varying weather patterns and climate differences, there are likely slight variations as to the exact peak time frame.

Surveillance data collected by Anastasia Mosquito Control District of St. John’s County (AMCD) revealed a strong presence of *Ae. aegypti* located in the downtown area of Saint Augustine during the 2016 season. From this data, three separate sites were chosen throughout the downtown Saint Augustine area based on their high activity of *Ae. aegypti*. These sites included Site 1 (29.883834, -81.314417), Site 2 (29.895839, -81.315446), and Site 3 (29.895532, -81.316158). Each site had characteristics of ideal habitats for *Ae. aegypti*, including bromeliads, shaded areas, containers, and other vegetation. There were similar street lights at all three sites.

The site 1 traps were placed behind a church located in a heavily populated area in which lots were close to one another with moderate traffic flow. The traps were placed near heavy vegetation that included copious amounts of bromeliads and ample coverage by palms that provided shade. Surrounding areas beyond the trap location included a concrete area outside the church building as well as a wooden fence line directly behind the traps. This site did not possess a large number of artificial containers when compared to the other two sites.

Site 2 was located in an alley with houses tightly congested in the midst of downtown Saint Augustine. This differed from the slightly less congested area of site 1. Although the alley itself did not have a lot of traffic concerns due to its compact size, the area immediately adjacent to the alley was a heavy traffic area of downtown Saint Augustine. The trap location had an air conditioner unit located directly beside and was completely shaded. The bordering yards also contained a moderate amount of vegetation, including bromeliads, and were densely encompassed by containers. This differed from the surrounding area of site 1, in which the number of artificial containers was limited.

As for site 2, site 3 was located in the backyard of a residence in a heavily populated area with a considerable amount of traffic, as it was also located in close proximity to downtown Saint Augustine.