Bloodfeeding patterns of *Aedes aegypti* mosquitoes in San Joaquin County, California

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ABSTRACT

Aedes aegypti were first discovered in San Joaquin County, CA, in 2019. This species poses a threat to human health, as they can transmit viruses such as dengue, yellow fever, chikungunya, and Zika. Understanding the bloodfeeding patterns of *Aedes aegypti* in the county is crucial in determining risk of pathogen transmission. In this study, bloodmeals from *Aedes aegypti* and various native *Aedes* species collected in San Joaquin County were identified to host species using PCR and DNA sequencing. Feeding patterns of *Aedes* species were compared to determine specific differences in host species selection and to elucidate the portion of human bloodmeals, and thus potential risk of virus transmission, by *Aedes aegypti*.

INTRODUCTION

- *Ae. aegypti* were first detected in San Joaquin County, CA (SJC) in 2019. The other tested *Aedes* species, *Ae. vexans, Ae. nigromaculis*, and *Ae. melanimon,* are endemic to SJC.
- *Ae. aegypti* mosquitoes can transmit viruses like dengue, yellow fever, and chikungunya.
- Dengue virus has been detected in CA and may pose risks in SJC due to *Ae. aegypti* presence[2].
- The majority of *Ae. aegypti* bloodmeals are human, while those of the other *Aedes* species are more variable[3,4].
- In tropical regions, humans make up 70-99% of *Ae. aegypti* bloodmeals. In TX, HI, and FL, humans made up 31%, 53%, and 83% of bloodmeals respectively[3,4].

- Unlike WNV, which has an enzootic cycle, dengue is maintained in a mosquito-human-mosquito cycle (Figure 1).

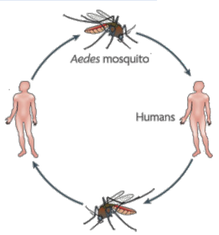


Figure 1. Dengue transmission cycle.

OBJECTIVES

- Compare host selection patterns between *Ae. aegypti* and other *Aedes* species in San Joaquin County to illustrate the potential risk of arboviral disease transmission to humans.
- Determine the prevalence of human bloodmeals from *Ae. aegypti* in San Joaquin County.

METHODOLOGY

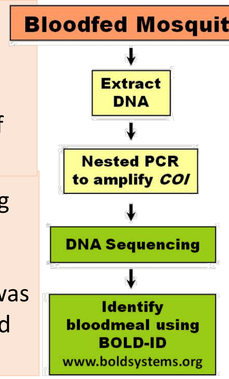
Mosquito Collection

- The San Joaquin County Mosquito and Vector Control District collected *Aedes* mosquitoes.
- *Ae. vexans*, *Ae. nigromaculis*, and *Ae. melanimon* were caught using a CO2 trap while *Ae. aegypti* were caught using a BG-Sentinel trap.
- All *Ae. aegypti* mosquitoes were caught in suburban residential areas while all other *Aedes* were caught in rural areas near bodies of water across SJC.

Figure 2. (Left) CO2 trap. (Right) BG-Sentinel trap.

Bloodmeal Identification

- Extraction was done using the DNeasy Blood and Tissue Kit from Qiagen.
- Nested PCR was done to limit the amplification of pseudogenes and increase PCR yield.
- To determine which hosts are being fed on by the mosquitoes, a 658-bp "barcoding gene" called the cytochrome c oxidase 1 (COI) gene was amplified, sequenced, and submitted to boldsystems.org.



PRELIMINARY RESULTS

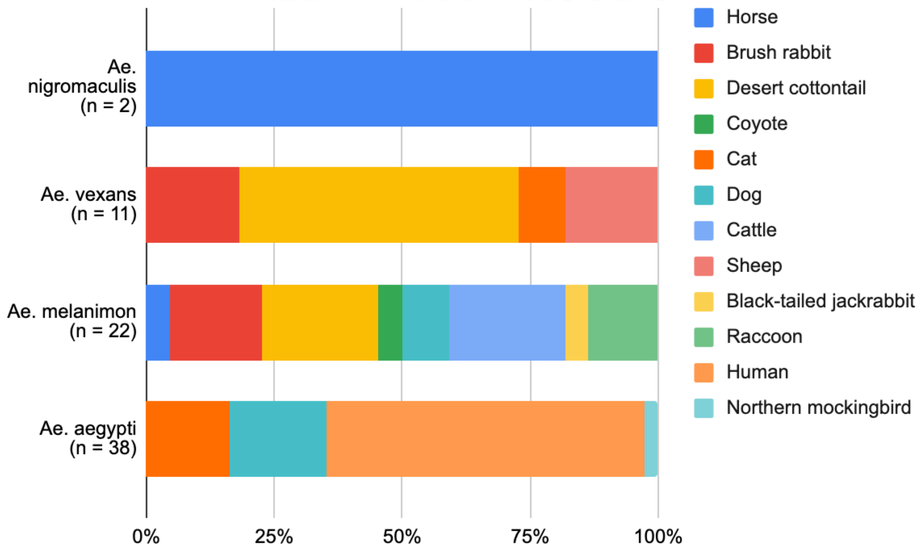


Figure 3. *Aedes* bloodmeal hosts.

- 38 *Ae. aegypti* and 36 other *Aedes* bloodmeals were identified to a host.
- The two bloodmeals from *Ae. nigromaculis* came from horses while *Ae. vexans* fed mostly on desert cottontail (54.5%) followed by sheep (18.1%) and brush rabbit (18.1%). *Ae. melanimon* fed equally on cattle (22.7%) and desert cottontail (22.7%) followed by brush rabbit (18.2%).
- *Ae. aegypti* fed predominantly on humans (60.5%) followed by dogs (18.4%).

DISCUSSION

- Non-*aegypti* mosquitoes were caught across 14 rural areas which coincided with bloodmeal hosts including cattle, sheep, and desert cottontail. The rural area also allowed for a wider range of hosts to be fed on by the other *Aedes*.
- The highest host diversity among the other *Aedes* was in *Ae. melanimon,* but it also had twice the sample size as *Ae. vexans*.
- *Ae. aegypti* mosquitoes were caught in 13 residential areas due to their behavior of dwelling alongside humans and in man-made containers like flowerpots[5]. This contributes to the majority of bloodmeals being humans and domesticated dogs and cats.
- Having a decreased proportion of human bloodmeals from 70-99% in tropical regions to 60.5% in SJC could dampen the transmission cycle of diseases like dengue[3]. In TX, Zika transmission via *Ae. aegypti* was reduced likely due to the relatively low percentage (31%) of human bloodmeals[4].
- Previous work in SJC has shown that the other *Aedes* showed <10% human bloodmeals (unpublished). In this study, none of the other *Aedes* mosquitoes in this study fed on humans, only *Ae. aegypti*.
- Given the propensity to feed on humans and the traveler cases of dengue in SJC each year, the mosquitoes which are of largest risk toward human populations in SJC are *Ae. aegypti*.
- The work presented is preliminary and larger sample sizes of *Aedes are* being tested to illustrate a wider array of host bloodmeals.

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