

## ABSTRACT

The primary control effort for mosquito-borne diseases is using insecticides to kill mosquitoes. It is critical to assess if mosquito populations are becoming more resistant to commonly used insecticides as they would reduce their efficacy and limit the efficacy of disease control efforts. Starting in 2018, we initiated an ambitious, long term project to monitor insecticide resistance in cities along the Texas/Mexico border. We collected *Aedes* mosquito eggs from between 5 and 9 cities along the border every week. We partnered with local city authorities, including vector control and environmental health officers, to identify up to 4 field collection sites in each participating city, using multiple oviposition cups at each site. Collected eggs were hatched in the lab, identified to species as adults, and then tested for insecticide resistance using the CDC Bottle Bioassay to commonly used insecticides: Permethrin, Deltamethrin, and Sumethrin. Our efforts in 2020 were disrupted in March by the SARS-COV2 pandemic, but we have resumed collection and testing efforts as of September 2020.

Here we present some of the key findings related to both geographic and temporal resistance to insecticides in the common disease vectors in South Texas through 2020.

## Introduction

In South Texas, *Aedes aegypti* and *Aedes albopictus* mosquitoes can be found in the Lower Rio Grande Valley (consisting of Cameron, Hidalgo, and Starr Counties) which directly borders northern Mexico.<sup>2</sup> Both species rely on environmental factors such as humidity, seasonal temperatures, and precipitation patterns for successful reproduction cycles.<sup>1</sup> Thus, making the Lower Rio Grande Valley an ideal habitat for *Ae. aegypti* and *Ae. albopictus* due to the sub-tropical sub-humid marine climate.<sup>3</sup> This puts the public health at risk due to *Ae. aegypti* and *Ae. albopictus* being vectors for chikungunya, dengue, and Zika viruses. Therefore, insecticide-based control methods play a critical role in reducing such vector-borne diseases.<sup>4</sup> These data presented will reflect the species composition and insecticide resistance in October 2020 from Rio Grande City, McAllen, Progresso, Harlingen, and San Benito, TX.



Figure 1. Map of the 5 collection cities in the Lower Rio Grande Valley. Each city contained 3-4 collection sites which were collected once a week from September thru early December.

## Methods

- 5 field sites were established along TX/MX border (figure 1)
- Collected eggs weekly from oviposition cups (figure 2)
- Hatched eggs for species identification
- Performed Insecticide Resistance Testing using the CDC Bottle Bioassay method (figure 3):
  - Coated bottles with insecticide and left to dry for 24 hours
  - 25-30 females of one species in each bottle
  - Counted number of dead mosquitoes every 15 minutes for 2 hours



Figure 2. Here I am doing field collections during the SARS-COV2 pandemic

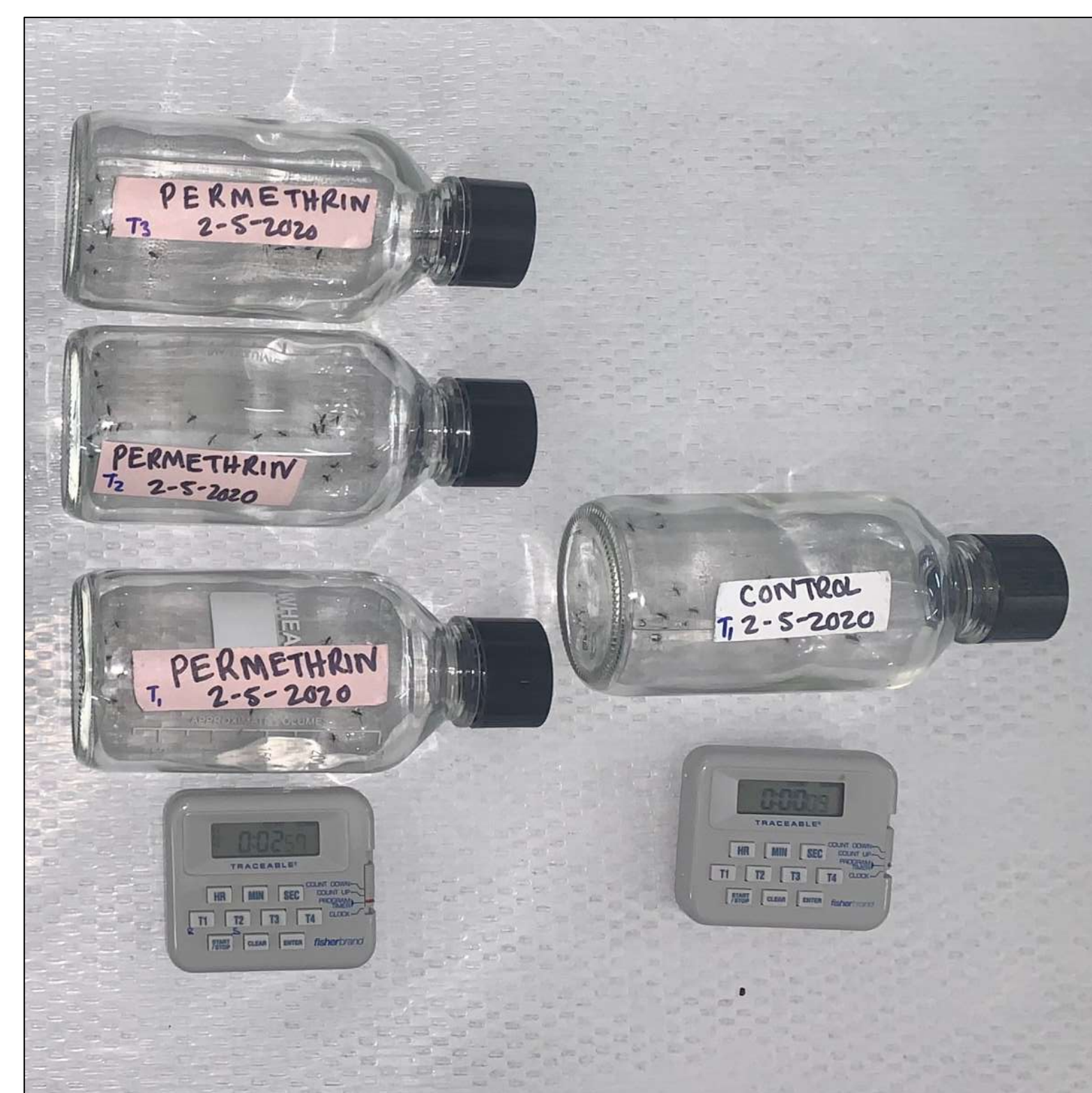


Figure 3. Three bottles were coated with Permethrin. The control was coated with 1ml of pure acetone. Each bottle had 25-30 females of the same species.

## Results

### October 2020 Species Composition

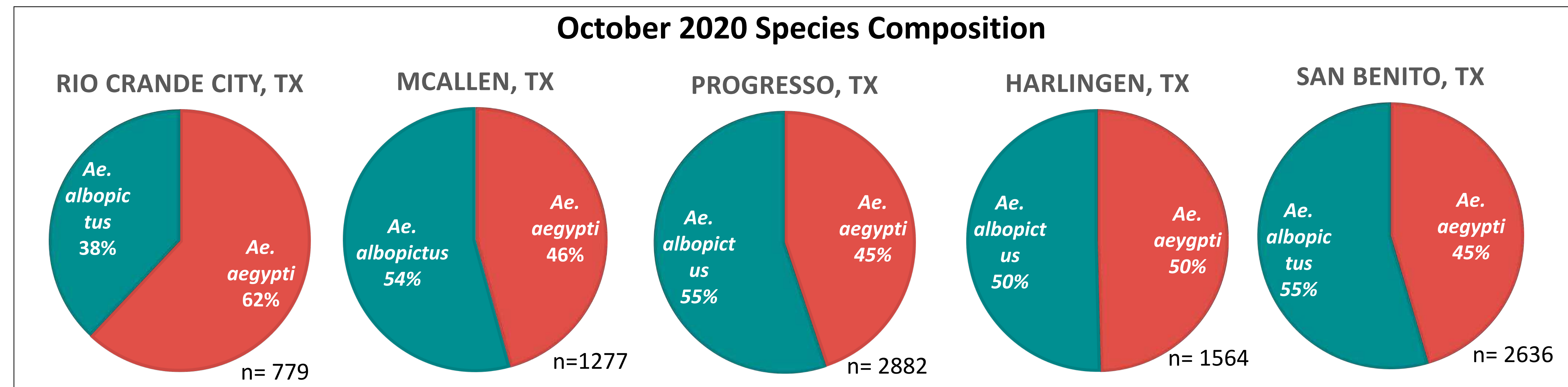


Figure 4. October 2020 Species Composition. Each pie chart is organized from left to right starting with the most western city being Rio Grande City and most eastern city being San Benito. There are more *Ae. albopictus* mosquitoes present in Rio Grande City and become less present traveling east. The species composition are similar in McAllen, Progresso, and San Benito with slightly more *Ae. albopictus* present. Of the 5 cities, Progresso (n=2882) and San Benito (n=2636) produced the most *Aedes* mosquitoes compared.

### October 2020 Insecticide Resistance City Comparison

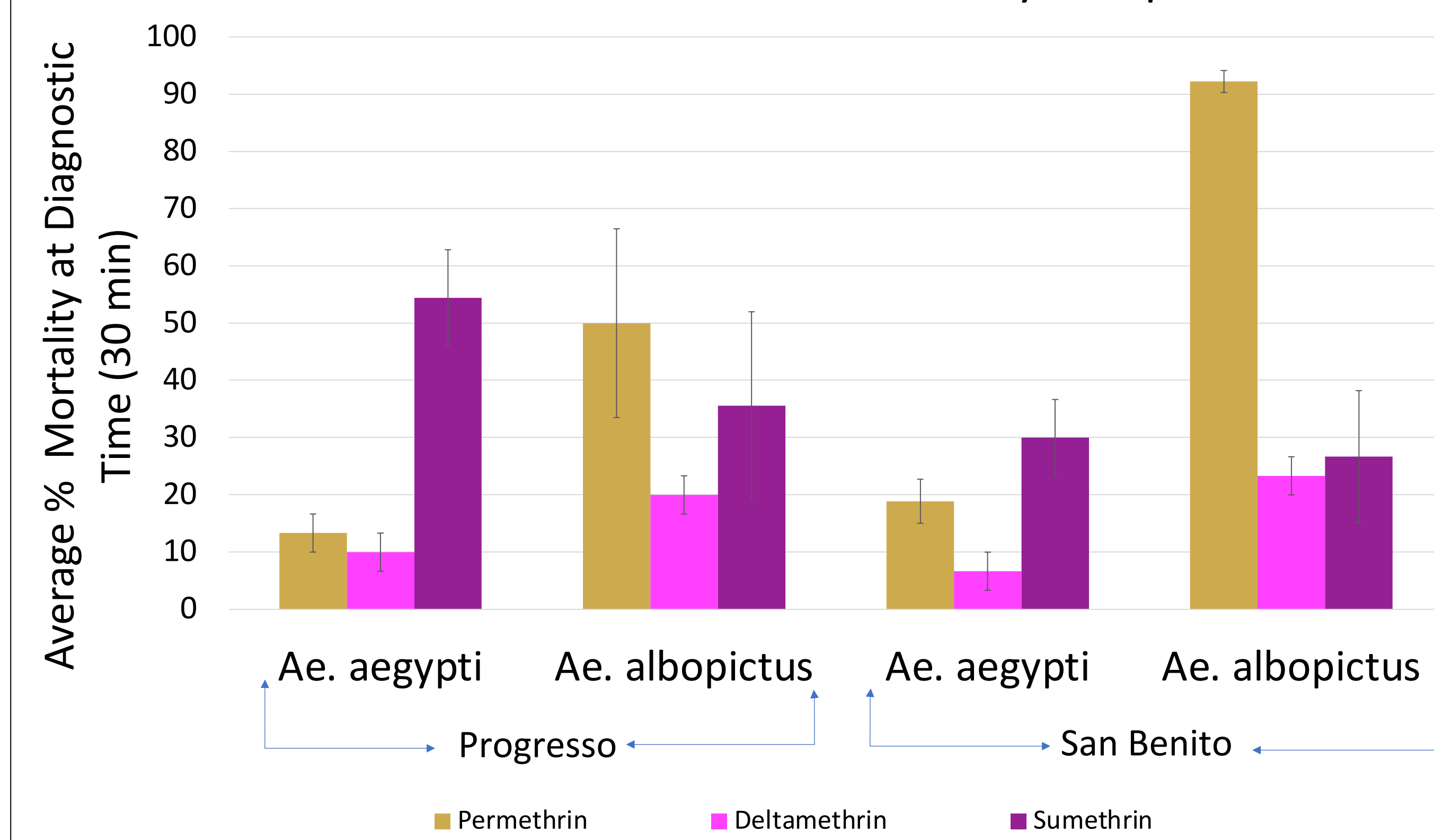


Figure 5. Progresso and San Benito were tested with Permethrin, Deltamethrin, and Sumethrin due to more female *Ae. aegypti* & *Ae. albopictus* available. In both cities, Permethrin shows less than 20% *Ae. aegypti* dead and 50-90% *Ae. albopictus* dead at 30 minutes; Deltamethrin shows less than 25% of both species dead at 30 minutes; and Sumethrin shows 30-50% *Ae. aegypti* dead and 25-35% *Ae. albopictus* dead at 30 minutes.

### October 2020 Permethrin Resistance

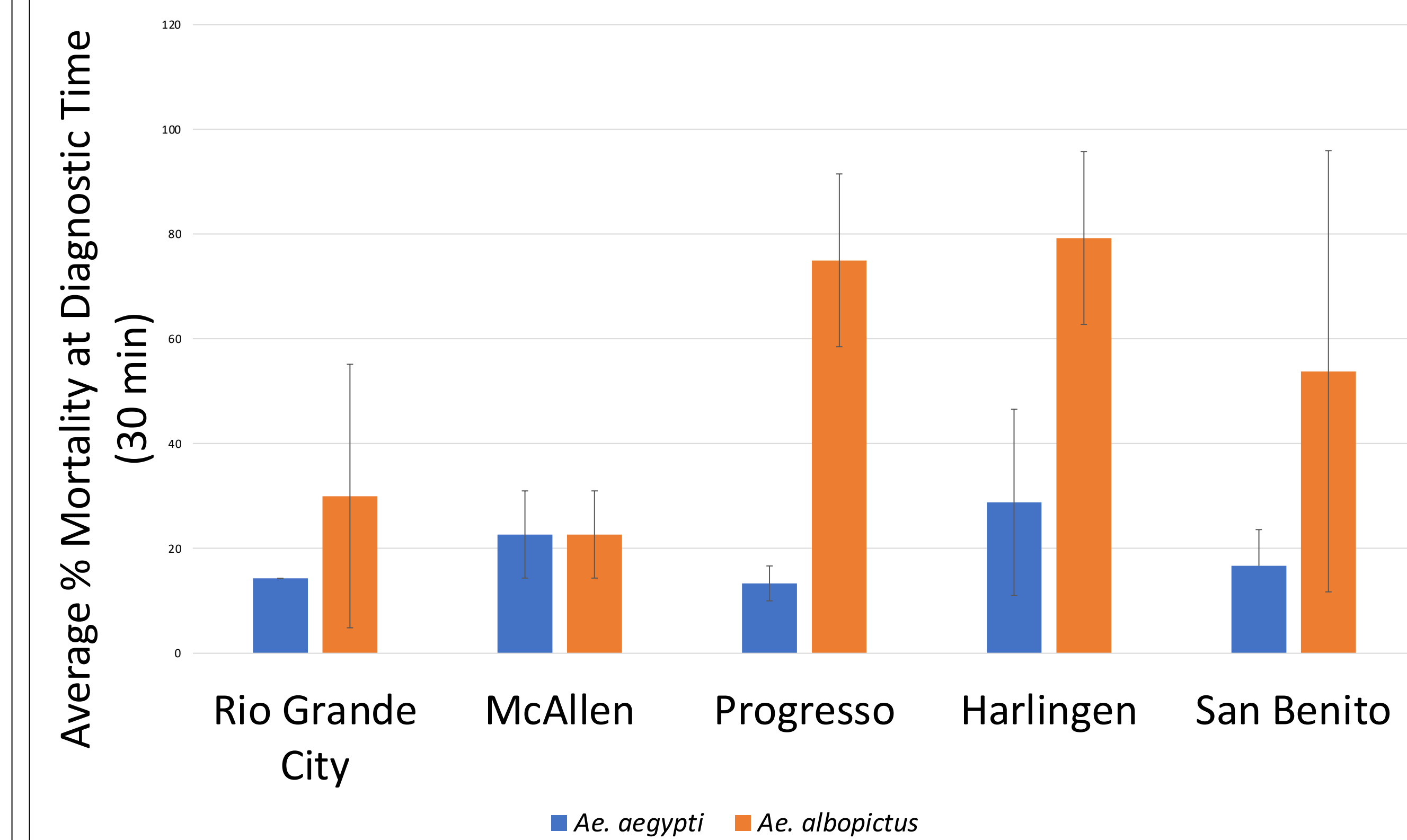


Figure 6. Each city was consistently tested with Permethrin in October 2020. For *Ae. albopictus*, Progresso (75%) and Harlingen (79%) had the highest mortality rates at 30 minutes.

## Discussion

- As the population (n) of *Aedes* mosquitoes increases west to east along the TX/MX border, there are more *Aedes albopictus* present than *Ae. aegypti* (figure 4)
- In Progresso and San Benito, there is resistance amongst both species when tested with Permethrin, Deltamethrin, and Sumethrin since a portion of each species survived past the diagnostic time. Although, 90% *Ae. albopictus* mosquitoes died from San Benito (figure 5)
- Both species in all cities are resistant to Permethrin. *Ae. albopictus* female mortality rate in Progresso (75%) and Harlingen (79%) were the highest at 30 minutes (figure 6)

## Acknowledgements

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## References

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