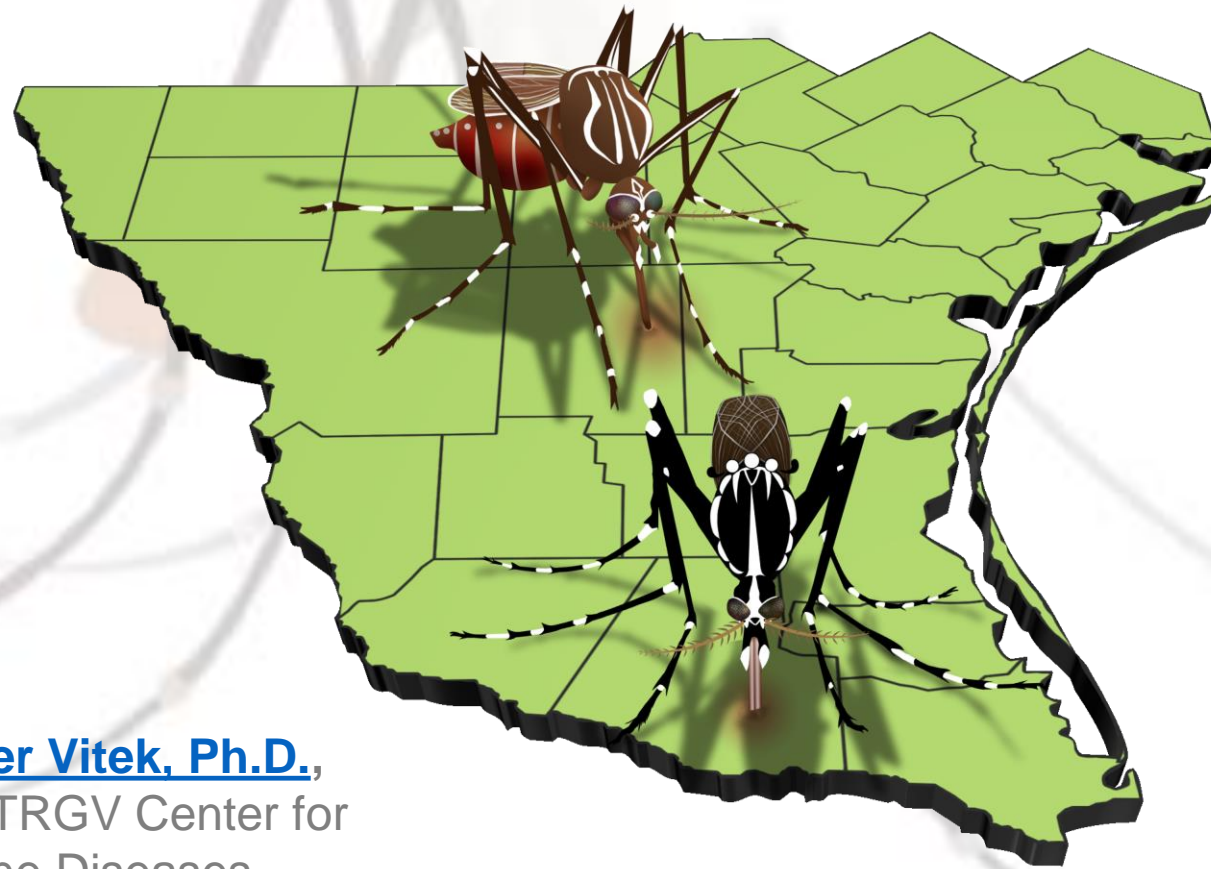


Mosquito Vectors in South Texas



INFECTIOUS DISEASE

Local Case of Severe Mosquito-Borne Disease Found in Texas

Alexandra Sifferlin

May 31, 2016



For more, visit [TIME Health](#).

Health experts in Texas **report** the first locally-acquired case of the mosquito-borne disease **chikungunya** in the state. The disease is spread by the same mosquitoes that transmit Zika.

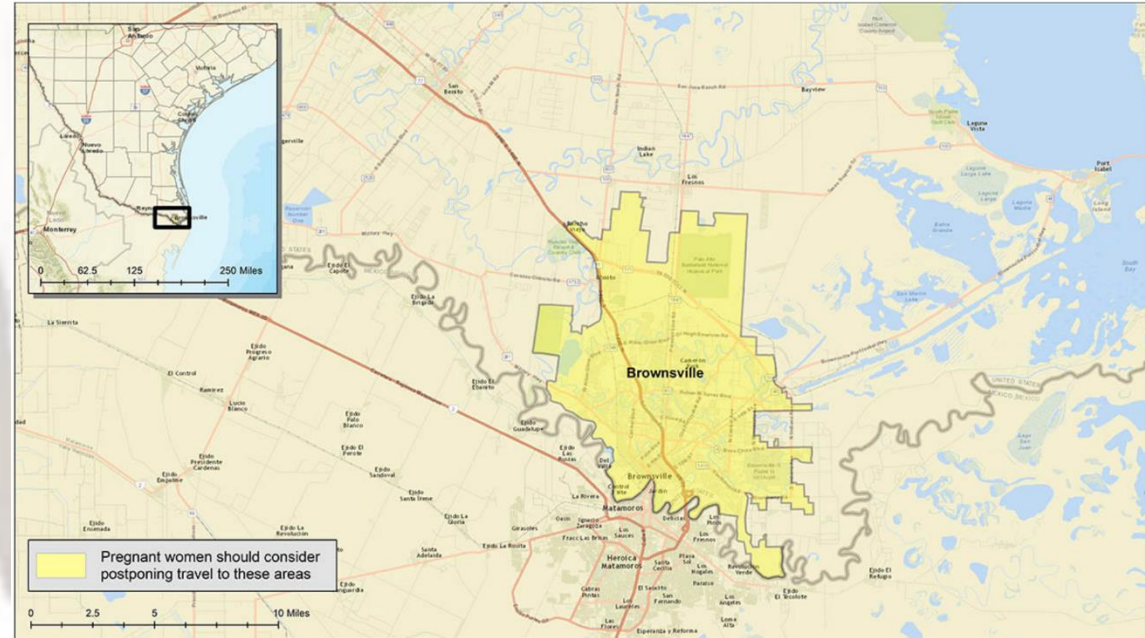
Am. J. Trop. Med. Hyg., 77(5), 2007, pp. 925–928
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Short Report: Relative Susceptibilities of South Texas Mosquitoes to Infection with West Nile Virus

Dana L. Vanlandingham, Charles E. McGee, Kimberly A. Klinger, Nathan Vessey, Chris Fredregillo, and Stephen Higgs*

Reemergence of Dengue in Southern Texas, 2013

Dana L. Thomas, Gilberto A. Santiago, Roman Abeyta, Steven Hinojosa, Brenda Torres-Velasquez, Jessica K. Adam, Nicole Evert, Elba Caraballo, Elizabeth Hunsperger, Jorge L. Muñoz-Jordán, Brian Smith, Alison Banicki, Kay M. Tomashek, Linda Gaul, Tyler M. Sharp



Brownsville, TX. Yellow shows areas where pregnant women should consider postponing travel.

Outbreak of Locally Acquired Mosquito-Transmitted (Autochthonous) Malaria — Florida and Texas, May–July 2023

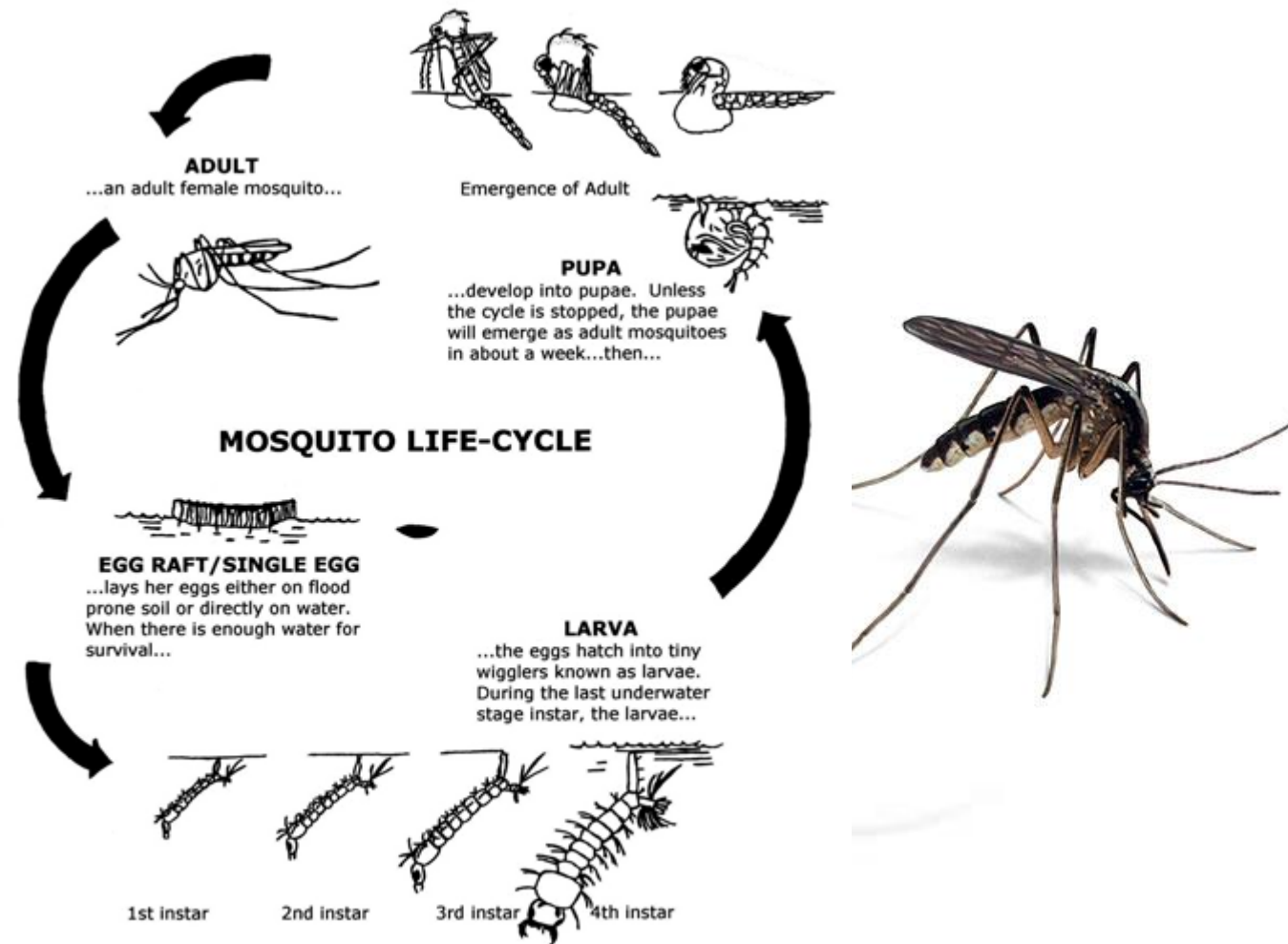
Weekly / September 8, 2023 / 72(36);973–978

Diseases of concerns

Cameron and Hidalgo County	2015	2016	2017	2018	2019	2022
Dengue	0	0	2	1	1	0
Dengue (local)	0	0	0	0	2	0
Chikungunya	1	0	0	0	0	0
Chikungunya (local)	1	0	0	0	0	0
Zika	0	26	17	2	0	0
Zika (local)	0	6	5	0	0	0
WNV	1	0	0	5	0	0
Malaria	One case in 2023!					

Mosquito Biology

- Holometabolous insect
- Aquatic and terrestrial life stages
- Multiple stages for potential intervention
- >3,500 species worldwide
 - 172 species in U.S.
 - ~85 species in Texas
 - Estimate ~55 species in and around Cameron & Hidalgo Counties

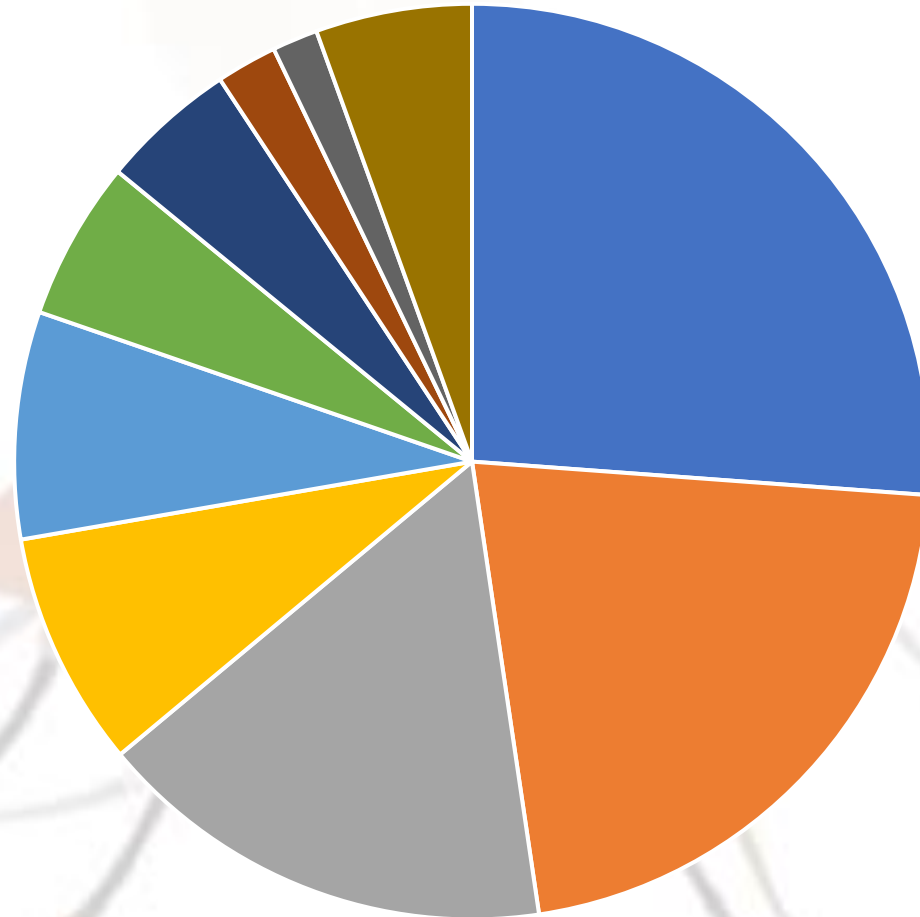


32 Species Collected in South Texas

- *Aedes aegypti**
- *Aedes albopictus**
- *Aedes vexans*
- *Aedes bimaculatus*
- *Aedes epactius*
- *Aedes infirmatus*
- *Aedes scapularis*
- *Aedes sollicitans*
- *Aedes taeniorhynchus*
- *Aedes thelctor*
- *Aedes triseriatus*
- *Aedes zoosophus*
- *Anopheles crucians*
- *Anopheles pseudopunctipennis*
- *Anopheles punctipennis*
- *Anopheles quadrimaculatus**
- *Culex chidesterei*
- *Culex coronator*
- *Culex declerator*
- *Culex erraticus*
- *Culex interegator*
- *Culex nigripalpus**
- *Culex quinquefasciatus**
- *Culex restuans*
- *Culex salinarius*
- *Culex tarsalis**
- *Culex thriambus*
- *Mansonia titilans*
- *Psorophora ciliata*
- *Psorophora columbiae*
- *Psorophora cyanescens*
- *Uranotaeia lowii*

Species Composition - Hidalgo County

27 species
total collected



- Ae aegypti*
- Cx quinquefasciatus*
- Ps cyanescens*
- Ae vexans*
- Cx nigripalpus*
- Ae albopictus*
- Oc sollicitans*
- Oc taeniorhynchus*
- Cx coronator*
- Other



Mosquito Species	Larval Habitat(s)	Biting Time	Flight Range
<i>Aedes aegypti</i>	AC	C, D	under 100 yards
<i>Aedes albopictus</i>	AC, TH	C, D	100 - 300 yards
<i>Aedes atlanticus</i>	WP	C, D	0.25 - 0.5 mile
<i>Aedes canadensis</i>	WP, DD, FS	C	0 – 0.25 mile
<i>Aedes sollicitans</i>	SM	C, N, D	5 – 40 miles
<i>Aedes taeniorhynchus</i>	SM	C, N, D	5 – 40 miles
<i>Aedes triseriatus</i>	TH, AC	D	0.5 – 1 mile
<i>Aedes vexans</i>	FW, GP, IP	C, N	10 – 25+ miles
<i>Anopheles punctipennis</i>	WP	C, N	0 – 0.25 mile
<i>Anopheles quadrimaculatus</i>	FW, GP, LM	C, N	0.5 - 1 mile
<i>Culex erraticus</i>	WP	N	0 - 0.25 mile
<i>Culex quinquefasciatus</i>	AC, SCB, GRP	C, N	0.25 - 0.5 mile
<i>Culex restuans</i>	WP, GRP, DD	C, N	1 - 2 miles
<i>Culex salinarius</i>	GP, LM, FS, SM	C, N	0.25 - 5 miles
<i>Psorophora ciliata</i>	IP, RF, GRP	C, N	5 - 10 miles
<i>Psorophora columbiae</i>	IP, RF, GRP	C, N	5 - 10 miles
<i>Psorophora ferox</i>	WP	C, N	1 – 2 miles
<i>Psorophora howardii</i>	WP, Coastal Pools	C, N	1 – 2 miles

AC: Artificial containers
 GP: Grassland pools
 TH: Tree holes
 DD: Drainage ditches
 GRP: Ground pools
 RF: Rice fields
 FS: Freshwater swamps
 IP: Irrigated pastures
 SCB: Sewage catch basins
 FW: Flood waters
 LM: Lake margins
 SM: Salt marshes
 WP: Woodland pools
 RE: Rooted emerged vegetation

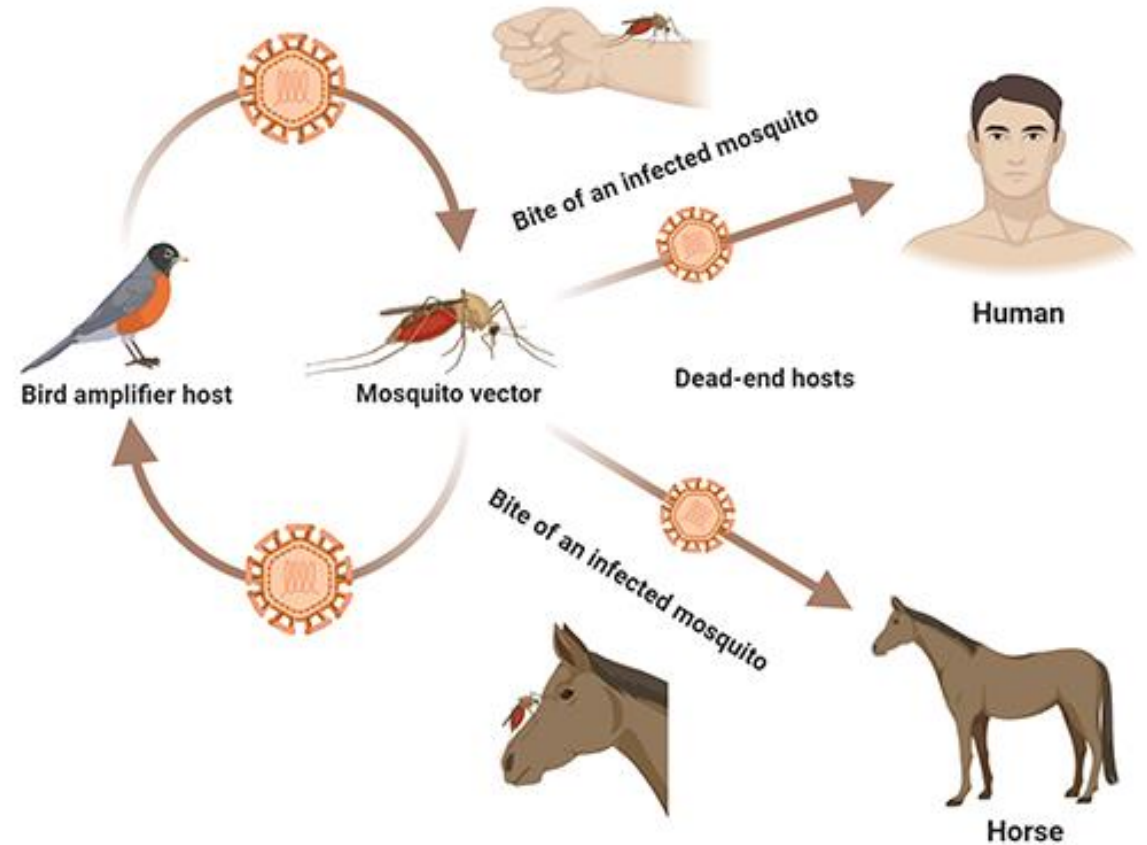
D: Day
 N: Night
 C: Crepuscular (dusk and dawn)



Culex

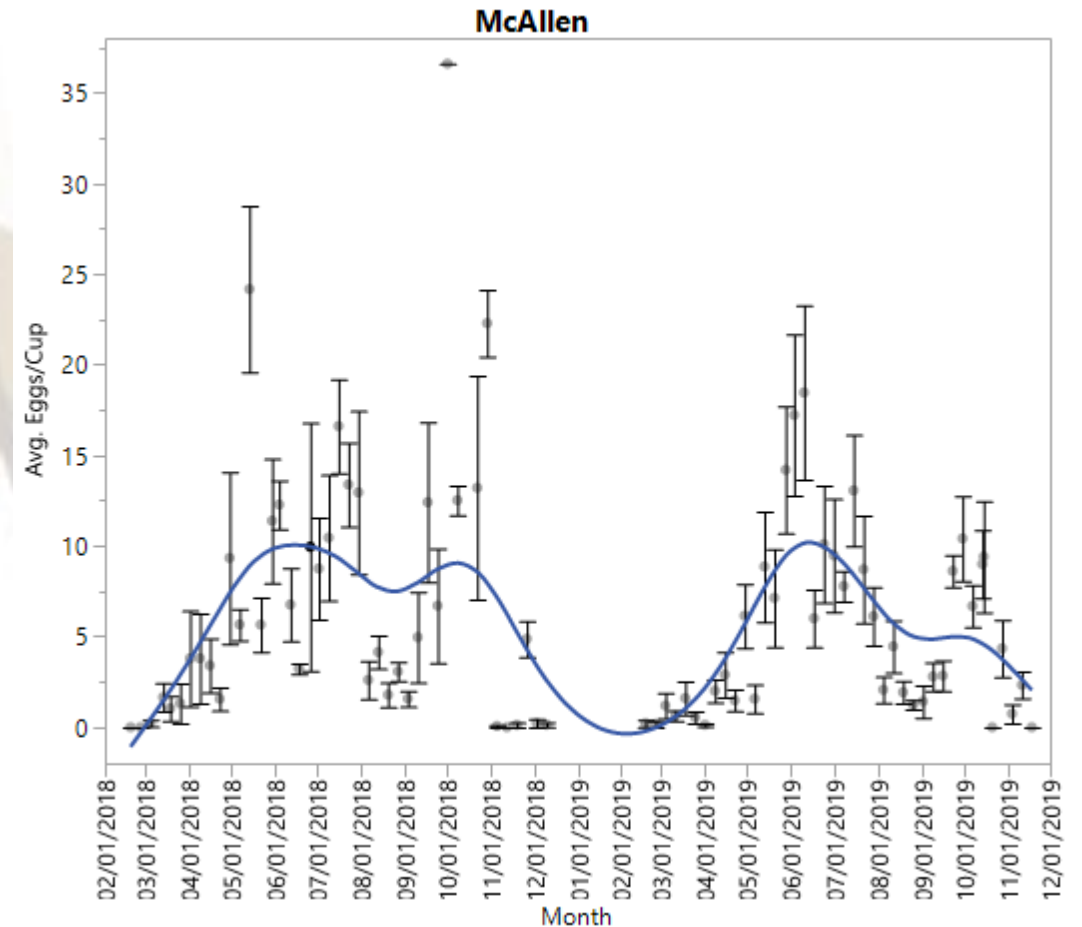
- Often avian feeder
- More active at crepuscular periods
- More common in mid/late summer

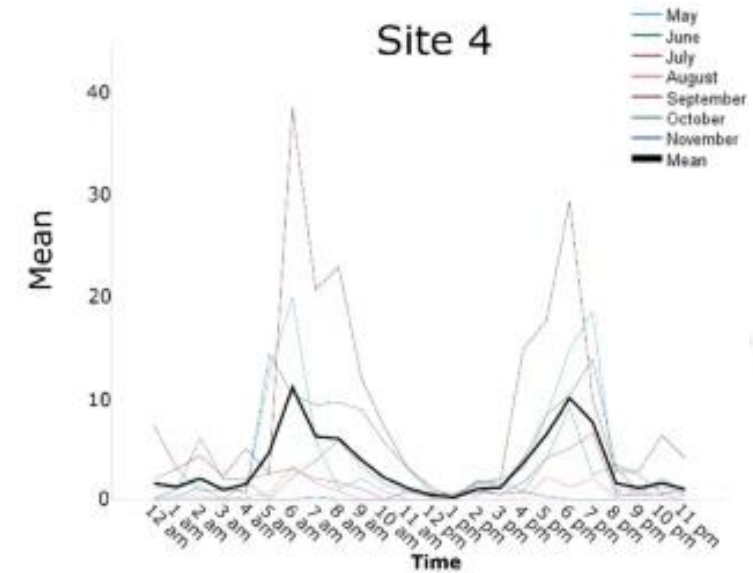
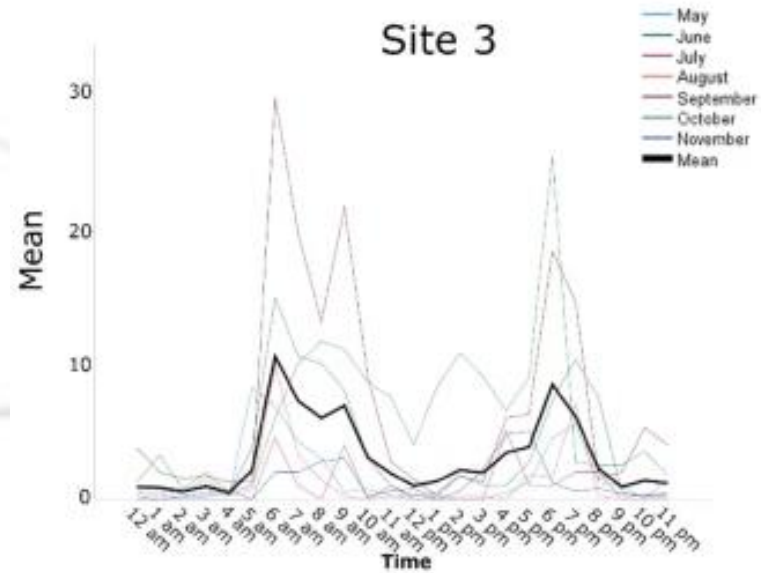
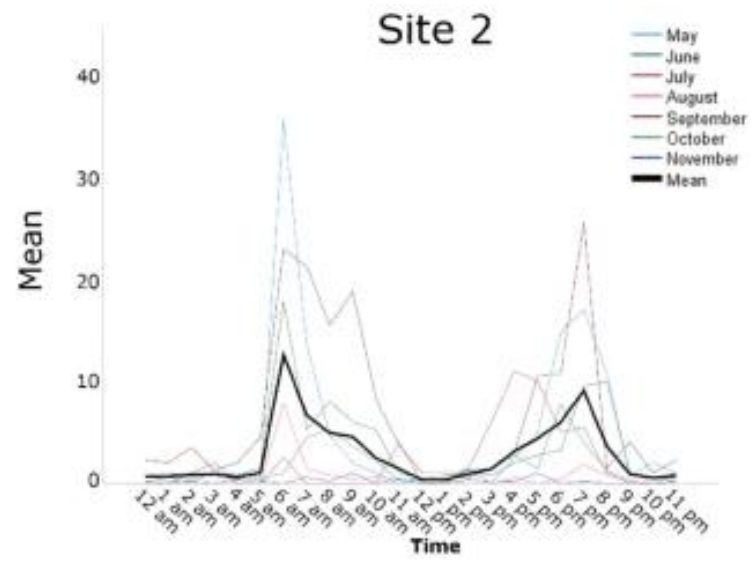
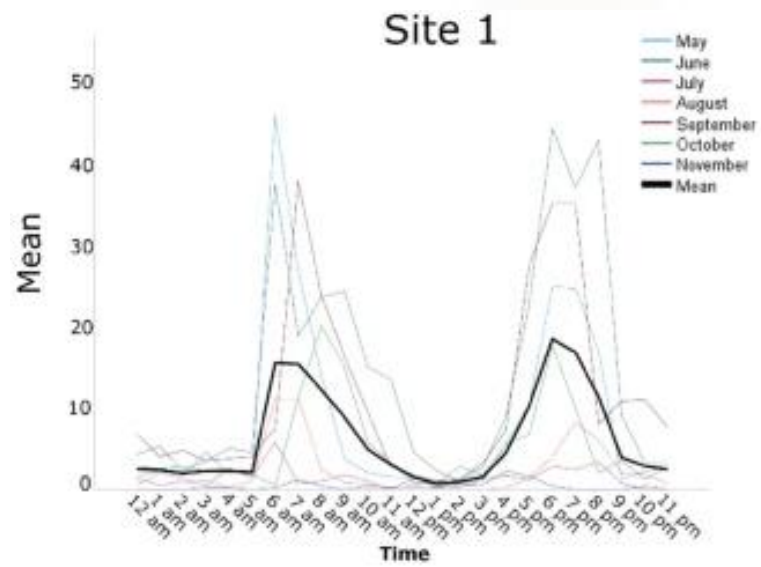
West Nile Virus Transmission Cycle

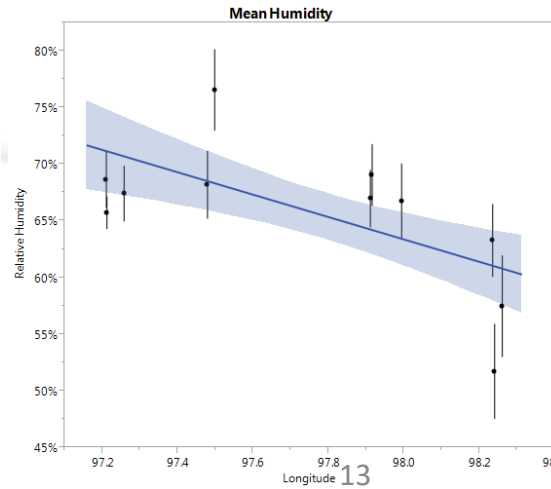
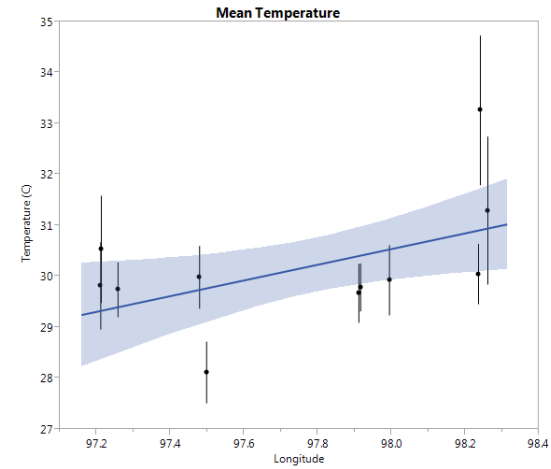
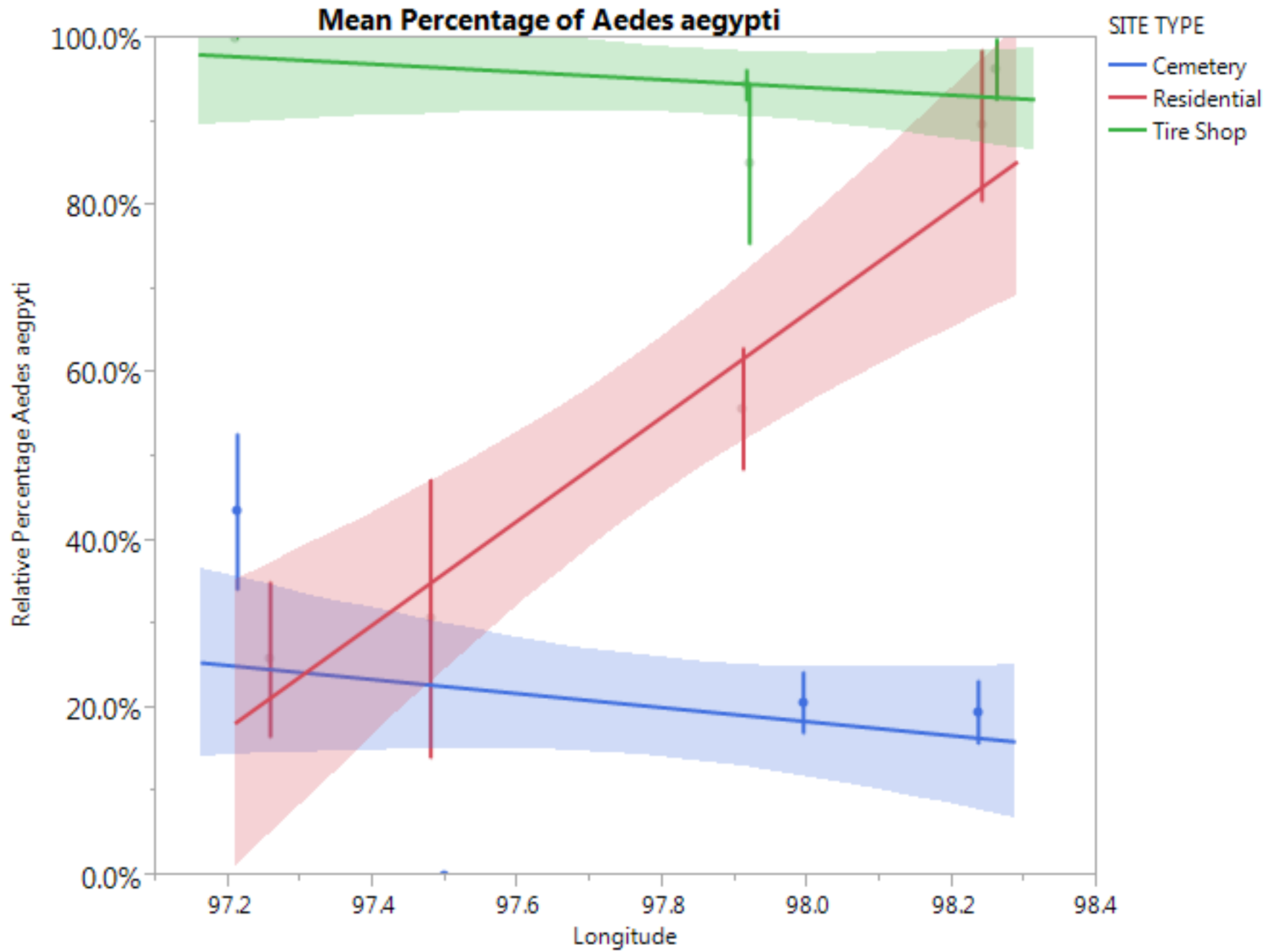


Aedes

- Opportunistic (*Aedes albopictus*) or preferentially feed on humans (*Aedes aegypti*)
- More active crepuscular periods (some daytime)
- Bimodal peak of abundance

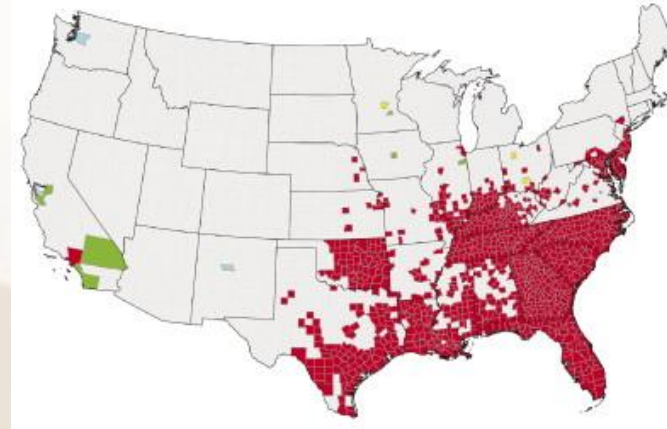







Concerns in South Texas


- Introduction of new species
- Introduction of diseases
- At risk population
- Effective control strategies



ZIKAVirus: What you should know



Symptoms



- FEVER**
- RASH**
- JOINT PAIN**
- RED EYES**
- MUSCLE PAIN**
- HEADACHE**

If you have symptoms:

- Talk to your healthcare provider
- Get plenty of rest
- Drink fluids to prevent dehydration
- Avoid aspirin or non-steroidal anti-inflammatory medications

Remember!
Mosquitoes rest in dark, humid places – under the sink, in closets, under furniture or in the laundry room.

TAKE CONTROL OF YOUR HEALTH. Learn more at [cdc.gov/zika](https://www.cdc.gov/zika)

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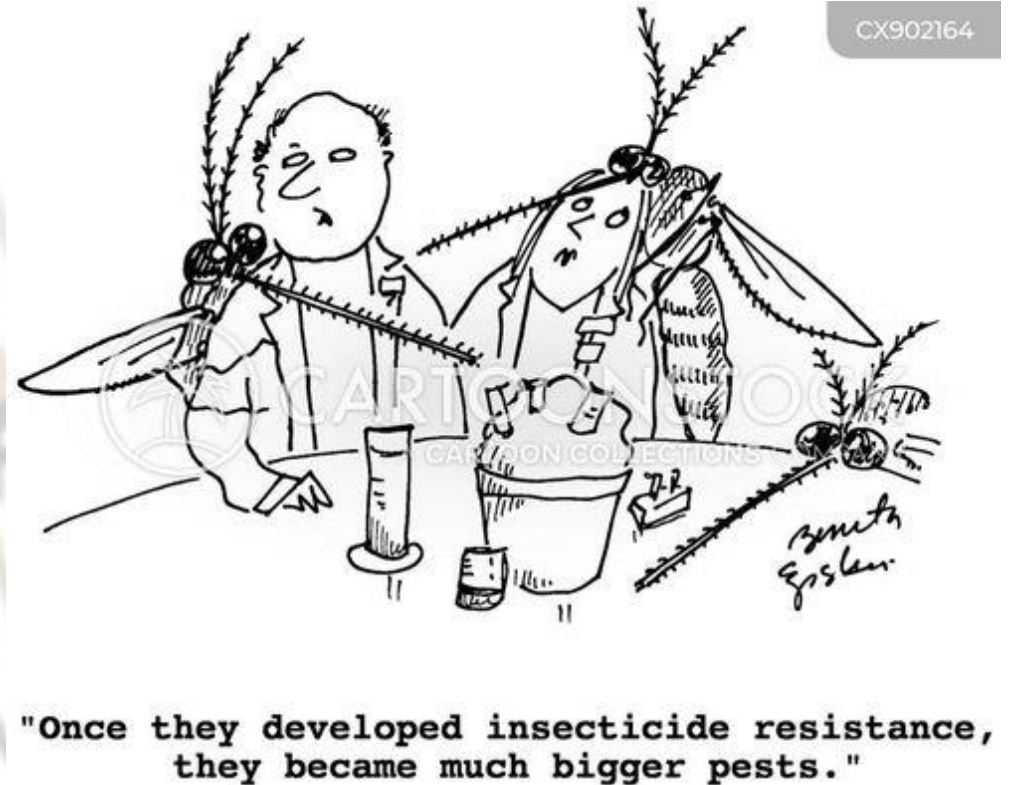
Control options

- Genetic control
 - SIT, genetically modified mosquitoes
- Biological control
 - Entomopathogenic fungi, predators, pathogens, parasites
- Environmental management
 - Source reduction
- Chemical control
 - Insecticides (adulticides/larvicides)



Concerns about insecticide resistance

- Decreased efficacy in control
- Increased costs in control
- Positive feedback cycle
- Limited introduction of new chemicals



Insecticide exposure

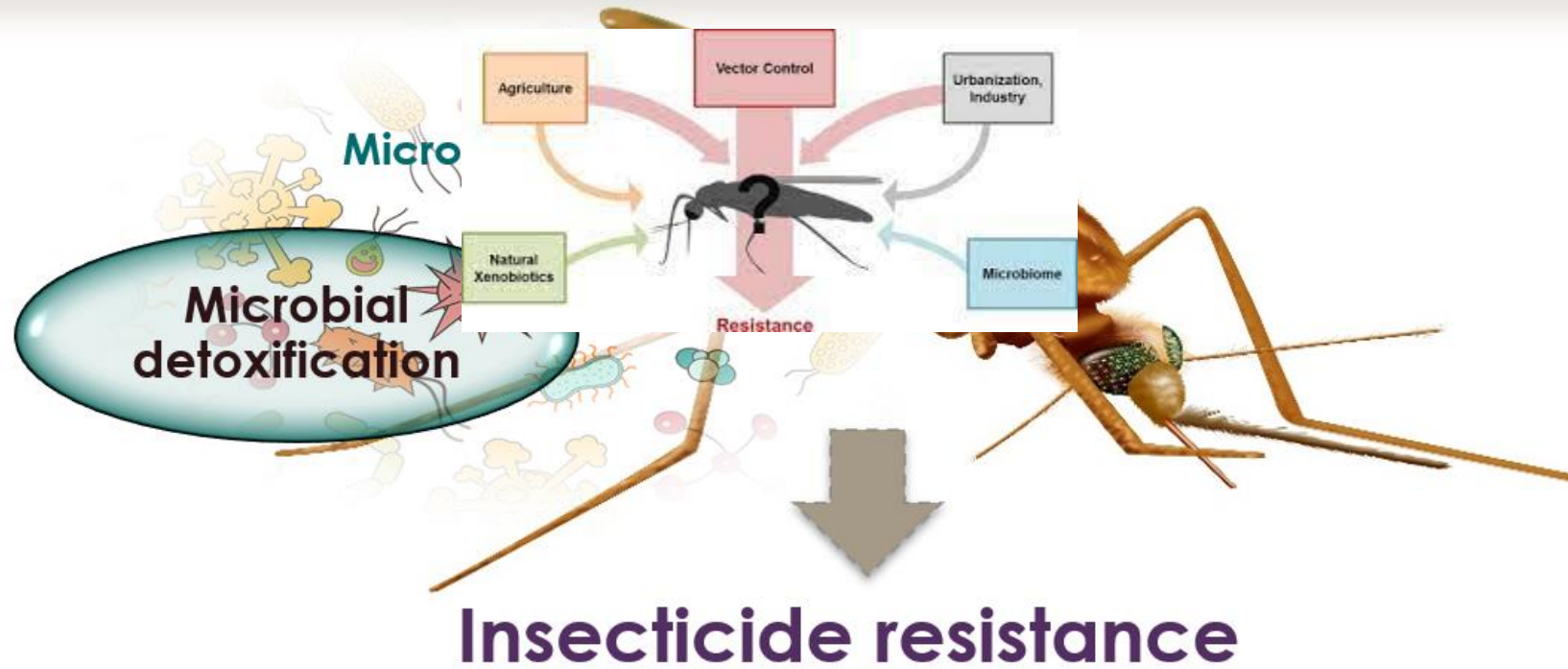
Known host mechanisms

Cuticle modification

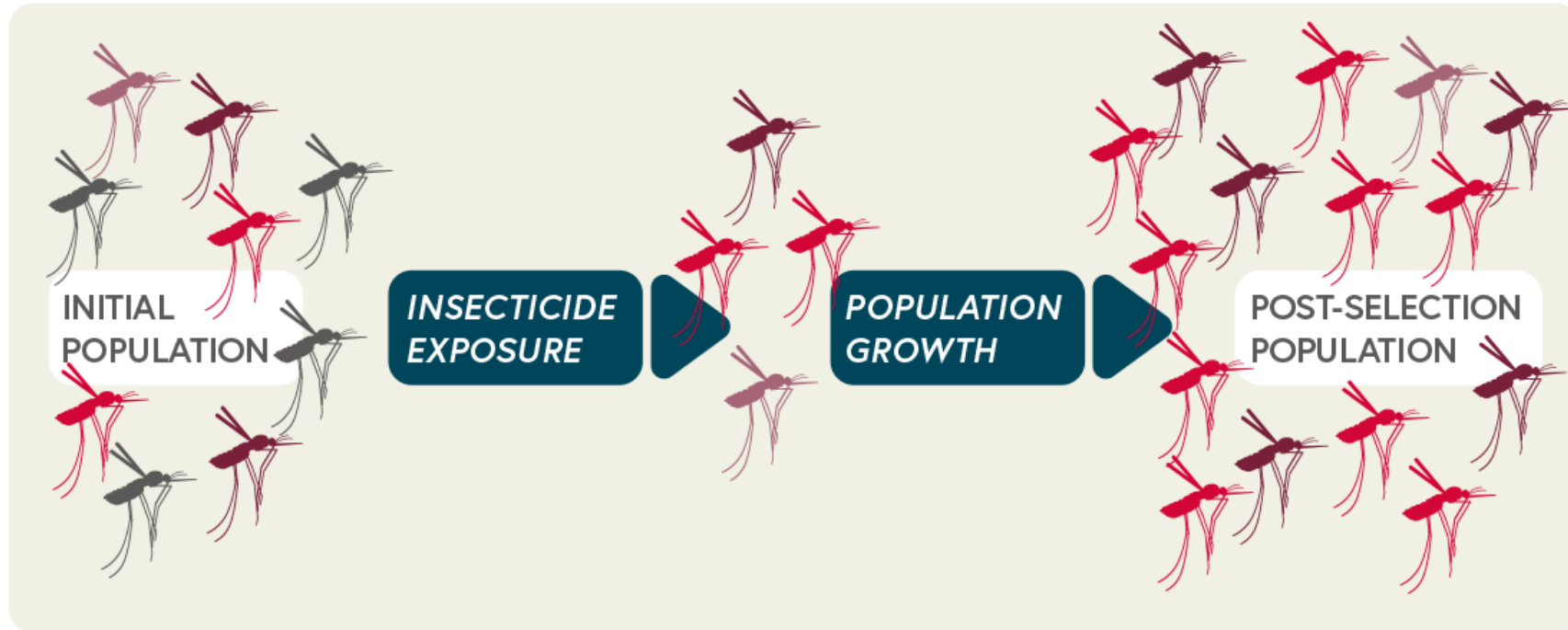
Increased metabolism

Target site alterations

Behavior change



Spread of resistance!

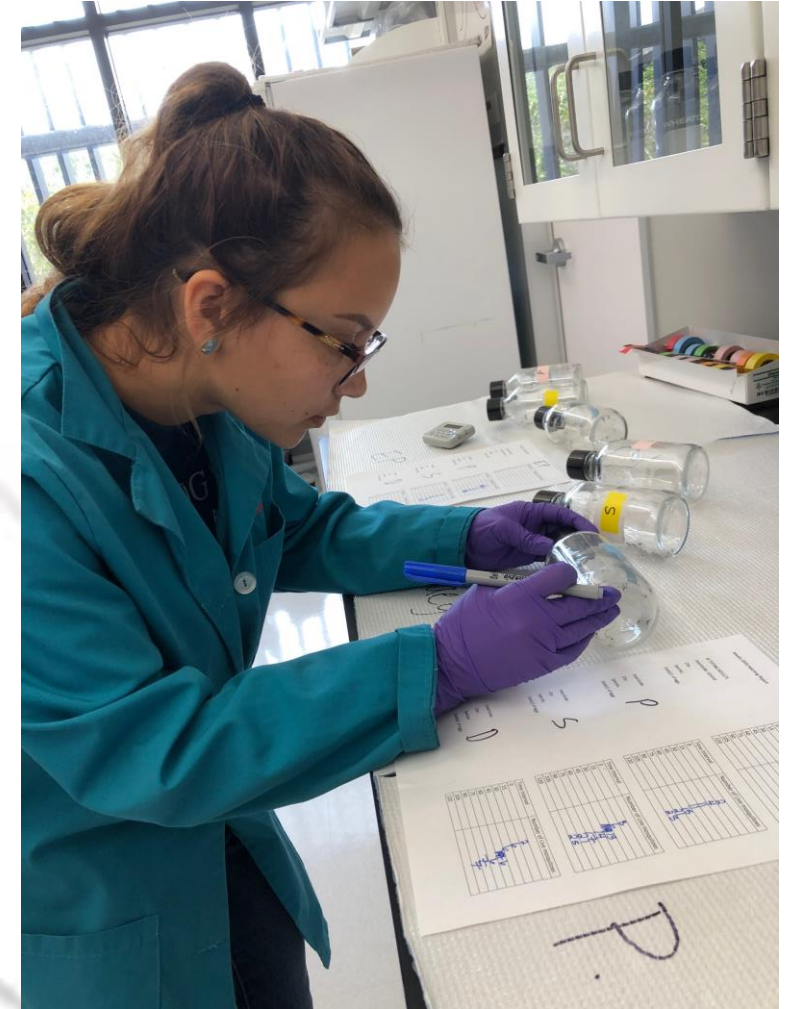
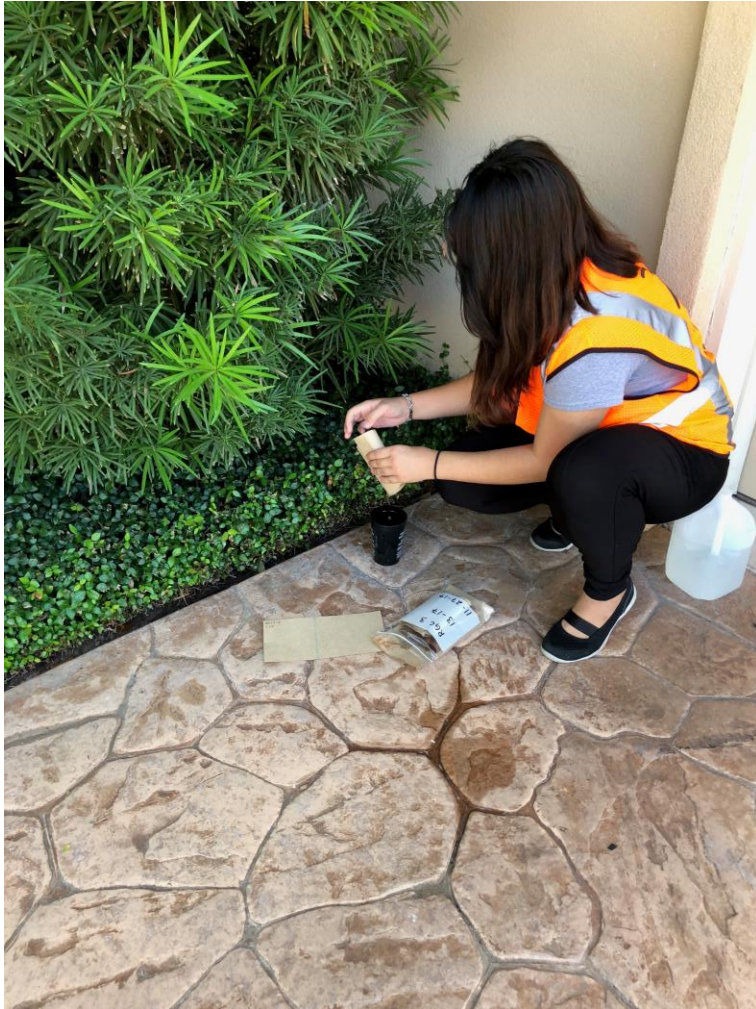


RESISTANCE INTENSITY

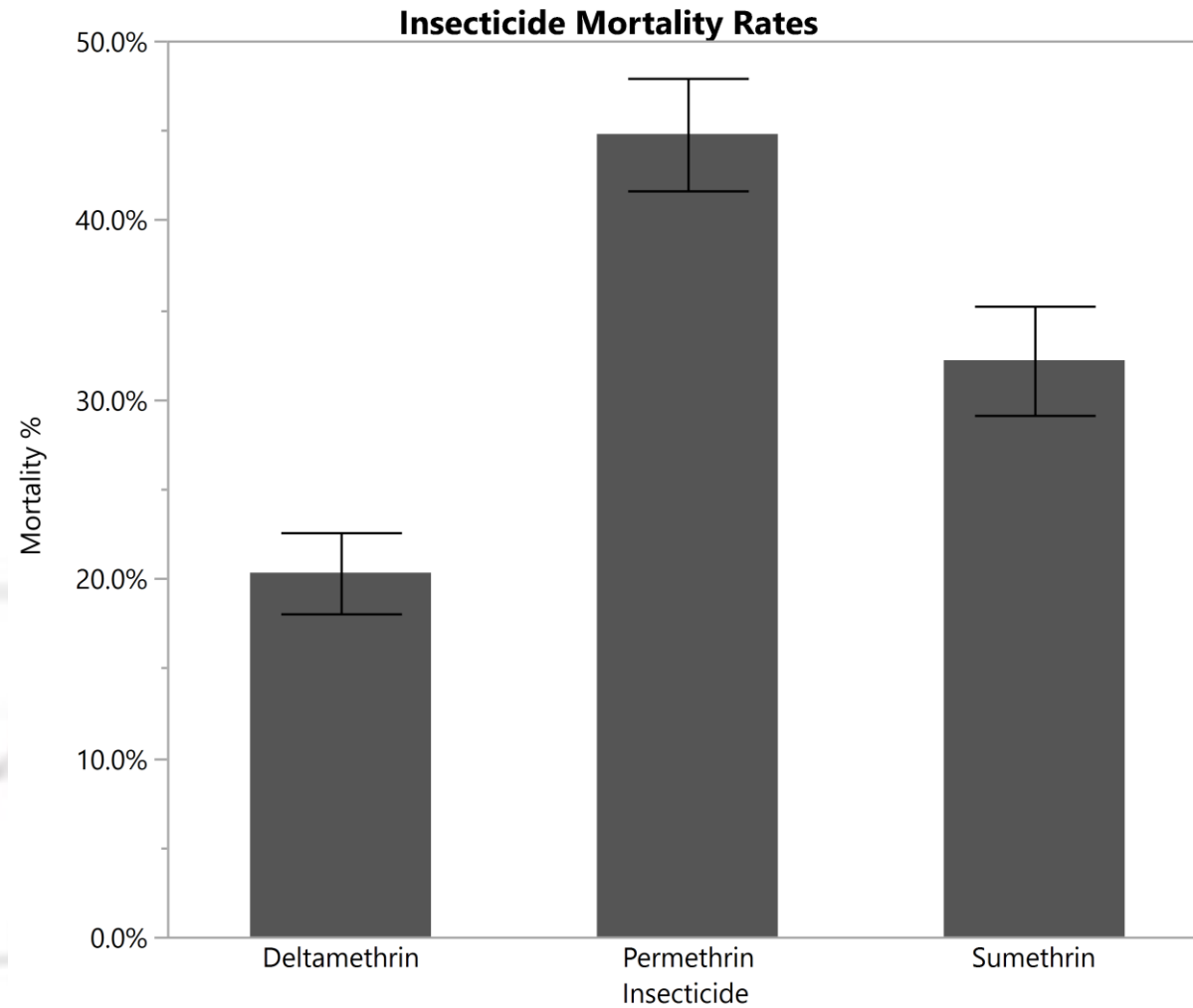
LOW

HIGH

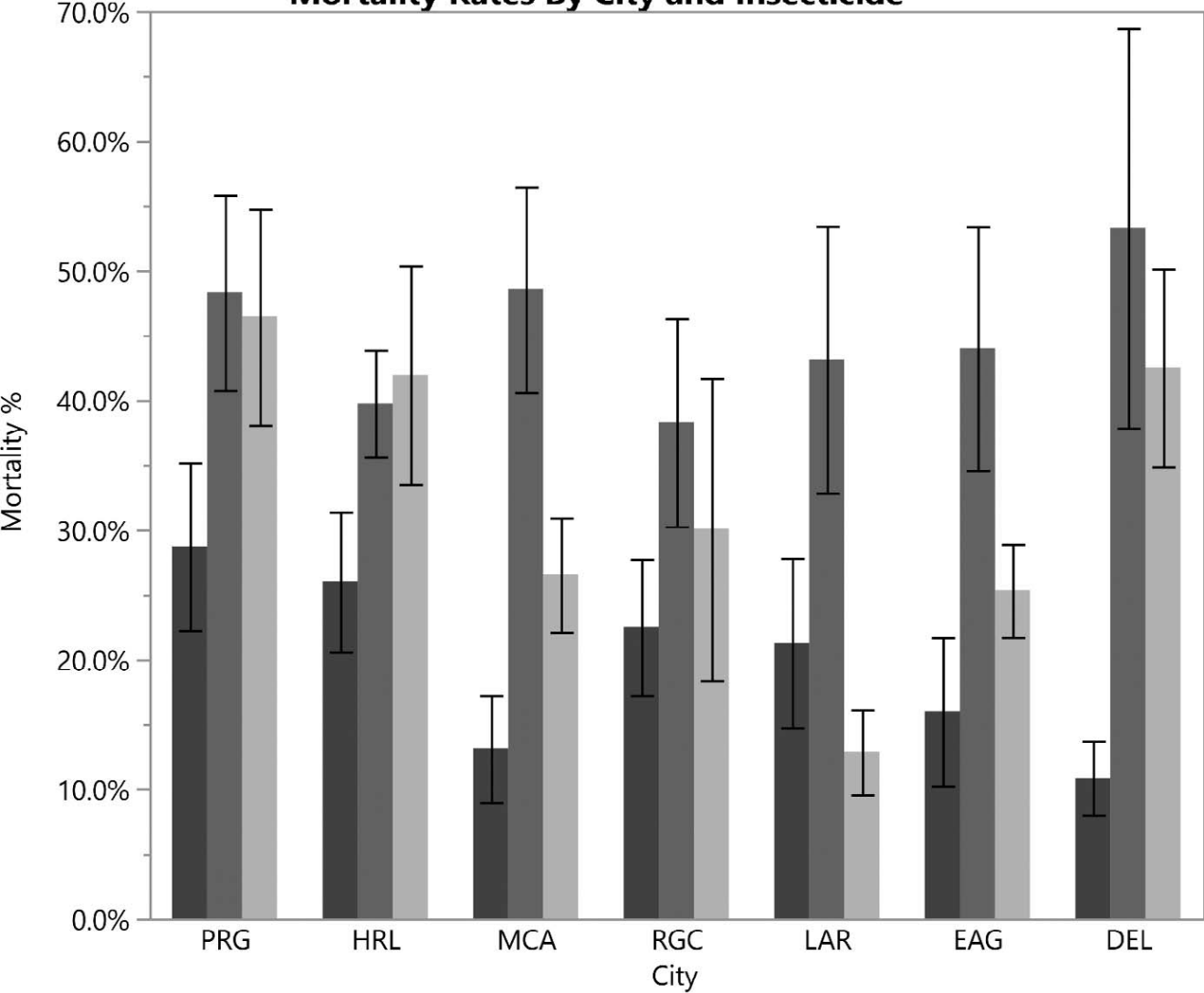
CDC Bottle Bioassay



What do we see in RGV

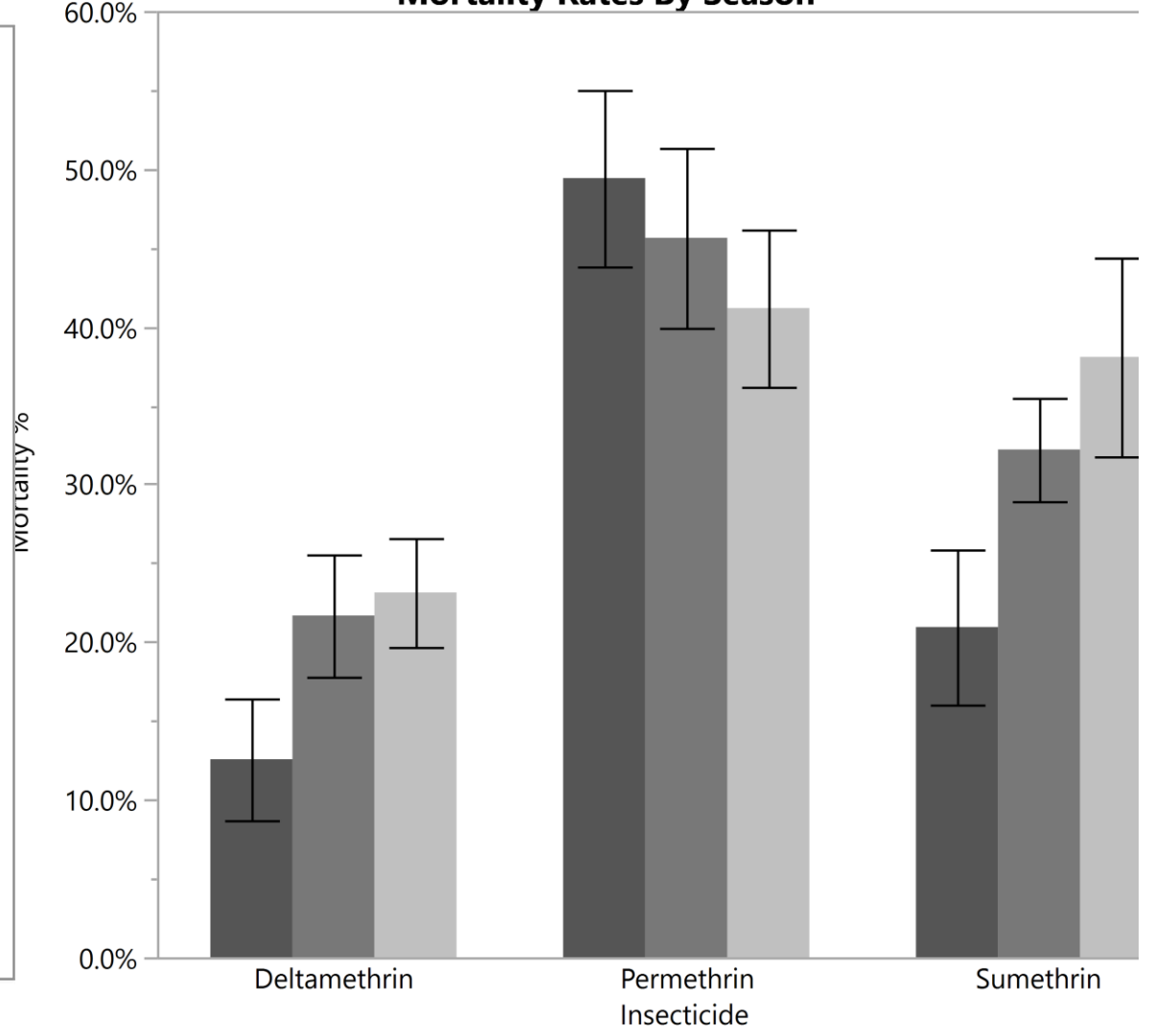


Mortality Rates By City and Insecticide



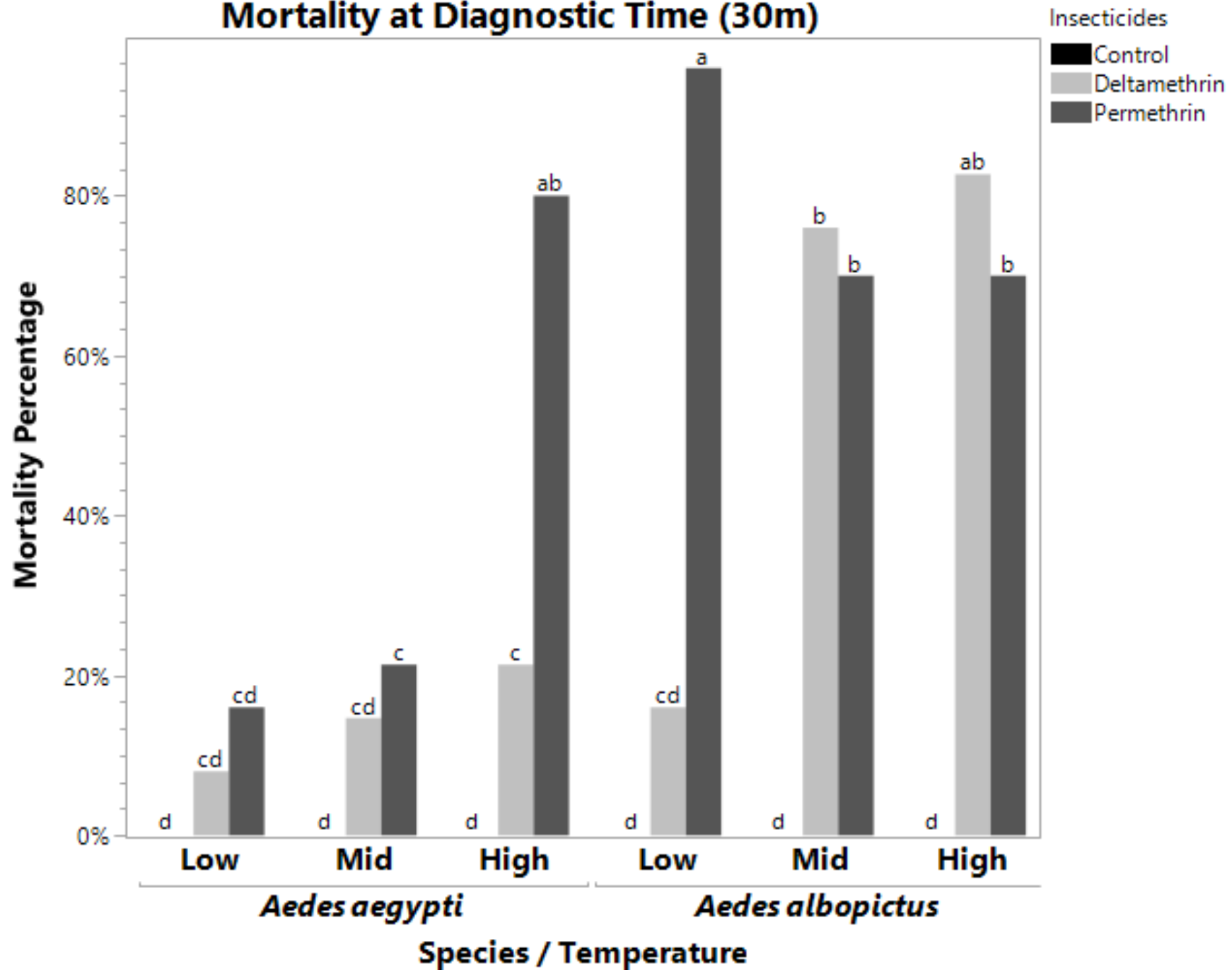
Insecticide Deltamethrin Permethrin Sumethrin

Mortality Rates By Season



Season Spring Summer Fall

Mortality at Diagnostic Time (30m)



Acknowledgments:



Heather Hernandez
Lily Lozano
Diana Gonzalez
Angel Jimenez
Zhikynah Lamsis
Flor Martinez
Felicia Vazquez
Wendy Salinas
Thalia Rios
Ludmila Akyea
Bianca Guerra
Juan Garcia
Valerie Hernandez



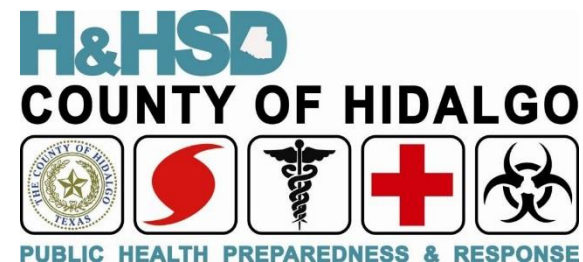
Scott Weaver



John Paul Mutebi



Steven Kotsatos
Cesar Rodriguez
Cristina Flores



Eddie Olivarez
Aaron Salazar
Steven Hinojosa



Josh Ramirez



Art Rodriguez
Henry Presas
Fred Barnes
Jesus Rodriguez
Roberto Garcia



TEXAS
Health and Human
Services

Texas Department of State
Health Services

Whitney Qualls
Ron Tyler
LeighAnne Lawton

Bethany Bolling
George Peck

Multiple regional counties and cities assisting in field collection efforts!

Funding:



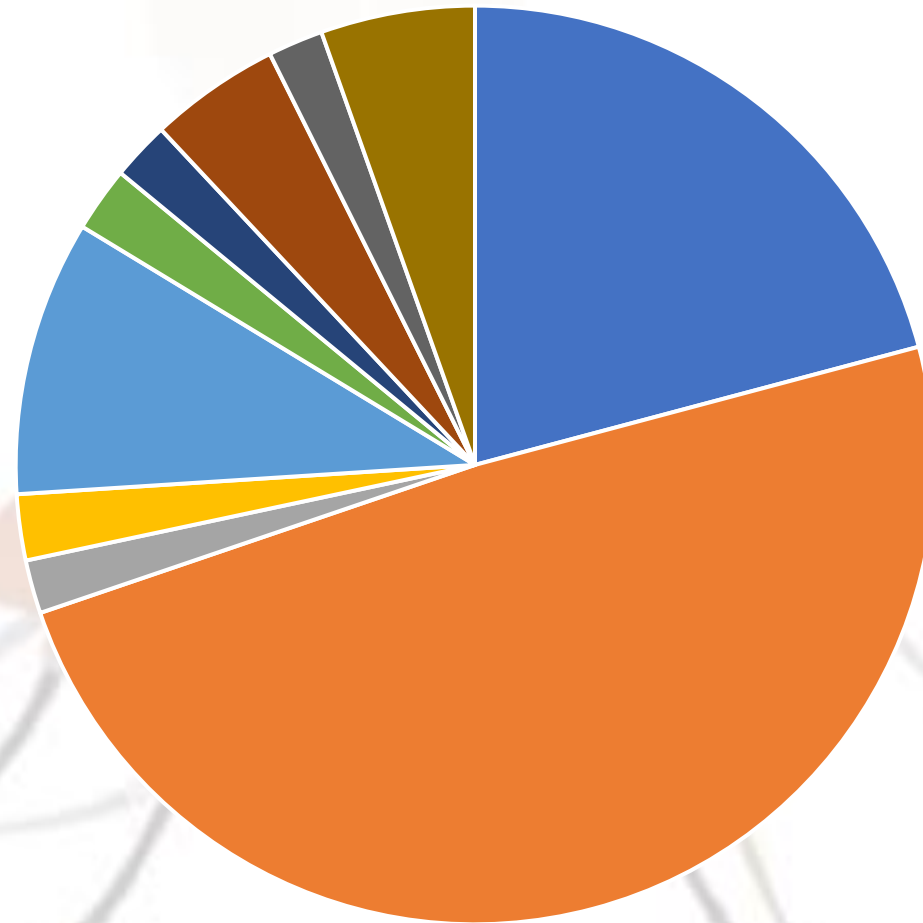
TEXAS
Health and Human
Services

Texas Department of State
Health Services

Thank you!

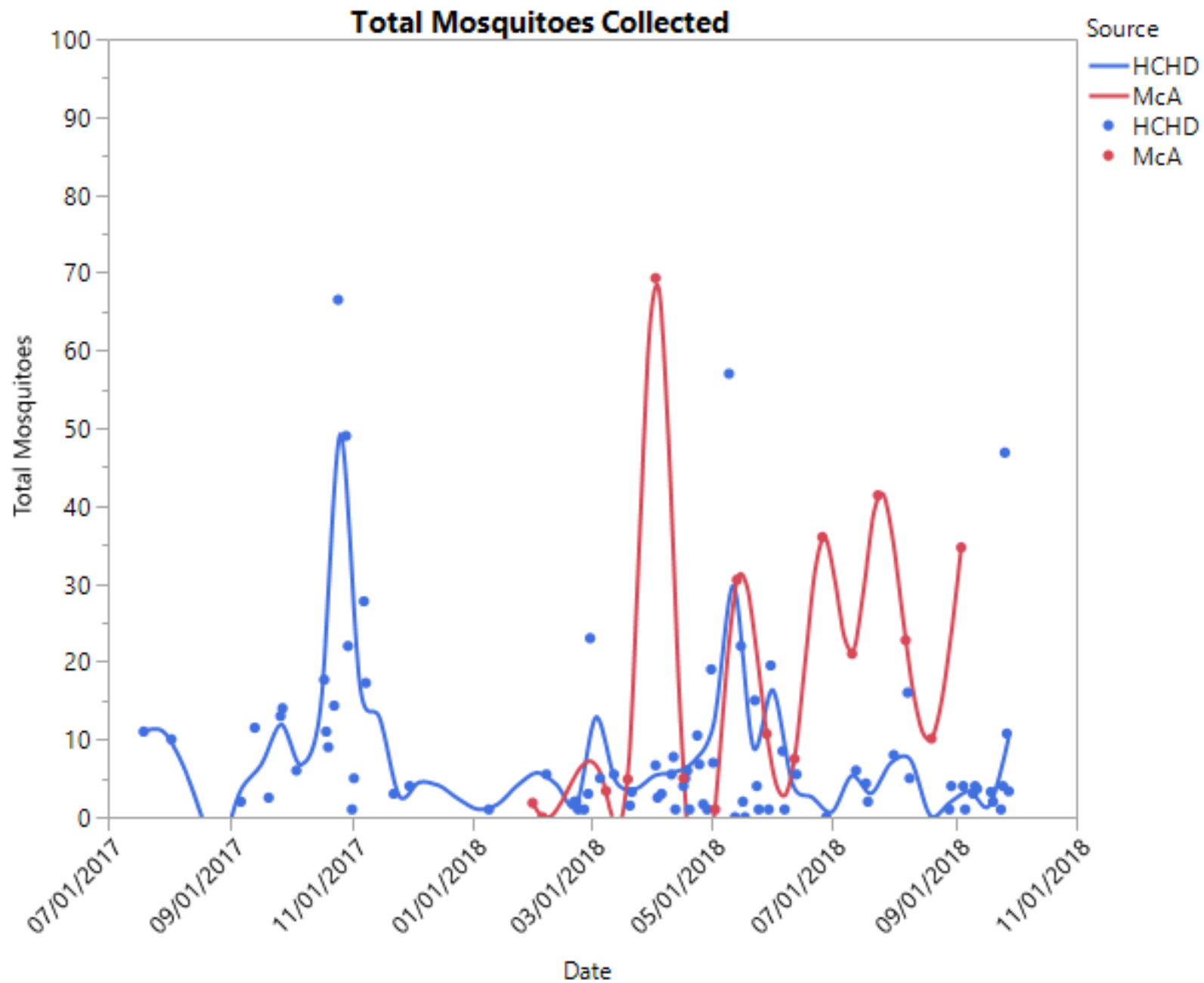


Species Composition - Brownsville



24 species
total collected

- Ae aegypti*
- Cx quinquefasciatus*
- Ps cyanescens*
- Ae vexans*
- Cx nigripalpus*
- Ae albopictus*
- Oc thelcter*
- Oc taeniorhynchus*
- Cx erraticus*
- Other*



Major biochemical mechanisms conferring resistance to important classes of insecticides in mosquitoes



	Biochemical mechanism of resistance				
	Metabolic			Target-site	
	Esterases	Monooxygenases	GSH S-Transferases	kdr	MACE
Pyrethroids	○	●		●	
DDT		○	●	●	
Carbamates	○				●
Organophosphates	●	○			●

Diagnostic dose and times (expected 100% mortality)

Insecticide	Insecticide concentration (µg/bottle)	<i>Ae. aegypti</i>	<i>Ae. albopictus</i>	<i>Cx. pipiens</i>	<i>Cx. quinquefasciatus</i>	<i>Cx. tarsalis</i>
		Diagnostic time per species (minutes)	Diagnostic time per species (minutes)	Diagnostic time per species (minutes)	Diagnostic time per species (minutes)	Diagnostic time per species (minutes)
Chlorpyrifos	20	45	45	90	45	60
Deltamethrin	0.75	30	30	45	60	--
Etofenprox	12.5	15	30	15	30	60
Fenthion	800	--	--	75	45	45
Malathion	400	15	30	45	45	45
Naled	2.25	30	30	45	45	45
Permethrin	43	10	10	30	30	30
Prallethrin	0.05	--	--	60	60	--
Pyrethrum	15	15	30	45	45	30
Sumethrin	20	10	45	30	45	30

Insecticide Resistance Surveillance

- Fall 2017 – Established 7 field sites along TX/MX border
 - 2 sites added in 2019
- Collected eggs weekly from oviposition cups
- Hatch eggs for species identification and IR testing
 - Jan-Mar: “Winter”
 - Apr-Jun: “Spring”
 - Jul-Sep: “Summer”
 - Oct-Dec: “Fall”

