



Delta MVCD – Oxitec Public Educational Webinar #7



Oxitec's Technology and Sustainability: Providing Effective Mosquito Control While Preserving Biodiversity, Endangered Species, and Protecting Our Environment.

Tuesday, October 18th, 2022

Introductions – Panelists With You Today



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Delta MVCD-Oxitec Public Educational Webinar Series

Introduction to our Webinar Series

Delta MVCD and Oxitec are hosting a series of public educational webinars to share information with residents of Tulare County and provide forums to answer questions.

- Webinars are open to everyone.
- Webinars are recorded and made available for everyone after the event.
- All questions relating to the webinar topic(s) will be answered (some in batches if questions are similar).
- If time runs out, we will accept questions in writing via info@oxitec.com.



Delta MVCD-Oxitec Public Educational Webinar Series

Delta MVCD-Oxitec Public Educational Webinar #7:

Today's Agenda:

- California habitats, California mosquitoes.
- Invasive *Aedes aegypti* in California.
- Traditional mosquito control and its challenges.
- Integrated Vector Management (IVM).
- Oxitec mosquitoes as a vector control tool.
- OX5034 human and environmental safety profile.
- Q&A.

Documentation, resources, references, and other information are available at californiamosquitoproject.com.

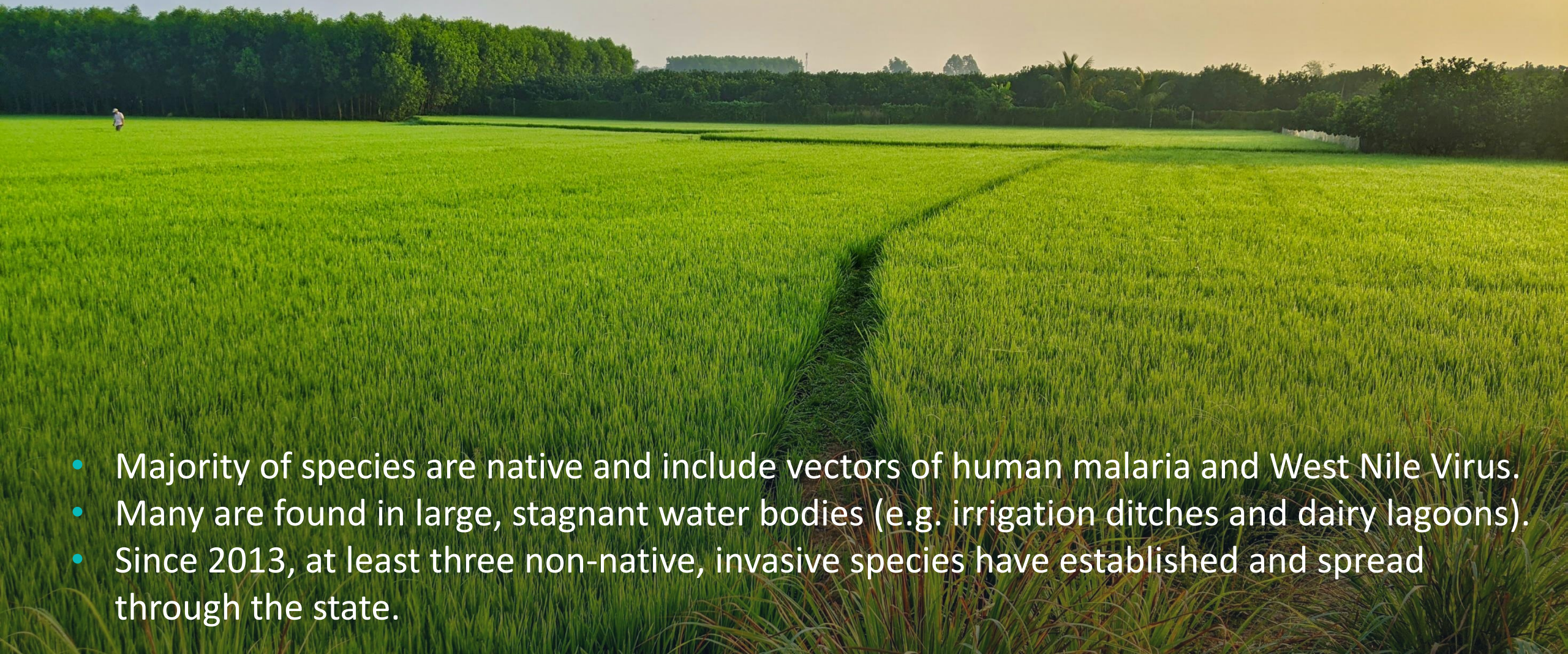
Uniquely California



- California is the most biologically diverse state in the country.
- Home to more unique species of plants and animals than any other state.
- 359 species of plants and animals classified as endangered or threatened in California.
- Underlying reasons include habitat loss and pesticides.



There are 53 Species of Mosquitoes Found in California



- Majority of species are native and include vectors of human malaria and West Nile Virus.
- Many are found in large, stagnant water bodies (e.g. irrigation ditches and dairy lagoons).
- Since 2013, at least three non-native, invasive species have established and spread through the state.



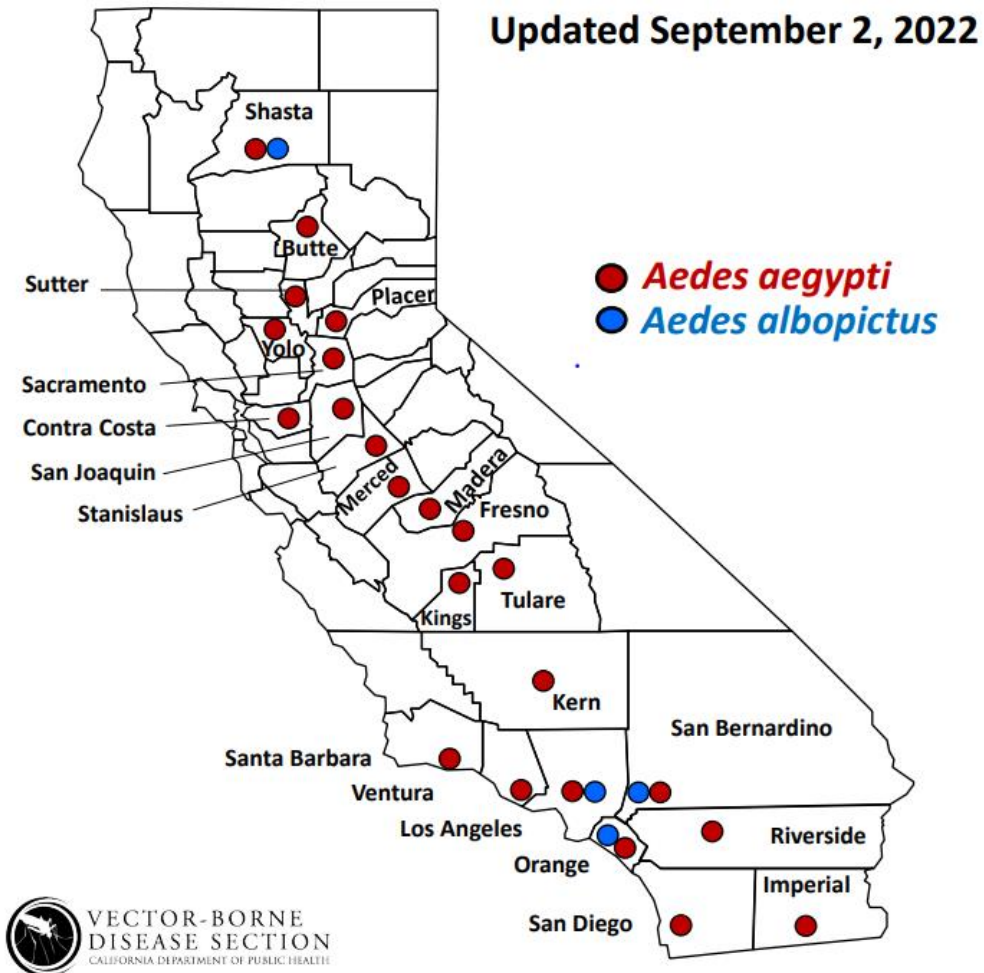
...And This One Presents a Threat to Public Health

- The mosquito *Aedes aegypti* is an invasive species in California ... and is rapidly expanding elsewhere in the world too!
- This species feeds almost exclusively on people and is a vector of the viruses that cause dengue, Zika, chikungunya, and yellow fever.

Why Now, Why California?

Potential risk of local dengue, Zika, chikungunya, and yellow fever transmission.

- **2013:** *Ae. aegypti* detected in **Fresno, Madera, and San Mateo Counties.**
- **2014:** *Ae. aegypti* persisted in those 3 counties and were also detected in **Kern, Tulare, Los Angeles, and San Diego Counties.**
- **2015:** Detected in **Imperial and Orange Counties.**
- **Inherent challenges to *Aedes aegypti* control.** Cryptic harborages, oviposition & larval sites, daytime behavior.
- **Insecticide resistance:** Need more tools in our toolbox.





Why is *Aedes aegypti* Hard to Control?

- Females lay eggs in small, natural and artificial containers that hold temporary water in and near people's homes.
- This species has developed insecticide resistance, compromising chemical control efforts.
- It is mainly active during the daytime (diurnal).



How Do We Control *Aedes aegypti* Currently?

- Community education.
- Removing active or potential breeding sites “Tip & Toss.”
- Wide-area sprays of larvicides and adulticides - it’s hard to reach so many cryptic sites.

Integrated Vector Management (IVM)



- There is no “silver bullet.” IVM requires a blend of approaches that incorporates the new generation of biological tools capable of providing effective and sustainable control.
- All new control tools would ideally be target-specific, and safe for people, animals and the environment.

Controlling *Aedes aegypti* Will Not Affect Other Organisms



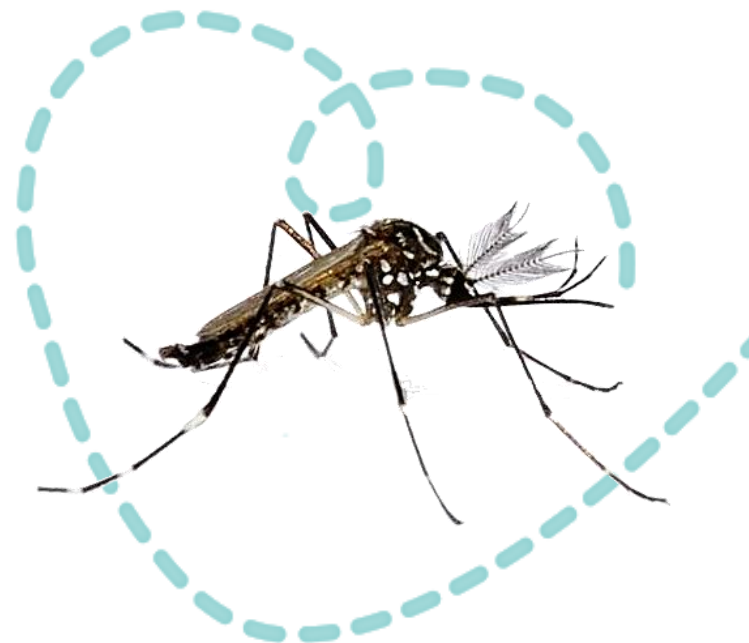
- Larvae of *Aedes aegypti* develop in containers that hold temporary water. Predators of mosquito larvae, such as frogs and fish, are not found in these containers.
- Predators of mosquitoes are generalists.
- Adult *Aedes aegypti* never emerge in great numbers. They are not an important source of biomass for aerial predators, such as dragonflies, birds, or bats.
- Reference: Bonds JAS *et al.* 2022 *Pest Management Science* 78: 2729-2745.

Overview of Oxitec's Friendly™ *Aedes aegypti*

✓ TARGETED SUPPRESSION

✓ SAFE, NON-TOXIC, NON-ALLERGENIC

✓ PROVEN EFFECTIVENESS



MALE-ONLY RELEASES
(male mosquitoes do not bite)

TRACEABLE IN THE FIELD

SELF-LIMITING IN THE ENVIRONMENT

Unique combination of characteristics ensures leading safety and performance profile

Simple and Effective – For Professionals and the Public



- 5034 eggs and diet come ready prepared in a release box.
- With the addition of water, male adults soon emerge.
- Males search for and mate with local female *Aedes aegypti*, preventing female offspring.
- A simple ‘just-add-water’ approach, suitable for professionals and the public.



Expert Organizations are Calling for New Tools

On a scientific and public health level, our project has received **support from many leading government associations and pertinent expert bodies.**

“We encourage the Department of Pesticide Regulation to expand evaluation of this innovative technology in California. Approval of Oxitec’s Research Authorization will enable the Delta Mosquito and Vector Control District to fully assess the efficacy and control potential in their community. This data is critical as mosquito control experts throughout the country continue to explore the use of additional mosquito control public health interventions.”

- American Mosquito Control Association
- Delta Mosquito and Vector Control District
- Entomological Society of America
- Mosquito and Vector Control Association of California
- Northwest Mosquito Vector Control Association

*“The Mosquito and Vector Control Association of California (MVCAC) comprises approximately 70 mosquito control and public health agencies throughout the state that are charged with protecting the public from vectors and vector-borne diseases. Our member agencies are on the frontlines of mosquito-borne disease prevention and are facing increasing challenges due to the spread of invasive species. **We are writing to encourage the California Department of Pesticide Regulation to approve Oxitec’s application for a Research Authorization.**”*

- Kenneth Klemme, Mosquito and Vector Control Association of California Board President

Two-Year Study by EPA Confirmed Positive OX5034 Human and Environmental Health Profile



No risk to human health:

“Because male mosquitoes do not feed on humans...they do not pose a human health risk.”

EPA Human and Environmental Health Risk Assessment: <https://www.regulations.gov/document/EPA-HQ-OPP-2019-0274-0359>

The EPA Has Determined That Releasing OX5034 Will Not Harm Other Organisms



“No direct or adverse effects due to consumption of OX5034 males by non-target organisms is expected...There are also no indirect adverse effects anticipated...”

EPA Human and Environmental Health Risk Assessment: <https://www.regulations.gov/document/EPA-HQ-OPP-2019-0274-0359>

Nordin et al., (2013) Oral ingestion of transgenic RIDL *Ae. aegypti* larvae has no negative effect on two predator Toxorhynchites species. PLoS One. 2013;8(3):e58805. doi: 10.1371/journal.pone.0058805. PMID: 23527029; PMCID: PMC3604150.

Marubbi et al., (2017) Exposure to genetically engineered olive fly (*Bactrocera oleae*) has no negative impact on three non-target organisms. Scientific Reports 7, 11478. OPEN ACCESS: https://www.nature.com/articles/s41598-017-11908-4?WT.feed_name=subjects_genetic-engineering

EPA Concluded OX5034 Would Not Increase Disease Transmission



No additional risk of disease, mosquito population increase or more robust mosquitoes?
“The EPA finds it is unlikely that the local mosquito population would pose any increased risk to humans or the environment as a result of releases of OX5034 mosquitoes...”

Summary of the Data and Information Related to Vectorial Capacity: <https://www.regulations.gov/document/EPA-HQ-OPP-2019-0274-0351>

Evans et al., (2019). Transgenic *Aedes aegypti* Mosquitoes Transfer Genes into a Natural Population. *Sci Rep* 9, 13047 (2019). <https://doi.org/10.1038/s41598-019-49660-6>

What are the Two Additional Genes and Proteins in OX5034?

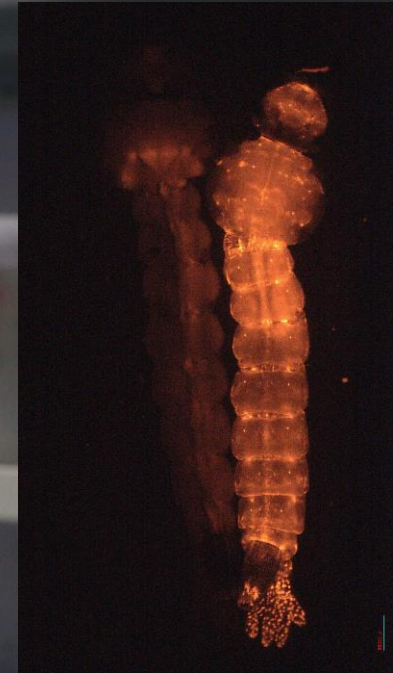
- **tTAV-OX5034** is a protein that results in the death of female larvae of *Aedes aegypti*, males are unaffected and mature to adulthood normally.
- **DsRed2-OX5034** is a fluorescent protein – a “marker” – that allows us to identify our mosquitoes and their progeny either in the lab or from the field.

How Does the Self-Limiting Gene Work?

THE tTAV PROTEIN:

- Non-toxic protein **prevents female development and allows male-only production.**
- This also enables **egg release devices, suitable for the general public to use.**

Is the Fluorescent Marker Safe?



THE DSRED2 PROTEIN:

- **Widely used in biology for 20 years**, allows us to track Oxitec mosquitoes.
- Global experts in allergenicity curating the **AllergenOnline** and **COMPARE** databases reviewed the group of associated proteins and concluded there was no evidence for either putative or demonstrated allergenicity.
- Both global expert bodies have shown that **DSRed2 is not an allergen.**



OX5034 Proteins are Non-toxic and Non-allergenic

- EPA determined that, as no OX5034 female mosquitoes survive in the environment, there is no potential for exposure to the DsRed2 or tTAV proteins and therefore no requirement to complete an assessment of hazards associated with the proteins themselves. ***“... no determination has been made on the potential of either (additional OX5034) protein to pose mammalian hazard...no OX5034 female mosquitoes are being released or are expected to emerge in the environment, exposure is negligible and therefore, so is the potential risk from tTAV-OX5034 and DsRed2-OX5034.”***

EPA Human and Environmental Health Risk Assessment: <https://www.regulations.gov/document/EPA-HQ-OPP-2019-0274-0359>

<http://www.allergenonline.org/Letter%20removal%20GFP%20Scleronephtha%2023%20Mar%202018.pdf>

<http://db.comparedatabase.org/docs/COMPARE-PRP-Statement-2019-01-11.pdf?v=20190111>

Also see oxitec.com/technology for more details



How Does Friendly™ *Aedes* Fit Into Mosquito Control?



- Safe, non-toxic and non-allergenic.
- Environmentally friendly.
- Targets only one species.
- Avoids potential non-target effects.
- Easy operationally - “Just add water.”
- Male Friendly™ *Aedes aegypti* reach where sprays cannot.
- Can be integrated into an IVM program.

Happy 100th Anniversary to Delta MVCD!



For more information, please visit californiamosquitoproject.com

Questions and Answers

Any and all questions on this evening's topics are welcome.

(If we run out of time tonight, email info@oxitec.com and we will attempt to answer your question if it isn't included in the growing FAQ we publish online at californiamosquitoproject.com, oxitec.com/california and deltamvcd.org)

