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Mosquito and Vector Control Association of California – 2025 Research Priorities

Insecticide resistance

Insecticide resistance is an increasing problem for mosquito control agencies in California. There is a critical need to evaluate levels of resistance, investigate sources of resistance, and find solutions to combat resistance in mosquito populations.

Specific priorities: Determine statewide occurrence, severity, and types of adult and larval insecticide resistance; Develop tools for detecting and measuring resistance (molecular, biochemical, or bioassay) and guidelines for interpretation of results; Determine levels of resistance that result in operational failures

Mosquito control and surveillance strategies

There are currently limited classes of insecticides that are registered for use by public health agencies to control adult mosquitoes. Many of the products currently available are widely used by other sectors. To combat resistance and maintain effective control strategies, the development of new active ingredients, synergists, and application methodologies are needed**.**

Specific priorities: Identify products and application methods that can overcome resistance (novel chemistries, synergists, or guidelines for use of existing products); Investigate novel active ingredients, formulated products, and application methods; Explore methods for adopting existing control tools from other sectors; Expand unmanned aerial drone surveillance and control methods; Continue automated, remote trapping; Developing reliable methods for relating trap abundance data to true population density; Impact of habitat modification to limit mosquito reproduction (natural and artificial / constructed)

Aedes aegypti* and *Aedes albopictus

The introduction of *Aedes aegypti* and *Aedes albopictus* into California changed the vector control landscape. These species thrive in urban centers, lay desiccation-resistant eggs, and immatures can develop in small containers of water. These species are capable of transmitting multiple human pathogens currently not endemic to California and require targeted control strategies.

Specific priorities: Novel surveillance tools and techniques specific to invasive mosquito species; Analyze efficacy of surveillance and control strategies; Conduct ecological studies of dispersal, host-feeding, oviposition, and overwintering; Predict habitat utilization and dispersal using statistical models; develop models for local transmission of pathogens transmitted by these vectors, especially dengue given recent transmission in California

Sterile insect techniques

The establishment of *Aedes aegypti* and *Aedes albopictus* in California reinforced the need for new mosquito control strategies. Sterile insect techniques are emerging for these species, but more data is needed on the best methods for implementing and evaluating sterile insect programs in California. Independent investigations of sterile insect techniques are necessary to develop sound strategies.

Specific priorities: Explore methods and metrics to monitor release ratios, mating competitiveness, and release strategies; Conduct dispersal studies; Compare and contrast available strategies

Public outreach

Outreach and public education are critical components of an effective mosquito control program. Sustainable and cost-effective methods of influencing the behavior of residents are needed.

Specific priorities: Evaluate effectiveness of messaging; Determine feasibility of measuring behavioral changes in communities; Feasibility of having a service request interface with VectorSurv to gain knowledge on bite pressure and service awareness; leveraging artificial intelligence technology to gather additional data on resident knowledge and needs.

Assessing control and monitoring strategies

There are currently many tools for evaluating programmatic applications; however, accurate assessments pose challenges. There is a need for guidelines, based on field data, to help standardize the assessment of control efforts and monitoring tools and methods. Allowing vector control agencies to better target future control efforts.

Specific priorities: Develop optimized and statistically-sound methods; Promote core competencies in utilizing control tools; Compile guide for statewide use

Emerging vectors and vector-borne diseases

Beyond the most common and important vector species, there are numerous other important vectors in California. These vectors can interact with wildlife and spread pathogens to humans. Protecting people from less-studied vectors and vector-borne pathogens is important for mosquito and vector control agencies.

Specific priorities: Study biology and control of non-mosquito vectors; Study *Borrelia* spp. and *Rickettsia* spp. infection in ticks and reservoir species; Field evaluations of tick control products and strategies in sylvatic and peridomestic spaces; Impact of landscape management on density of host-seeking ticks; Evaluate the vector capacity of California mosquito species for emerging pathogens; Investigate risk of known emerging VB diseases: RMSF, Oropouche, JE; Continued evaluation of regional flea-borne typhus prevalence: transmission cycle, surveillance, control; Research on role of vectors in avian influenza zoonotic transmission; Extend surveillance diagnostic capabilities to detect introduced pathogens