

Introduction to Resistance

This toolkit provides basic information on pesticide resistance mechanisms and resistance management strategies. It also explains the foundational principles behind resistance testing and why it's a key component of an integrated vector management (IVM) strategy. Use these resources to learn more about insecticide resistance.

IVM Best Practices

1. Best Practices for Integrated Mosquito Management. American Mosquito Control Association (AMCA). (2021) This manual includes AMCA's recommendations for pesticide resistance testing following CDC procedures. Pesticide module begins on page 67. Resistance module begins on page 79.
Link: https://www.mosquito.org/assets/pdf/hr_november_2021_amca_bmp_ma/
2. AMCA Training Webinars: Insecticide Resistance - Module 12. American Mosquito Control Association. (2021)
This module covers Integrated Mosquito Management (IMM), including mosquito biology and the five key components of IMM. The webinar is available for non-AMCA members with registration.
Link: <https://amca.ce21.com/item/insecticide-resistance-module-12-593980>
3. Manual for Monitoring Insecticide Resistance in Mosquito Vectors and Selecting Appropriate Interventions. World Health Organization (WHO). (2022).
Link: <https://iris.who.int/server/api/core/bitstreams/c1272c09-2fd3-4eed-a262-887b4ed3968c/content>
Note: MVCAC recommends that most agencies utilize the CDC Bottle Bioassay rather than the WHO Tube or Bottle Bioassays covered in Section 6 of this manual. However, the rest of the information in this manual is helpful for developing insecticide resistance management programs.

Insecticide Resistance Management

1. Insecticide Resistance Training Module. Insecticide Resistance Action Committee (IRAC). (2020)
This module introduces insecticide resistance management for crops. This module is intended for beginners or those who need a refresher.
Link: <https://irac-online.org/documents/insecticide-resistance-training-basic-module/>
2. Pesticide Resistance Management: Section 2 Insecticide Resistance. University of California Agriculture and Natural Resources (UC ANR). (2019) This section explains how pesticide resistance develops and how to manage or delay it.

Link: <https://www.youtube.com/watch?v=O4V85JAZon8&t=75s>

3. Global Mosquito Resistance Management Virtual Summit. Valent BioSciences. (2022)
This video series covers a variety of topics related to insecticide resistance management.
 - a. Review of Resistance in U.S. Mosquitoes. Presented by Jennifer Henke, Coachella Valley Mosquito and Vector Control District.
Link: <https://www.youtube.com/watch?v=0T4Hzqg35mQ>.
 - b. Molecular Drivers of Insecticide Resistance in Malaria Vectors. Presented by Charles S. Wondji, Liverpool School of Tropical Medicine.
Link: <https://www.youtube.com/watch?v=XOYBzWhmZPQ>.
 - c. Life After Insecticide Resistance was Detected. Presented by Dina M. Fonseca, Rutgers University.
Link: <https://www.youtube.com/watch?v=kLoXshsm804&t=103s>.
 - d. If Every Problem is Unique, Can the Answer be the Same? Presented by Janet McAllister, PhD, CDC.
Link: <https://www.youtube.com/watch?v=GBL2i-8NUpA>.
 - e. Transient Tolerance to Pyrethroids in Gravid Mosquitoes: Implication for Viral Transmission and ULV Control. Presented by Mark Clifton, PhD, Northshore Mosquito Abatement District.
Link: https://www.youtube.com/watch?v=GUu_pc259kg.

Insecticide Resistance Mechanisms

1. Insecticide Mode of Action Training Module. Insecticide Resistance Action Committee. This module provides information on the various mechanisms and targets of insecticide resistance. This module is intended for individuals wishing to gain understanding of insecticide chemistry and physiology.
Training Module. IRAC. (2019):
<https://irac-online.org/documents/tutorial-on-moa-mechanisms/>

Pesticide MOA Summary Poster. IRAC. (2025):
<https://irac-online.org/documents/moa-structures-poster-english/>