

California Mosquito Pesticide Resistance Summary Table
Summary by California Department of Health Services, Vector-Borne Disease Section
October 2005

	<i>Culex tarsalis</i>		<i>Culex quinquefasciatus / pipiens</i>		<i>Aedes nigromaculis</i>	
County	Adult	Larvae	Adult	Larvae	Adult	Larvae
Alameda	malathion (3,24) chlorpyrifos (3)					
Alpine						
Amador	malathion (3) chlorpyrifos (3)					
Butte	malathion (3,24) chlorpyrifos (3)	malathion (1,2,23)		malathion (23)	OP unspecified (20)	
Calaveras						
Colusa	malathion (3, 12) chlorpyrifos (3)	malathion (14)				
Contra Costa	malathion (6) naled (6) resmethrin (6) pyrethrum (6)		chlorpyrifos (6)			
Del Norte						
El Dorado						
Fresno	malathion (6) naled (6) chlorpyrifos (6) resmethrin (6) pyrethrum (6) permethrin (11)	malathion (1,2,14) chlorpyrifos (14)	malathion (6) naled (6) chlorpyrifos (6)	temephos (6)	malathion (3) chlorpyrifos (3)	malathion (19) chlorpyrifos (21) temephos (21) methoprene (9)
Glenn	chlorpyrifos (3)					
Humboldt						
Imperial	malathion (3) chlorpyrifos (3)	malathion (1,2,14) chlorpyrifos(1,2,14)				

	<i>Culex tarsalis</i>		<i>Culex quinquefasciatus / pipiens</i>		<i>Aedes nigromaculis</i>	
County	Adult	Larvae	Adult	Larvae	Adult	Larvae
Inyo						
Kern ⁽¹⁾		malathion (14) chlorpyrifos (14)				malathion (19)
Kings		malathion (1,2,14,23) chlorpyrifos(1,2,14)			chlorpyrifos(4) OP unspecified (20)	
Lake						
Lassen						
Los Angeles	malathion (3)	malathion (1,2) chlorpyrifos (1,2)		malathion (5,23) temephos (5) chlorpyrifos (5)		
Madera	malathion (3,24)	malathion (2,23)			malathion (3)	
Marin		malathion (1,2)	pyrethrins (7) permethrin (7) deltamethrin (7) lambda-cyhalothrin (7)	pyrethrins (7) resmethrin (7) permethrin (7)		
Mariposa						
Mendocino						
Merced	malathion (6) naled (6) chlorpyrifos (6) pyrethrum (6)	malathion (14) chlorpyrifos (14)			malathion (3)	malathion (19,23)
Modoc						
Mono						
Monterey		malathion (14) chlorpyrifos (14)		malathion (23)		
Napa						
Orange		malathion (14)		malathion (14)		malathion (19)

	<i>Culex tarsalis</i>		<i>Culex quinquefasciatus / pipiens</i>		<i>Aedes nigromaculis</i>	
County	Adult	Larvae	Adult	Larvae	Adult	Larvae
Nevada						
Placer						
Plumas						
Riverside	malathion (3) chlorpyrifos (3,6) naled (6) pyrethrum (coachella) (6)	malathion (2,14) chlorpyrifos(1,2,14)	chlorpyrifos(6) naled (6)	temephos (5,6) chlorpyrifos (5)		
Sacramento	malathion (3,6) chlorpyrifos (3) naled (10) pyrethrum (13) (un-synergized)	malathion (23)				
San Benito						
San Bernardino		malathion (1,2) chlorpyrifos (1,2)				
San Diego		malathion (14)				
San Francisco						
San Joaquin		malathion (14)		malathion (5) temephos (5)		malathion (19)
San Luis Obispo						
San Mateo	unspecified (13)	malathion (14)				
Santa Barbara						
Santa Clara						
Santa Cruz						
Shasta	malathion (3)	malathion chlorpyrifos (1)	naled (6)	temephos (6)	chlorpyrifos (3)	malathion (19)
Sierra						
Siskiyou						

County	<i>Culex tarsalis</i>		<i>Culex quinquefasciatus / pipiens</i>		<i>Aedes nigromaculis</i>	
	Adult	Larvae	Adult	Larvae	Adult	Larvae
Solano	malathion (3,24)	malathion (23)			chlorpyrifos (3)	malathion (19)
Sonoma		malathion (1,2)				
Stanislaus		chlorpyrifos (14) malathion (23)			chlorpyrifos (3)	malathion (19,23)
Sutter	malathion (3) chlorpyrifos (3)	malathion (18,23)			malathion (3) OP-Unspecified(20)	
Tehama		malathion (1,2,14)				malathion (19)
Trinity						
Tulare		malathion (14,23) chlorpyrifos (14) OP unspecified (16)		malathion (23)	chlorpyrifos (4,20) naled (20)	chlorpyrifos (4,20) malathion (19)
Tuolumne						
Ventura						
Yolo	malathion (3) chlorpyrifos (3)	malathion (23)				
Yuba	malathion (3) chlorpyrifos (3)	malathion (18,23)			malathion (3)	

A. Information presented may not be complete and does not reflect actions taken to reverse documented pesticide resistance.

B. Negative pesticide resistance assay results are not represented in the table. Species tested include *Aedes melanimon* and *Anopheles* sp.

Footnotes

1. *Aedes melanimon* larvae from Kern County collections have shown resistance to malathion (23)

- OP – organophosphate
- Pyrethrum – natural pyrethrins
- Pyrethroids – permethrin, resmethrin, sumithrin, deltamethrin, lambda-cyhalothrin (all synthetic)
- Temephos – Abate brand products
- Malathion – Fyfanon ULV and other brands
- Methoprene – Altosid brand products
- Naled – Trumpet brand mosquito spray

Please contact Tim Howard with any comments: Thoward@dhs.ca.gov (916) 552-9784

References for California Mosquito Pesticide Resistance Summary Table (October 2005)

1. Thompson, M. A. 1985. Insecticide susceptibility of mosquitoes in California: Status of organophosphorus resistance in larval *Culex tarsalis* through 1984, with notes on restoration of surveillance program. *Proc Calif Mosq Control Assoc.* 53: 71-73.
2. Thompson, M. A. 1986. Insecticide susceptibility of mosquitoes in California: Status of organophosphorus resistance in larval *Culex tarsalis* through 1985. *Proc Calif Mosq Control Assoc.* 54: 60-63.
3. Thompson, M. A. 1989. Susceptibility levels of adult mosquitoes to the organophosphorus insecticides in California. *Proc Calif Mosq Control Assoc.* 57: 66-173.
4. Wilder, W. H., C.H. Schaefer. 1969. Organophosphorus resistance levels in adults and larvae of the pasture mosquito. *Aedes nigromaculis* (Ludlow) in the San Joaquin Valley of California. *Proc Calif Mosq Control Assoc.* 37: 64-67.
5. Zouhair, I. E., G.P. Georghiou. 1985. Geographic variation of resistance to organophosphates, propoxur, and DDT in the southern house mosquito, *Culex quinquefasciatus*, in California. *J Am Mosq Control Assoc.* 1985. 1(3): 279-283.
6. Cornel, A.J., M. Stanich, R. McAbee, S. Mulligan III, D. Farley. 2001. Mosquito pesticide tolerance surveillance in California. *Proc Calif Mosq Control Assoc.* 69: 17-23.
7. McAbee, R. D., K-D. Kang, N.A. Stanich, J.A. Christiansen, C.E. Wheelock, A.D. Inman, B.D. Hammock, A. J. Cornel. 2003. Pyrethroid tolerance in *Culex pipiens* var *molestus* from Marin County, CA. *Pest Manage Sci.* 60: 359-368.
8. Cornel, A. J., M.A. Stanich, R.D. McAbee, F.S. Mulligan III. 2002. High level methoprene resistance in the mosquito *Ochlerotatus nigromaculis* (Ludlow) in Central California. *Pest Manage Sci.* 58: 791-798.
9. Cornel, A. J., M.A. Stanich, D. Farley, F.S. Mulligan III, G. Bye. 2000. Methoprene tolerance in *Aedes nigromaculis* in Fresno County, California. *J Am Mosq Control Assoc.* 16(3): 223-228.
10. Townzen, K. 2005. Documented resistance or susceptibility to OP insecticides: Adult and larval stages. Unpublished summary table supplied by Ken Townzen, California Department of Health Services.
11. Cornel, A. J. 2005. Adult *Culex* pyrethroid susceptibility profiles: Unpublished summary table supplied by Anton Cornel, Ph.D., University of California at Davis.
12. Townzen, K., M. Kimball, R. McBride, D. Whitesell. 2002. Notes on the aerial application of Trumpet in the Butte Sink. *Proc Calif Mosq Control Assoc.* 70: 64-66.
13. Yoshimura, G., D. Brown. 2004. Sacramento – Yolo MVCD. In-house efficacy trial – considering unsynergized pyrethrum as an adulticide for use on “organic” rice. Unpublished.

14. Zboray, E. P., M.C. Gutierrez. 1979. Insecticide susceptibility of mosquitoes in California: Status of organophosphorus resistance in larval *Culex tarsalis* through 1978, with notes on mitigating the problem. *Proc Calif Mosq Control Assoc.* 47: 26-28.
15. Kauffman, E. E. 1968. The effects of insecticide resistance on Sutter-Yuba mosquito abatement district. *Proc Calif Mosq Control Assoc.* 36: 91.
16. Murray, W.D. 1968. Field tests of Flit ® on organophosphorus-resistant *Aedes nigromaculis* in the Delta Mosquito Abatement District. *Proc Calif Mosq Control Assoc.* 36: 93.
17. Gillies, P. A., D.J. Womeldorf, K.E. White. 1968. Cross tolerance of California *Aedes nigromaculis* (Ludlow) larvae to EPN, Abate ®, and Dursban ®. *Proc Calif Mosq Control Assoc.* (Abstract). 36: 85.
18. Case, D. A., E.E. Kauffman. 1984. Organophosphate insecticide resistance in mosquito populations in Sutter and Yuba Counties, California. *Proc Calif Mosq Control Assoc.* 52: 11-16.
19. Womeldorf, D. J., P.A. Gillies, W. H. Wilder. 1966. Mosquito larvicide susceptibility surveillance – 1965. *Proc Calif Mosq Control Assoc.* 34: 77-79.
20. Schaefer, C. H., W.H. Wilder. 1970. Insecticide resistance and cross-resistance in *Aedes nigromaculis*. *J Econ Entom.* 63(4): 1224-1226.
21. Schaefer, C. H. 1967. Pasture mosquito resistance in California. *Pest Control.* January, 1969: 36-37.
22. Gillies, P. A., D.J. Womeldorf, K.E. White. 1984. Interpretation of resistance in California *Aedes nigromaculis* larvae. *Proc Calif Mosq Control Assoc.* 52: 79-81.
23. Womeldorf, D. J., P.A. Gillies, K.E. White. 1968. Present status of insecticide resistance in Californian mosquito larvae. *Proc Calif Mosq Control Assoc.* 36: 81-84.
24. Thompson, M. A. 1988. California Department of Health Services resistance surveillance unit program. Unpublished report.

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