

INSECTICIDE SUSCEPTIBILITY OF THE ORIENTAL HOUSE FLY, *MUSCA DOMESTICA VICINA* MACQUART, IN THAILAND

MICHAEL F. SULLIVAN, SOMKIET VONGTANGSWAD† and PACHAREE NAWARAT

Department of Medical Entomology, Medical Research Laboratory, SEATO Medical Project, Rajvithi Road, Bangkok, Thailand*.

INTRODUCTION

The Oriental house fly, *M. domestica vicina* Macquart, is common throughout Thailand. It, as well as a number of other arthropods, both of medical and agricultural importance, have been the target of government-organized control programs in which insecticides have been widely used. DDT has been applied in malaria, haemorrhagic fever and agricultural pest control programs for many years in Thailand; other insecticides including malathion, trichlorfon (Dipterex), lindane, dieldrin, and carbaryl (Sevin) have been used to a lesser degree. This study reports the results of tests to determine the susceptibility of the Oriental house fly to DDT, malathion and lindane.

MATERIALS AND METHODS

Between July 1969 and May 1970 house flies were collected from the capital cities of eight provinces in Thailand: Phra Nakhon (Bangkok), Chon Buri, Nakhon Ratchasima, Trat, Samut Songkhram, Nakhon Sawan, Udonthani and Chiengrai. Collections were transported to the SEATO Medical Research Laboratory and reared under conditions of controlled temperature (75° - 85°F) and relative humidity (> 60%). Adults were allowed to feed on 5 per cent sugar water; larvae were reared in a chicken feed medium composed of 80% ground corn, 13% peanut

oil meal, 6.7% rice bran and 0.3% salt by weight.

F₁ generation female flies were tested for tolerance to DDT, lindane and malathion 3-7 days after emergence. The methods used are described in detail in a publication of the Armed Forces Pest Control Board (1968), and they varied according to the chemical group of the insecticides being tested. In the case of DDT and lindane, flies were exposed to varying strengths of insecticide in order to determine the concentrations lethal for 50 per cent (LC₅₀) and 90 per cent (LC₉₀) of the population. The concentrations of insecticide used ranged from 0.2-2.5 per cent DDT and 0.0004-1.0 per cent lindane; 2.5 ml acetone solutions of each concentration were applied to the inner surface of 1 pint glass jars and evenly distributed by allowing the solvent to evaporate while rotating the jars. The flies were placed in the jars and exposed for a 15 minute period and then removed to holding cages for 24 hours prior to recording mortality. The lethal concentration values were obtained by plotting a concentration-mortality regression line on log-probit scale paper. In the case of malathion, flies were exposed to a concentration of 27 mg per square meter applied to the inner surface of glass petri dishes by acetone evaporation. The percentage of flies knocked down (unable to walk) was recorded at 2½ minute intervals until complete knockdown or for a maximum of 5 hours. The lethal time (LT) values were obtained by plotting a time-knockdown regression line on log-probit scale paper.

† Faculty of Public Health, Mahidol University, Bangkok, Thailand.

* Alternate Address : SEATO Medical Project, U.S. Component, APO San Francisco 96346.

INSECTICIDE SUSCEPTIBILITY OF HOUSE FLY

The lethal concentration and lethal time values of the strains tested during this study were compared to the values obtained for an insecticide susceptible strain (USDA) maintained by the U.S. Department of Agriculture.

RESULTS AND DISCUSSION

The levels of insecticide tolerance obtained in these tests on Oriental house fly populations from Thailand are given in Tables 1 through 3.

The degree of insecticide tolerance is indicated by the ratio of LC values obtained for the strains tested to those of the susceptible USDA strain.

Evidence of resistance to DDT was found in tests of house flies from Nakhon Ratchasima and Trat (Table 1). Resistance to lindane was demonstrated for flies from Phra Nakhon, Nakhon Ratchasima, Trat, Nakhon Sawan and Udonthani; partial resistance to lindane

Table 1
DDT tolerance levels of eight strains of the Oriental house fly from Thailand compared with USDA susceptible strain of the house fly (15 min. exposure).

Strain	LC ₅₀ *		LC ₉₀ *	
	Per cent concentration	Ratio of Thai strain to USDA strain	Per cent concentration	Ratio of Thai strain to USDA strain
Susceptible	0.054	-	0.19	-
Phra Nakhon	0.13	2.4	0.47	2.5
Chon Buri	1.17	3.1	0.35	1.8
Nakhon Ratchasima	0.47	8.7	1.1	5.8
Trat	0.44	8.1	> 2.5	> 13.1
Samut Songkhram	0.17	3.1	0.32	1.7
Nakhon Sawan	0.14	2.6	0.28	1.5
Udonthani	0.09	1.7	0.22	1.2
Chiengrai	0.07	1.3	0.25	1.3

*LC₅₀ & LC₉₀ : concentrations of an insecticide required to kill 50 per cent and 90 per cent, respectively, of the exposed population in a specified period of time.

Table 2
Lindane tolerance levels of eight strains of the Oriental house fly from Thailand compared with USDA susceptible strain of the house fly (15 minute exposure).

Strain	LC ₅₀ *		LC ₉₀ *	
	Per cent concentration	Ratio of Thai strain to USDA strain	Per cent concentration	Ratio of Thai strain to USDA strain
Susceptible	0.0059	-	0.024	-
Phra Nakhon	0.07	11.9	> 1.0	> 41.6
Chon Buri	0.0061	1.0	0.135	5.6
Nakhon Ratchasima	0.09	15.3	> 1.0	> 41.6
Trat	> 1.0	> 169.5	> 1.0	> 41.6
Samut Songkhram	0.015	2.5	> 1.0	> 41.6
Nakhon Sawan	0.7	118.6	> 1.0	> 41.6
Udonthani	0.03	5.1	> 0.2	> 8.3
Chiengrai	0.012	2.0	> 1.0	> 41.6

*LC₅₀ & LC₉₀ : concentrations of an insecticide required to kill 50 per cent and 90 per cent, respectively, of the exposed population in specified period of time.

Table 3
 Malathion tolerance levels of eight strains of the Oriental house fly from Thailand compared with a susceptible strain of the house fly (27 mg per square meter concentration insecticide).

Strain	LC ₅₀ *		LC ₉₀ *	
	Number of minutes for knockdown	Ratio of Thai strain to USDA strain	Number of minutes for knockdown	Ratio of Thai strain to USDA strain
Susceptible	31	-	42	-
Phra Nakhon	15	0.5	21	0.5
Chon Buri	21	0.7	27	0.6
Nakhon Ratchasima	22	0.7	>300	>8.1
Trat	17.5	0.6	22	0.5
Samut Songkhram	20	0.6	32	0.8
Nakhon Sawan	22.5	0.7	29	0.7
Udonthani	22	0.7	>300	>8.1
Chiengrai	29	0.9	38	0.9

*LC₅₀ & LC₉₀ : length of time required to kill 50 per cent and 90 per cent, respectively, of the exposed population at a specified concentration of insecticide.

was observed in flies from Chon Buri, Samut Songkhram and Chiengrai (Table 2). The house flies tested from most areas were susceptible to malathion, however, a portion of those from Nakhon Ratchasima and Udonthani were resistant to this chemical (Table 3).

It is not known to what extent the base-line susceptibility data for Thai house fly populations resemble those of the USDA susceptible strain. The base-line data are a range of dosages or lengths of exposure that will produce low to complete mortality in a susceptible population. In the case of malathion it is apparent that the base-line susceptibility level of the Thai house fly populations was below that of the USDA strain. The lethal time values for the Thai strains were less than that of the USDA strain in all cases except the partially resistant populations from Nakhon Ratchasima and Udonthani (Table 3). In the cases of DDT and lindane it was not determined whether the base-line data

for the Thai and USDA strains were similar or not. They were alike, however, in the case of DDT, if the minimum LC₅₀ (0.07%) and LC₉₀ (0.22%) figures for the Thai strains (Table 1) represented the actual base susceptibility for the Thai population.

SUMMARY

Insecticide tolerance evaluations were made for Oriental house fly populations from eight areas in Thailand. Lindane resistance was found to be widespread. In most areas, house fly populations were susceptible to DDT and malathion.

REFERENCES

- ARMED FORCES PEST CONTROL BOARD, (1968). Methods for determining the susceptibility or resistance of insects to insecticides. *Tech. Inf. Memo.* 3 (Washington, D.C.), 40 pp.