

ANNUAL PROGRESS REPORT

SEATO Medic Study No. 50	Determination of Insecticide Tolerance Level of Selected Mosquito Species in Thailand
Project No. 3A 025601 A 811	Military Medical Research Program S. E. Asia
Task 01:	Military Medical Research Program S. E. Asia
Subtask 01:	Military Medical Research Program SEASIA (Thailand)
Reporting Installation:	US Army-SEATO Medical Research Laboratory APO 146, San Francisco, California  Division of Medical Research Laboratories  Department of Medical Entomology
Period Covered by Report:	1 April 1963 to 31 March 1964
Principal Investigator:	1/Lt. James M. Neely, MSC
Reports Control Symbol:	MEDDH-288
Security Classification:	UNCLASSIFIED

ABSTRACT

SEATO Medical Study No. 50      Determination of Insecticide Tolerance  
Level of Selected Mosquito Species in  
Thailand

Project No. 3A 025601 A 811      Military Medical Research Program  
S. E. Asia

Task 01:      Military Medical Research Program  
S. E. Asia

Subtask 01:      Military Medical Research Program  
SEASIA (Thailand)

Reporting Installation:      US Army-SEATO Medical Research Laboratory  
APO 146, San Francisco, California  
  
Division of Medical Research Laboratories  
  
Department of Medical Entomology

Period Covered by Report:      1 April 1963 to 31 March 1964

Principal Investigator:      1/Lt. James M. Neely, MSC

Reports Control Symbol:      MEDDH-288

Security Classification:      UNCLASSIFIED

The objective of this study is the determination of the of the insecticide susceptibility status of some of the important mosquitoes of Thailand. The increase in the number of insecticides to which mosquitoes have become tolerant and/or resistant during the past few years, has emphasized the importance of determining the resistant. The insecticide tolerance levels of some important species of mosquitoes in Thailand are being determined by means of the World Health Organization test kits; as recommended by the Armed Forces Pest Control Board. Initial emphasis has been placed on the study of the most important species in the Bangkok area, with a planned later extension to other populations. Both larval and adults are being tested. To date, tests of the tolerance of laboratory and wild strains of Culex pipiens quinquefasciatus and Aedes aegypti have shown a high degree of tolerance to D.D.T. for some strains of

both species. Some wild strains of Aedes aegypti, collected in the field, have shown very high resistance to D.D.T. Both Aedes aegypti and Culex quinquefasciatus are susceptible to dieldrin, and Baytex, a commercial organic phosphate compound. Tests made with Anopheles balabacensis, an important malaria vector in Thailand, have shown it to be highly susceptible to D.D.T.



hour, then removed to plain plastic tubes for twenty-four hours. Mortality counts are made at that time, including counts from a control tube in which the mosquitoes are exposed to solvent impregnated paper, without insecticide. The larval test kit consists of a graduated series of concentrations of the test insecticide, which are added to measured amounts of water containing the test larvae. Mortality counts are made after twenty-four hours. Replicate tests are performed to permit the calculation of LC-50 values. In addition to the standard test insecticides supplies by WHO, commercial insecticides available in Thailand are tested when possible.

Progress: Insecticide testing was suspended in early 1963, due to the assignment of the principal investigator to other duties in Northern Thailand. Work was resumed in mid-December, but again suspended until January due to the principal investigator having contracted a serious case of falciparum malaria. Since resumption of the testing program, the laboratory colonies of Aedes aegypti and Culex quinquefasciatus were again subjected to a complete series of tests. When last tested, colony adults of C. quinquefasciatus had yielded an LC-50 of 0.5% for DDT, and Aedes aegypti yielded an LC-50 of 1.0%. During the year the colonies were moved to a new insectary, and in the process all of the old stock was killed. New specimens were obtained from the same areas of Bangkok as the old colonies, and retested. The new strain of Culex quinquefasciatus adults proved to be highly resistant to DDT, but the LC-50 for dieldrin was 1.2%. The larvae from the colony of C. quinquefasciatus showed an LC-50 of 0.30 ppm. for DDT. The LC-50 for C. quinquefasciatus larvae from the colony when exposed to dieldrin was 0.02 ppm.

Because of its importance in the transmission of the virus of hemorrhagic fever, Aedes aegypti strains from several sources were tested during the period. Additional emphasis was also placed on this species because of the developing interest on the part of Thai authorities in controlling A. aegypti in Bangkok. Officials of the Ministry of Health have reported finding several strains of DDT tolerant A. aegypti in Bangkok, a fact which will considerably influence the control program. The newly established laboratory colony was tested against DDT and dieldrin, and the adults and larvae appeared to be normally susceptible to these insecticides (Table 1). It is planned to retest the colony at frequent intervals to provide baseline data for evaluating changes in the wild populations in the city as the control program progresses. One wild strain, from the Soi Plook Chit area of Bangkok, was tested with DDT and dieldrin during the period. As shown in table 1 and figure 1, this strain appeared to be markedly resistant to DDT, especially in the larval

TABLE 1

Insecticide Tolerance Levels of Selected Mosquito  
Species in Thailand

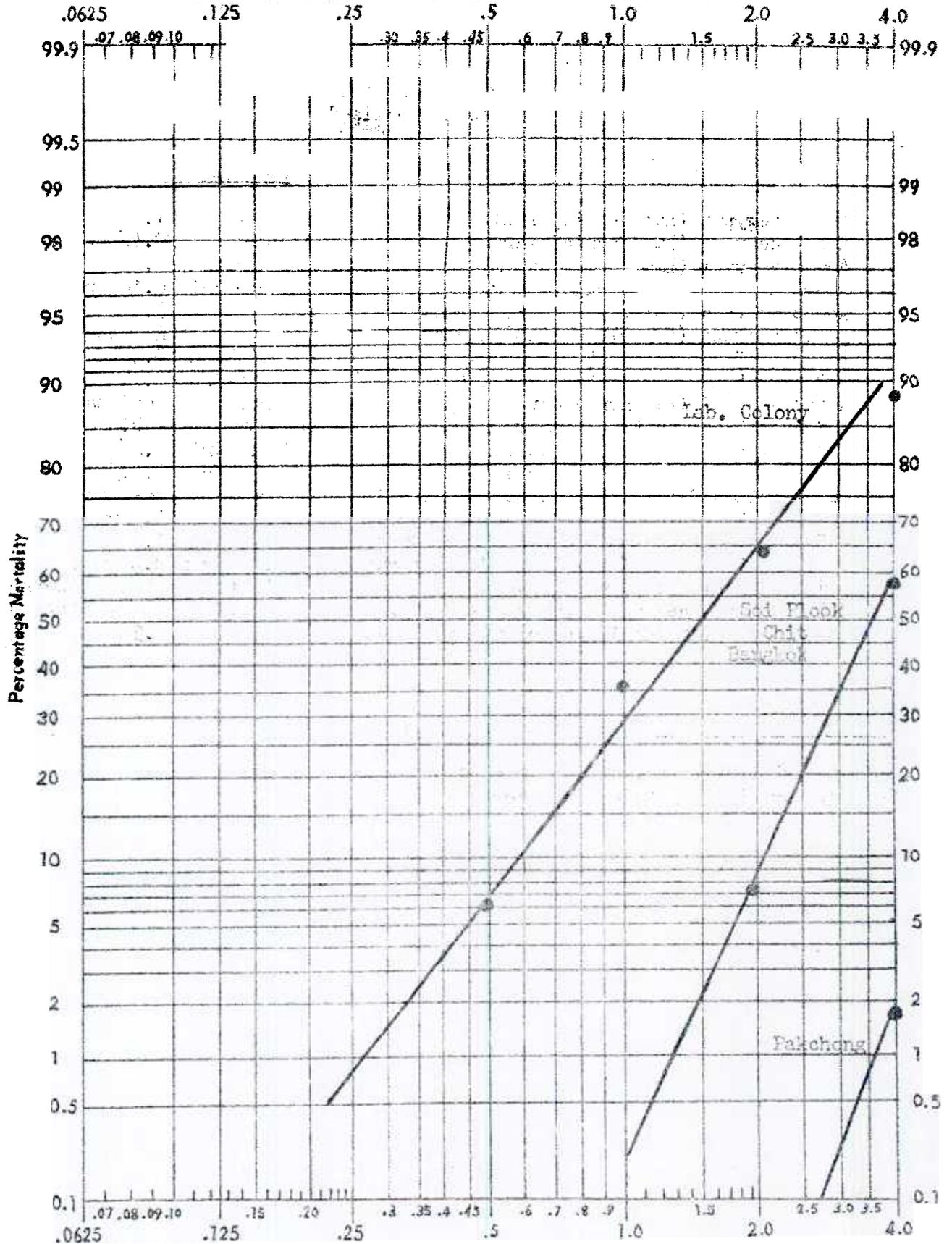
		<u>Insecticide</u>
Aedes aegypti (Lab strain) adults		DDT 1.5%
Aedes aegypti (Lab strain) larvae		DDT 0.4% ppm
Aedes aegypti (Lab strain) adults		Dieldrin 0.6%
Aedes aegypti (Lab strain) larvae		Dieldrin 0.10 ppm
Aedes aegypti (Soi Plook Chit) adults		DDT 3.5%
* Aedes aegypti (Soi Plook Chit) larvae		DDT Resistant
" " " adults		Dieldrin 0.4%
" " " larvae		Dieldrin 0.40
Aedes aegypti (Pakchong) adults		DDT Resistant
" " " larvae		DDT Resistant
" " " adults		Dieldrin 0.4%
" " " larvae		Dieldrin 0.40%
* Culex quinquefasciatus (Lab strain) adults		DDT Resistant
" " " " larvae		DDT 0.3 ppm
" " " adults		Dieldrin 1.2%
" " " larvae		Dieldrin 0.02 ppm
** Aedes aegypti (Lab strain) adults		Baytex 6 Highly Susceptible
** Culex quinquefasciatus (Lab strain) adults		Baytex 6 Highly Susceptible
Anopheles balabacensis (Khao Mai Kaeo) adults		DDT 0.3%

---

\* No mortality at any of the test concentrations

\*\* Only preliminary test have been completed

Fig 1. Dosage mortality relationships to DDT of 3 S populations with different resistance levels  
Concentration of DDT (%)



stage. Its response to dieldrin also differed from the laboratory colony. This strain will be observed again as time permits. There is no history of an organized spraying campaign in the section of Bangkok where it was obtained. A strain of Aedes aegypti was also obtained from the city of Pakchong, approximately 150 Kilometers north of Bangkok. Unlike Bangkok, Pakchong is in a highly malarious zone, and has been sprayed with DDT and dieldrin for several years, including an application of DDT in 1963. It has been observed in a number of countries with malaria control or eradication campaigns that A. aegypti tends to disappear from sprayed areas. However, our virus collections in Pakchong (Study No. 42) showed a large number of A. aegypti in the city and surrounding villages. No satisfactory kill of A. aegypti from Pakchong could be obtained with DDT, even when the contact period was greatly extended, and it appears that the strain is extremely resistant to DDT. However, an adult LC-50 of 0.4% with dieldrin indicated that the species was still susceptible to that insecticide in Pakchong.

Limited preliminary tests were made with papers impregnated with several concentrations of Baytex 6, an organic phosphate supplied by the local representatives of the Bayer Co. Tests at all concentrations have not been completed, but it appears to be highly effective against A. aegypti and C. quinquefasciatus adults from the laboratory colonies.

Members of the malaria study group of the Laboratory conducted tests with WHO test kits against adults of Anopheles balabacensis at Khao Mai Kaeo. This species is a very important malaria vector in that area. An LC-50 value of 0.3% for DDT was obtained using wild-caught adults, indicating satisfactory susceptibility to the insecticide. An incomplete series with adult Anopheles minimus in the same area indicated that this species was normally susceptible. These tests will be resumed during the rainy season when additional mosquitoes become available.

Summary: Insecticide susceptibility testing was resumed in early 1964. Laboratory colonies of A. aegypti and C. quinquefasciatus were tested to provide baseline data for DDT and dieldrin. The C. quinquefasciatus colony exhibited signs of DDT resistance, while A. aegypti from the colony was susceptible to DDT. Both species were susceptible to dieldrin, and to an organic phosphate. Several wild strains of A. aegypti appeared to be resistant to DDT.

Conclusions: The appearance of presumptive insecticide tolerance in A. aegypti may have a considerable effect on programs for control of hemorrhagic fever. The situation warrants additional observation and study.