STUDY REPORT

1. Title: Plague Occurrence in Wild and Domestic Rodents and their Fleas and Susceptibility of Fleas to Insecticides.

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OBJECTIVES

A. To assess the relative importance of domestic rodents and their fleas in the current plague outbreak in South Vietnam and to assess the relative susceptibility of these fleas to various insecticides.

B. To determine if foci of wild rodent plague exist in the Republic of Vietnam and determine animal and flea species involved.

A. Domestic rodent plague:

DESCRIPTION

An extensive plague control program for the I, II, & III Corps Tactical Zones (CTZ) of the RVN was programmed and carried out by the Ministry of Health during the latter months of 1968 and early months of 1969. This program consisted of an extensive dusting program (DDT 10%) combined with a mass immunization program using the live attenuated vaccine produced by the Institute Pasteur, Saigon. The decrease in human cases was expected to attest to the efficacy of this large scale effort. However, the public health officials in II CTZ planned to trap animals in each province before and after DDT dusting so that flea indices and resistance levels of fleas to DDT could be determined. This afforded us the opportunity to identify and examine both the rodents and flea ectoparasites collected throughout II CTZ. Live animals were flown to the central laboratory established at the Institute Pasteur, Nha Trang, where they were identified, combed for flea ectoparasites, bled, and autopsied to remove spleen tissue to be examined for evidence of P. pestis infection. All fleas were identified and flea colonies were established using fleas collected from several areas for insecticide susceptibility tests. The remaining fleas were appropriately pooled and examined for evidence of P. pestis infection.

PROGRESS

Although the laboratory results are not yet completed, it is evident that there has been no appreciable decrease in the flea populations following the dusting program. Relative abundance of the 4 domestic animal species indicated that of about 1000 animals collected in 9 of 11 provinces of Region Two, approximately 45% of them were identified as Rattus exulans, 40% Rattus norvegicus, 13% Suncus murinus and 2% Rattus rattus. The absence of Bandicota species was unusual. Identification of more than 1500 fleas collected from these animals indicated that about 99% of them were Xenopsylla cheopis, with the remaining 1% consisting of the following species:

1. Xenopsylla astia
2. Xenopsylla vexabilis
3. Ctenocephalides felis
4. Ctenocephalides canis
5. Stivalius klossi
6. Leptopsylla segnis

Some difficulties were encountered in establishing the flea colonies and of 24 colonies initiated, only 8 were successful and are now flourishing. The adult fleas emerging from these colonies are being tested for susceptibility to various insecticides using the WHO test kits and recommended techniques.

Preliminary resistance – susceptibility tests for DDT were conducted on three colonies which had adequate numbers of specimens for tests. Tests run with DDT concentrations of 0.5, 1.0, 2.0 and 4.0% on fleas from Nha Trang (Table I), Pleiku (Table II), and Qui Nhon (Table III), using exposure times of one hour and twenty four hours, failed to establish an adequate end point. The highest concentration (4.0%) failed to kill any fleas after a one hour exposure and 24 hour observation. Only after prolonged exposure (24 hrs) was slight mortality observed.

B. Wild Rodent Plague:

DESCRIPTION

A search for possible wild rodent plague in Vietnam was undertaken by trapping at the Pasteur Farm (about 16 km. west of Nha Trang) and at Cam Ranh Bay. Programmed trapping in sylvan areas surrounding Dalat, Ban Me Tout and Pleiku was planned but was not possible due to the insecure nature of the areas.

The terrain surrounding the Pasteur Farm consists of an old rubber plantation with heavy secondary regrowth plus several fields of grassland which serve as pasture for horses and cows. Continued trapping in this area indicated a scarcity of animals. Trapping in an area of dry evergreen forest near Tiger Lake at Cam Ranh Base in April indicated a much richer fauna with a greater variety of wild rodents.

All rodents collected were identified. Tissue and serum were taken for laboratory examination for evidence of P. pestis infection and ectoparasites removed, indentified and examined for P. pestis infection.

PROGRESS

Trapping during the months of October, November, December and January at the Pasteur Farm yielded at total of 55 rodents from which were recovered 11 fleas; 33 rodents were identified as R. rattus, 19 as R. exulans and 3 as R. argentiventer. All eleven fleas were X. cheopis. No isolation of P. pestis was obtained from either rodents or fleas. However, one of 39 sera from these rodents, examined for antibody to P. pestis was reactive in the hemmagglutination test, thus indicating the probable presence of P. pestis infection in this animal population. Trapping in the Tiger Lake area yielded a variety of wild rodents: 7 Tupia glis, 6 Menetes berdmorei, 4 Rattus rajah, and 9 Rattus rattus. No flea ectoparasites were found on any of these rodents. Tissue and blood specimens from these animals are currently being examined for evidence of P. pestis infection.

Table 1. Flea Resistance Testing NHA TRANG (Post—Dusting)

Percent DDT Concentration	Number dead/Number exposed		
	1 Hr. Exposure Test #1	24 Hr. Exposure	
		Test #1	Test #2
Control	0/10	0/10	0/10
0.5	0/10	1/10	—
1.0	0/10	0/10	1/10
2.0	0/10	1/10	0/10
4.0	0/10	3/10	0/10

Table 2. Flea Resistance Testing PLEIKU (Pre Dusting)

Percent DDT Concentration	Number dead/Number exposed			
	1 hr. Exposure			24 hr. Exposure
	Test #1	Test #2	Test #3	Test #1
Control	1/10	0/10	3/10	0/10
0.5	3/10	0/10	0/10	0/10
1.0	0/10	0/10	0/10	1/10
2.0	0/10	1/10	1/10	4/10
4.0	0/10	1/10	1/10	6/10

Table 3. Flea Resistance Testing QUI NHON (Pre Dusting)

Percent DDT Concentration	Number dead/Number exposed				
	1 hr. Exposure			24 hr. Exposure	
	Test #1	Test #2	Test #3	Test #1	Test #2
Control	0/10	0/10	0/10	0/10	0/10
0.5	0/10	0/10	0/10	0/10	0/10
1.0	0/10	0/10	0/10	0/10	0/10
2.0	0/10	0/10	0/10	0/10	0/10
4.0	6/10	0/10	0/10	1/10	3/20