

ANNUAL PROGRESS REPORT

SEATO Medic Study No. 49
Project No. 3A 025601 A 811:

Task 01:
Subtask 01:

Reporting Installation:

Period Covered by Report:

Principal Investigator:

Associate Investigators:

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Ectoparasites of the Vertebrates
of Thailand
Military Medical Research Program
S. E. Asia
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SEASIA (Thailand)
US Army-SEATO Medical Research
Laboratory, APO 146, San Francisco,
California
Division of Medical Research Laboratories
Department of Medical Entomology
1 April 1963 to 31 March 1964
Major J. E. Scanlon, MSC
Mr. Kitti Thonglongya
Miss Panita Lakshana
Dr. C.M. Clifford *
Dr. T.C. Maa **
Dr. R. Traub ***
MEDDH-288
UNCLASSIFIED

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ABSTRACT

SEATO Medic Study No. 49: Ectoparasites of the Vertebrates of Thailand

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

Subtask 01: Military Medical Research Program SEASIA (Thailand)

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This study has as its object the production of a complete catalog of the ectoparasites of the vertebrates of Thailand. Over thirteen hundred

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vertebrates (largely mammals) were examined in Thailand during the year, chiefly in connection with studies on rickettsial disease. Whenever possible, ectoparasites were removed from the hosts and identified by Department personnel or sent to cooperating specialists. Host-parasite lists and other data of interest were compiled for an eventual series of catalogs of the ectoparasites of Thailand which will be in assistance to present and future disease studies. Approximately one hundred species of chiggers have now been identified, of which fourteen are being described by Department personnel. Nine other chigger species were described during the year by cooperating specialists. Twenty five species of ticks were identified, including two new Haemaphysalis species. Twenty five species of pupiparous Diptera were also collected, and several of these were reported for the first time from Thailand. Nineteen species of blood-sucking lice were found on small Thai mammals, and eleven additional species were identified in a collection sent from West Pakistan.

BODY OF REPORT

SEATO Medic Study No. 49: Ectoparasites of the Vertebrates of Thailand

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Objective: To establish a list of the ectoparasites of the vertebrates of Thailand. To assemble information on the host-parasite relationships of the various species, information on their geographical distribution,

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abundance, and other facts of their biologies.

Description: Ectoparasites are removed from mammals, birds and other vertebrates collected in connection with various disease studies in Thailand. The ectoparasites are preserved, sorted into major group and identified, or submitted to specialists for identification. Aliquots of collections used for inoculation of test animals are given preference in identification. Taxonomic studies are also conducted on the vertebrate hosts, chiefly the mammals.

Progress: A large number of mammals were added to the collection during the period, while only 14 birds were collected. The vertebrates examined are listed in table 1. At the end of the period, all of the birds collected from the opening of the study were turned over to the ornithologist recently assigned to the Laboratory. In addition to the specimens collected by Laboratory personnel, several hundred vertebrates and their ectoparasites collected by Bishop Museum collectors in South Thailand were examined and forwarded to the Museum. Cooperating specialists returned a large number of identified specimens during the period. The vertebrate hosts and each of the ectoparasite groups of importance will be discussed separately below.

Mammals

Several hundred mammal skins were examined by one of the investigators (KT) and Dr. John Harrison, University of Malaysia. A draft checklist of the mammals of Thailand has been prepared and is being corrected for publication. A key to the small mammals and another to the rodents of Thailand has been prepared, and will be published after being tested and modified. Over 300 mammal skins, most of them accompanied by skulls, was sent to the United States National Museum, as a donation from the U.S. Army. These specimens will be held at the Museum pending further study by the curator and members of this project. The provision of skulls is especially important since tedious and exacting work is required to produce them. The collection sent to the USNM is one of the larger collections of small mammals ever assembled with matching skulls. The following are some notes on the common species of mammals collected in connection with scrub typhus studies, and on some of the more rare species seen during the year:

Rattus rattus- This very common species appears to be one of the most important reservoirs of rickettsiae (see Study No. 46). From this viewpoint it is unfortunate that it has such a wide distribution. It was collected in urban and suburban areas, lalang grass, fruit gardens and primary jungle. Nests of R. rattus were also found in coconut palms and bamboo thickets. It appears to be common in Thailand from the coast to the upper part of the

mountains. S.E. Asia is the center of distribution of this complex species, and there appear to be a number of subspecies or infrasubspecific taxa here. No attempts has been made to determine the status of these forms, and none will be made until the collection at the USNM and the British Museum can be consulted.

Rattus rajah- This spiny rat is primarily an inhabitant of hill forests. It occurs from low hills (ca. 700 feet) up to approximately 4500 feet. The high rate of rickettsial isolation made from this species in Thailand (Study No. 46) indicate its probable importance as a reservoir in the hill forest habitat. It was found in association with Rattus rattus, R. niviventer (at Khao Yai), and R. berdmorei (wet areas at Chong Mek and Chantburi).

Rattus berdmorei- A little known rat in Thailand. Found chiefly in wet areas along streams, etc. However, two specimens were taken from unusual localities; one from a lalang grass field in Choburi Province in association with Bandicota indica; the other from a banana grove at Chong Mek. The latter specimen was associated with Bandicota bengalensis, a much rarer species in Thailand.

Rattus niviventer- A small rat with a rather spotty distribution. It appears to occur chiefly in deciduous forests on the lower mountain slopes. on Khao Yai it approximately equalled R. rajah (based on a small sample); while at Chong Mek R. rajah was far more common.

Rattus exulans- This small rat can adapt itself well to domestic situations, fruit gardens, or forests surrounding villages. It may be a more common domestic species at times than R. rattus, and some records of Mus musculus in cities in Thailand may actually refer to this small rat. It is suspected to play an important role in the transmission of scrub typhus in Burma, but apparently does not in Thailand, to judge by the low rate of isolation from the specimens examined by us (Study No. 46).

Bandicota indica- A large grizzled rat with a general appearance somewhat like that of the Norway rat. This species is very closely associated with man, and the high rate of isolations of rickettsiae from this species in our study indicates that it may be of considerable importance. It is found chiefly in the dikes separating rice paddies and in the woods and scrub surrounding the paddies. Many villagers dig the rats from their holes at certain times of the year as an item of food.

Menetes berdmorei- A ground squirrel, rather than a rat. It is especially common around Chiangmai, and while primarily a forest animal it adapts readily to life in a garden on the edge of town. It appears to migrate to wetter areas during the dry season. At Chong Mek, for instance it was taken along stream during the dry season (May-June) but was

essentially absent in the same sites after the rains started. Isolations were made from this squirrel and its ground dwelling habits and occasional association with man may make it important as a rickettsial reservoir.

Tupaia glis- Unlike all of the preceding animals, this species is not a rodent. After many years of debate, it is now generally agreed that it is a primitive primate. It is common throughout Thailand, from the fringes of Bangkok to deciduous forests, and it is often sold as a pet. Nine of 72 pools of tissue from the tree shrew were positive for rickettsiae during this study.

Some additional notes on rarer mammals encountered in Thailand:

Hylomys suillus- The lesser gymnuran. Very few of these rare insectivores were reported since the original specimen was described from Hinlap, Thailand. Two chigger infested specimens were captured on Khao Yai, one in a thicket of Calamus sp., the other in evergreen forest.

Bandicota bengalensis- The specimen from Chong Mek appears to be the most eastern record to this species, which occurs in India, Burma and Malaya. It was collected in a banana plantation, but is recorded chiefly as a rice field inhabitant. Scrub typhus rickettsiae have been recovered from this rat in Burma.

Rattus cremoriventer- Originally described from Trang, Southern Thailand, and later recorded from Doi Inthanon, the highest peak in Thailand. The present specimens collected from deciduous forests at Chong Mek differs from the described form somewhat in skull and fur color, and many represent a new species.

Rattus fulvescens- Specimens of this rather rare rat were collected on Doi Suthep, Chiangmai. It resembles R. niviventer but has a longer tail. It has been reported as a host of Leptotrombidium deliensis in Assam.

Vandeleuria oloracea- is a small climbing rat which constructs nests in the giant grasses (Saccharum sp.) along the Ping river near Chiangmai.

Discussions of the habits and rates of extoparasite infestation of the various mammals collected during these studies are being prepared for publication. The following discussion relates to the various groups of ectoparasites studies.

Chiggers

Because of the intensive work in scrub typhus during the year most of the effort in ectoparasite investigations has been devoted to this group. Over 17,000 microscope slide mounts of chiggers were prepared during the year. The lack of these proved to be Leptotrombidium deliense and related species. Drawings of thirteen new species of chiggers were prepared by artists at the 406th Medical General Laboratory in Japan. The investigator primarily charged with the study of the chiggers (PL) departed for Baltimore in March to cooperate with Dr. Robert Traub of the University of Maryland School of Medicine and Mr. M. Nadchatram of the Institute of Medical Research, Malaysia in the description of these thirteen species, and a number of others. Nine new species of chiggers were described during the year by cooperating specialists in Malaysia and Australia. These included: Ascoschongastia (Laurentella) leechei Domrow, A. (L.) kittii Domrow. The other species are still in press and the names cannot be cited here at present. In addition, one new species was illustrated in Bangkok, and is presently being described in Baltimore. In all, approximately one hundred species of chiggers have now been identified.

It is anticipated that this number will increase greatly as the detailed study of the group progresses. Leptotrombidium deliense and closely related species make up the bulk of the specimens identified thus far. Data have been tabulated for these and other species listing occurrence by host for each of the areas in Thailand surveyed. These data will be published when identification of the difficult species has been completed. As noted in study number 46, large numbers of L. akamushi were found for the first time at Khao Yai National Park. Late in the report period chigger rearings were set up in Bangkok, largely for Leptotrombidium species. The primary purpose of the rearings at first will be to obtain associated larval, nymphal and adult stages for taxonomic study. If large scale rearing proves feasible, the work will be extended to determination of infection potential of the larval stages.

Ticks

The finding of the rickettsiae of Indian tick typhus in a pool of larval ticks from the Chiangmai area (see Study No. 46) has emphasized importance of obtaining additional information on the ticks of Thailand. During the year a large number of ticks were submitted to the Rocky Mountain Laboratory, USPHS, and a list of the species identified by them during the year will be found in table 2. Two new species of Haemaphysalis were described during the year based partially on these collections. These names are still in press and cannot be cited here. The finding of

TABLE 1. Vertebrates and ectoparasites collected in Thailand, April 1963 to March 1964

	Total Parasites		Chiggers	Ticks	Fleas	Flies
<u>CLASS MAMMALIA</u>						
<u>ORDER INSECTIVORA</u>						
<u>FAM. ERINACEIDAE</u>						
1. Hylomys suillus	2	2	-	2	-	-
<u>FAMILY TUPAIIDAE</u>						
2. Tupaia glis	178	127	8	120	28	4
<u>ORDER CHIROPTERA</u>						
<u>FAMILY PTEROPIDAE</u>						
3. Rousettus amplexicaudatus	6	6	-	2	2	-
4. Cynopterus brachyotis	4	3	-	-	-	6
<u>ORDER CARNIVORA</u>						
<u>FAMILY MUSTELIDAE</u>						
5. Melogale personata	3	1	-	-	1	-
6. Arctony collaris	1	-	-	-	-	-
<u>FAMILY VIVERIDAE</u>						
7. Paradoxurus hermaphroditus	3	1	-	-	1	-
8. Herpestes javanica	4	4	2	4	1	-
9. Herpestes sp.	1	-	-	-	-	-
<u>ORDER LAGOMORPHA</u>						
<u>FAMILY LEPORIDAE</u>						
10. Lepus siamensis	4	4	-	1	3	-
<u>ORDER RODENTIA</u>						
<u>FAMILY SCIURIDAE</u>						
11. Ratufa bicolor	1	1	-	-	-	1
12. Callosciurus erythraeus	3	3	2	1	-	1
13. Callosciurus finlaysoni	4	4	1	3	1	1
14. Callosciurus sp.	1	-	-	-	-	-
15. Callosciurus maccllellandi	2	1	1	-	-	1
16. Menetes berdmorei	160	121	27	96	28	28
17. Dremomys rufigenys	1	1	1	1	1	1

	Total	Parasites	Lice	Chiggers	Ticks	Mites			
<u>FAMILY MURIDAE</u>									
18.	Rattus nitidus	1	1	-	1	-	-	-	
19.	Rattus rattus	431	361	69	318	75	282	18	
20.	Rattus rattus	135	39	6	14	5	14	17	
21.	Rattus sp.	38	34	8	15	8	32	2	
22.	Rattus sabanus	1	1	1	1	1	1	-	
23.	Rattus rajah	200	190	2	126	13	153	14	
24.	Rattus berdmorei	17	14	8	3	9	10	13	
25.	Rattus cremoriventer	1	1	-	-	-	1	-	
26.	Rattus niviventer	16	16	2	9	5	16	2	
27.	Rattus fulvescens	1	1	1	1	-	1	-	
28.	Bandicota bengalensis	1	1	-	-	-	-	-	
29.	Bandicota indica	121	90	14	78	26	32	-	
30.	Mus musculus	1	1	-	1	-	-	-	
31.	Vandelestia oleracea	1	-	-	-	-	-	-	
<u>FAMILY RHIZOMYIDAE</u>									
32.	Canomys badius	5	4	3	-	-	1	-	
Total 32 species		1347	1032	156	797	208	580	87	9
<u>CLASS AVES</u>									
<u>ORDER PASSERIFORMES</u>									
<u>FAM. DICRURIDAE</u>									
1.	Dicrurus sp.	1	-	-	-	-	-	-	
2.	Dicrurus macrocercus	1	1	1	-	-	-	-	
3.	Dicrurus paradiseus	1	-	-	-	-	-	-	
<u>FAM. TURDIDAE</u>									
4.	Copsychus malabaricus	1	1	-	1	1	-	-	
5.	Geokichla citrina	1	1	-	1	1	-	-	
6.	Saxicola caprata	2	-	-	-	-	-	-	
<u>FAM. PERICROCOTIDAE</u>									
7.	Pericrocotus flammeus	1	-	-	-	-	-	-	
<u>FAM. ORIOLIDAE</u>									
8.	Oriolus chinensis	1	-	-	-	-	-	-	
9.	Oriolus xanthornus	1	-	-	-	-	-	-	

<u>FAM. MUSCICAPIDAE</u>	Total							
Hypothymis azurea	1							
<u>ORDER CUCULIFORMES</u>								
<u>FAM. CUCULIDAE</u>								
Glaucidium cuculoides	1	1			1		-	
<u>ORDER STRIGIFORMES</u>								
<u>FAM. STRIGIDAE</u>								
Otus baekkanoeana	1	1	1	1	-		-	
<u>FAM. PORDARGIDAE</u>								
13. Bratachostomus hodgsoni	1		-		-		-	-
<u>ORDER PICIFORMES</u>								
<u>FAM. PICIDAE</u>								
14. Blythipicus pyrrhotis	1	1	-	-	-	1	-	-
Total 14 species	15	6	2	3	3	1	-	

Table 2. Ticks collected in Thailand, April 1963 to March 1964

Haemaphysalis cornigera var. anomala	Haemaphysalis doenitzi.
Haemaphysalis sharifi.	Boophilus microplus.
Haemaphysalis hystricis.	Amblyomma testudinarium.
Haemaphysalis megalaimae.	Rhipicephalus haemaphysaloides.
Haemaphysalis papauara.	Dermacentor auratus.
Haemaphysalis trapedoi.	Aponoma pattoni.
Haemaphysalis koninsbergeri.	Aponoma lucasi.
Haemaphysalis bispinosa.	Ixodes granulatus.
Haemaphysalis wellingtoni.	Ixodes radfordi.
Haemaphysalis bandicota.	Ixodes spincoxalis.
Haemaphysalis leachii.	Argas sp. (vespertilonis group)
Haemaphysalis leachii var. indica.	Ornithodoros sp. (batuensis group)
Haemaphysalis traguli.	

Ilaemaphysalis cornigera anomala is only the fourth record of this species, which was collected here from man. The general pattern in all of the areas surveyed has been a rather low incidence of ticks, restricted largely to the beginning of the rainy season. Many of the specimens taken from small mammals have been larvae, which cannot be identified beyond the generic level at this time. Limited rearing of associated stages have been undertaken to solve this problem, and this activity will be expanded in the coming year.

Other Acarina

All of the other acarina have been submitted to the Bishop Museum, Honolulu, for identification. None of the mesostigmatic mites or other forms (excluding ticks and chiggers) have been implicated in disease transmission in Thailand as yet. However, difficulty was experienced during the year with Ornithonyssus bacoti in the Laboratory mouse colony in Bangkok. A large infestation of the mites interfered with mouse production until brought under control with insecticides. A new species of Sarcoptes (itch mite) was also found on a small monkey (Macaca irus) in the animal colony. Twenty five species of acarines other than ticks and chiggers are now present in our collections, and host data have been assembled for them. A new species Laelaps (Echinolaelaps) aingworthae Strandmann and was described from specimens from our collections on Doi Suthep.

Anoplura

The blood-sucking lice are another group of mammal parasites which have not as yet been implicated in the transmission of disease in Thailand. While not as widespread or abundant as some of the other ectoparasite groups (see table 1) in Thailand, they do pose a potential problem of their blood feeding habits, at least in the maintenance of diseases among wild animal reservoirs. Nineteen species have now been identified in our collections. These are listed in table 3. Eleven species were also identified among specimens submitted to us by Dr. Robert Traub, from his collections in West Pakistan. These are listed in table 4. Most of the small mammal host species of Thailand have now been examined for lice, and it is doubted that the number of species seen will increase greatly. However, very few of the larger animals have been examined.

Siphonaptera

No report has been received as yet from Dr. Traub concerning the fleas sent to him from these collections. His initial impression was that the flea population among the small mammal hosts was quite limited in species range. A species close to Xenopsylla vexabilis was collected from Rattus berdmorei and examined by Dr. Traub in Bangkok. The bat flea

Table 3. Anoplura collected in Thailand, April 1963 to March 1964.

<i>Enderlinellus corrugatus</i> .	<i>Hoploplura pacifica</i> .
<i>Haemodipsus</i> sp. "S" (nov.)	<i>Hoploplura pectinata</i> .
<i>Pedicinus eurygaster</i> .	<i>Hoploplura erismata</i>
<i>Polyplax cannomydis</i> .	<i>Hoploplura</i> sp. nov. "A".
<i>Polyplax spinulosa</i> .	<i>Hoploplura</i> sp. nov. "B".
<i>Polyplax reclinata</i> .	<i>Neohaematopinus callosciuri</i> .
<i>Polyplax asiatica</i> .	<i>Neohaematopinus cognatus</i> .
<i>Polyplax insulsa</i> .	<i>Neohaematopinus capitaneus</i> .
<i>Hoploplura thurmanae</i> .	<i>Neohaematopinus elbeli</i> .
<i>Hoploplura malabarica</i> .	

Table 4. Anoplura from West Pakistan.

<i>Neohaematopinus echinatus</i> .	<i>Hoploplura</i> sp. nov. "B"
<i>Neohaematopinus</i> sp. nov. "1".	<i>Hoploplura</i> sp. nov. "C"
<i>Neohaematopinus</i> sp. nov. "2".	<i>Polyplax reclinata</i> .
<i>Hoploplura pacifica</i> .	<i>Polyplax stephensi</i> .
<i>Hoploplura maniculata</i> .	<i>Pedicinus hamadryas</i> .
<i>Hoploplura</i> sp. nov. "A".	

Table 5. Pupiparous Diptera from mammals and birds, Thailand, April 1963 to March 1964.

<i>Nycteribia parvula</i> .	<i>Carnus hemapterus</i> .
<i>Nycteribia modesta</i> .	<i>Ornithoica curtata</i> .
<i>Nycteribia allotopa</i> .	<i>Ornithoica metallica</i> .
<i>Nycteribia amboinensis</i> .	<i>Ornithoica stipturi</i>
<i>Nycteribia</i> n. sp. "SS"	<i>Ornithoica exilis</i> .
<i>Nycteribosca parvior</i> .	<i>Lynchia longipalpis</i> .
<i>Eucampsipoda sundaicum</i> .	<i>Lynchia simplex</i> .
<i>Eucampsipoda latisternum</i> .	<i>Lynchia chacolampra</i> .
<i>Leptocyclopodia ferrarii</i> .	<i>Lipotena gracilis</i> .
<i>Eribosca modesta</i> .	<i>Lynchia</i> sp. nov. "PP"
<i>Cyclopodia horsfieldi</i> .	<i>Lynchia</i> sp. nov.
<i>Basillia royii</i> .	<i>Raymondia pagodarum</i> .
<i>Ascoipteron</i> sp.	

Thaumapsylla breviceps orientalis was also recorded for the first time from the fruit bat Rousettus amplexicaudatus in Thailand.

Pupipara

The pupiparous Diptera have been implicated in the transmission of some forms of avian malaria. Their status as possible avian or mammalian disease vectors in Thailand has not been investigated. Dr. T.C. Maa of the Bishop Museum has identified twenty-five species of pupiparous Diptera from our collections, and these are listed in table 5. Several of these are new records for Thailand.

Summary: Ectoparasites were removed from as many as possible of the 1347 mammals and 15 birds captured during the year in studies of scrub typhus and other diseases. Additional ectoparasites were received from collectors in South Thailand, and from cooperating workers in Pakistan. Thirteen new species of chiggers were illustrated and are being described by Department personnel. Nine additional species of chiggers were described by cooperating specialists. Approximately one hundred species of chiggers have now been found in the Thailand collections. Twenty-five species of ticks were also found, including two new species of Haemaphysalis. Reports of identifications of twenty-five species of pupiparous Diptera, parasites of mammals and birds were also received. A new species of the blood-sucking mite genus Laelaps was described from specimens collected on Doi Suthep. Several new species of blood-sucking lice were found, and these are being described. Host data, geographical and habitat data are being tabulated for all of the vertebrate hosts and ectoparasites.

Conclusion: The ectoparasite fauna of certain small mammal groups in Thailand (chiefly rodents) was extensively studied during the year. The chiggers were by far the most important ectoparasites from the disease viewpoint, followed by the ticks. Further studies on mammals collected in the various disease programmes will undoubtedly produce additional records. The eventual aim of the study is the production of a catalog of all of the important ectoparasites in Thailand, for the support of future disease studies.