SEATO MEDICAL RESEARCH ON ECTOPARASITES

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STUDY REPORTS

1. Title: Distribution and ecology af ectoparasites of vertebrates in Southeast Asia.

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OBJECTIVE

To assemble information on the geographic and seasonal distribution and the host—parasite relationships of the ectoparasites of vertebrates in Southeast Asia, especially those of known or suspected importance in transmission of diseases of public health importance.

DESCRIPTION

Ectoparasites are removed from mammals, birds and other vertebrates collected in selected study sites and in connection with various disease studies in Thailand and elsewhere in Southeast Asia. The ectoparasites are preserved, sorted into major groups and identified at SMRL or submitted to specialists abroad for identification. Aliquots of collections used for inoculations of test animals are given priority in these identifications. Studies on the taxonomy and ecology of the various vertebrate hosts are also conducted.

PROGRESS

Ectoparasites were removed from 1102 small mammals (Table 1) representing 31 species collected in the following provinces during this report period: Udon Thani, Chieng Mai, Mae Hong Son, Kanchanaburi, Phra Nakhon, Saraburi, Nakhon Ratchasima, Chon Buri, Surat Thani, Narathiwat, Yala, Song Khla and Trang. The relative abundance of mites, ticks, lice and fleas on small mammals trapped in these areas was recorded, and the type of habitat from which these collections were made was classified into the following categories:

1) Evergreen forest, 2) deciduous forest, 3) mixed deciduous, 4) marginal between above habitats and agricultural areas, 5) regrowth (extension of forest or grassland into agricultural areas), 6) short term agricultural (annual crops such as rice) or long term agricultural (plantations or pasture) and 7) village and urban.

CHIGGERS

A total of 721 small mammals collected between June 1968 and March 1969, by live traps, were examined for chiggers.

From these, approximately 7000 microscope slide mounts of chiggers were prepared and identified. Among these were also 131 specimens from birds collected outside Thailand and submitted to SMRL for identification (Table 2). Specimens of the following species were collected from Thailand for the first

time during this period: Trombicula (T.) taphozous, Leptotrombidium (L.) keukenschrijveri, Leptotrombidium (Trombiculindus) variaculum, Gahrliepia (Walchia) cuspidata and Tecomatlana melvini. The last species was the first member of the genus Tecomatlana recorded from Thailand.

In all, 64 per cent of the small mammals examined had chiggers and there was an overall average of 44 chiggers per host. The less frequently collected hosts were more often infected (82 per cent) but had fewer chiggers (mean: 33 per host). Most of the common chiggers occurred on several hosts. Many of the less common chiggers also seemed to have broad host preferences. The notable exceptions among the common chiggers were Siseca rara which occurred mainly on Tupaia glis and Gahrliepia (Walchia) micropelta which occurred mostly on species of Mus.

Regrowth of virgin type vegetation into agricultural habitats had 10 and evergreen forest had 9 of the 11 commonest species, respectively, of chiggers, with marginal habitat in third place. Agricultural and village—urban habitats were poorest in numbers of common species, 3 and 5, respectively. Leptotrombidium (L.) arvina was restricted to the virgin forest and marginal habitats and completely absent in others. It was widespread in evergreen forest and second in abundance only to L. (L.) deliense in that habitat. L. (L.) deliense was found in all habitats, but was very abundant only in evergreen forest and regrowth habitats. Walchiella oudemansi was found on the same hosts and habitats as L. deliense but was less abundant. Ascoschongastia (Laurentella) audyi was found abundantly in all agricultural habitats. It was absent from evergreen and mixed deciduous forest but occurred rarely on Rattus rattus in deciduous forest and on R. exulans in village. A. (L.) indica was a most abundant chigger in all habitats except evergreen forest. It was exceedingly abundant in deciduous forest, occurring there in greater numbers than any chigger in any habitat. The 5 most abundant species of Gahrliepia (Walchia) were found in nearly all habitats. Except for G. (W.) micropelta on Mus spp., members of the Walchia group were most numerous on R. rajah in virgin and regrowth forest; G. (W.) disparunguis pingue had the broadest host and habitat occurrence.

FLEAS

During the period of this report 1055 small mammals were examined for fleas, and 183 (17%) of these were found infested with a total of 624 fleas (0.6 fleas per host). There was considerable difference in the abundance of fleas encountered in north and central Thailand as opposed to southern peninsular Thailand. In the south only 3 species of fleas were collected, and these infested only 11% of the 363 hosts examined from that region at a rate of 0.5 fleas per host. In central and northern Thailand, however, 22% of 692 mammals examined were infested with an average of 0.7 fleas per host; moreover, ten species of fleas were represented in these collections. Table 3 lists the distribution of these fleas by province. Except for a few unusually abundant or rare occurrences of fleas, which are discussed below, the commonest species of fleas encountered were as follows: Xenopsylla cheopis was most numerous and broadly distributed. It was largely limited to urban and village habitats. However 50 X. cheopis were found on two Rattus rattus which were trapped in a cave in Saraburi province which was located in a deciduous forest habitat. This species has never been encountered in evergreen forest anywhere in Thailand.

While fewer fleas were taken in the south of Thailand from all hosts, X. cheopis on R. norvegicus occurred at the rate of 2.2 fleas per rat in village and urban habitats. On R. exulans the rate was almost 1 flea per rat. This is at and above the index of X. cheopis per rat which Hirst in 1926 postulated as the potential level at which plague could be maintained and transmitted, and this index has been quoted as more or less of a standard. In more northern areas the average was 1.1 X. cheopis per R. exulans and only 0.2 per R. norvegicus.

Because of the relative abundance of X. cheopis compared to all other fleas the average of all fleas on all hosts was highest in villages and cities. Among the remaining habitats, the virgin habitats had more fleas per host than did the agricultural habitats.

Xenopsylla vexabilis was broadly distributed through northern and central provinces. Its preferred host is, with little doubt, Rattus berdmorei, and on this host it occurs at the highest rate for any flea on any common small mammal in Thailand. It is found in evergreen forest as well as in agricultural habitats, but never in village—urban habitats. Other hosts may serve to support this species; it occurred on Menetes berdmorei and R. norvegicus. Very few X. vexabilis were found on bandicoots during this present survey.

Stivalius klossi was next in abundance to X. cheopis on small mammals. It occurred about as frequently on Tupaia glis as on Rattus rajah. Other hosts of this flea included Menetes berdmorei, Rattus rattus, R. niviventer, R. fulvescens. It also occurred in nearly all habitats, but was limited in geographic distribution to northern and central Thailand.

An undescribed species of Stivalius was found on Tupaia glis and Menetes berdmorei in southern areas. Macrostylophora hastatus had fairly broad host occurrence in nothern areas. Stivalius aporus was not common.

2. Title: Developmental Stages and External Morphology of Nymphs of the Genus Gahrliepia (Oudemans, 1912) from Thailand (Acarina: Trombiculidae)

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OBJECTIVE

Although there are many species of the genus Gahrliepia present in Thailand, the post—larval stages of most of these species have not been studied. This report summarizes studies on the developmental behavior and external morphology of the nymphal stage of 7 common species of Gahrliepia occurring in Thailand. The nymphal stage, rather than the adult stage, was selected for study because it is smaller in size, has fewer body setae, and because nymphs can be reared from engorged larvae with relative ease.

DESCRIPTION

The rearing experiments were carried out with engorged larvae collected from several species of Rattus, Tupaia and other small mammals trapped in Narathiwat, Song Khla, Trang, Yala, Chon Buri, Chantaburi, Kanchanaburi and Saraburi provinces. All observations were made on the offspring of specimens whose siblings wers identified as Gahrliepine chiggers in the larval stage.

Chiggers were removed either from anesthetized hosts or by placing the living animals in wire cages suspended over pans of water for several days; engorged larvae that detached were collected from the surface film of the water. Larvae were placed in rearing tubes lined with a substrate of a charcoal—plaster mixture containing 10% activated charcoal. When nymphs emerged, they were fed on eggs of laboratory reared collembolans belonging to the families Poduridae and Entomobryidae which were added daily at the approximate rate of 10 eggs per nymph. All cultures were maintained at a constant temperature of 27.5°C, and humidity within the tubes kept elevated by addition of water to the substrate three times a week. Nymphs were preserved 1—2 days after emergence, and were identified from the associated larval skins.

PROGRESS

Nymphs were successfully reared from larvae of 7 following species of Gahrliepia:

Gahrliepia (Walchia) dismina Schluger et al, 1960
Gahrliepia (W.) disparunguis disparunguis (Oudemans, 1929)
Gahrliepia (W.) disparunguis pingue (Gater, 1932)
Gahrliepia (W.) kritochaeta Traub & Evans, 1957
Gahrliepia (W.) micropelta Traub & Evans, 1957
Gahrliepia (G.) fenestrulata Traub & Morrow, 1957
Gahrliepia (Schoengastiella) ligula (Radford, 1946)

All specimens of one species, Gahrliepia (Walchia) rustica (Gater, 1932), died during the prenymphal stage, nymphs of 7 species died after emergence while only 2 species were reared through to the adult stage. The time required for the development of these species in the laboratory, under the above mentioned techniques, is summarized in Table 4.

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a) Engorged larvae

Engorged larvae were collected from their hosts by the methods stated above. If the host was dead, fully engorged larvae detached from it faster than did those that were partially engorged or unfed. Engorged larvae were sluggish in their motions, and they became progressively more sluggish before entering the resting stage after 4—10 days at 27.5°C.

b. The prenymphal stage

This is a transition stage in the metamorphosis of the larvae to the nymph. In this stage, the mites were entirely motionless, while a complete transformation of the larval tissues took place. The body size gradually increased in size during this period.

c. Nymphal stage

When the prenymphal development was complete the larval skin ruptured transversally at a point just posterior to the larval scutum. The bases of the gnathosoma and of first two legs of the nymph emerged through this cleft. Pulsating movements of the hysterosoma assisted the process of ecdysis. When all four pairs of legs were freed, the new nymph began active movement and began to feed upon the collembola eggs within the first three hours. They suffered no noticeable effects when deprived of food for the first 4 or 5 days. Approximately 70% of fully engorged larvae developed into nymphs. Most nymphs entered the quiescent stage without showing signs of its approach, but a few became sluggish and took no food for several days prior to quiescence.

An evaluation of the morphological features found in nymphal stage of the species studied above indicated that very few specific differences exist which can be used to distinguish the nymphs although the larvae may differ morphologically. For example, Gahrliepia (W.) micropelta and Gahrliepia (W.) kritochaeta, both of them separable as larvae, are almost indistinguishable as nymphs. On the contrary, Gahrliepia (W.) disparunguis disparunguis and Gahrliepia (W.) disparunguis pingue, which are morphologically very similar in the larval stages, can be readily separated in nymphal stage.

Table 1 Species of mammals collected in Thailand during ectoparasite studies, 1968–69.

Species	Common Name	Number Captured
Atherurus macrourus	Bush–tailed porcupine	1
Bandicota bengalensis	Lesser bandicoot	49
Bandicota indica	Greater bandicoot	30
Callosciurus caniceps	Golden backed squirrel	16
Callosciurus notatus	Squirrel	5
Cannomys badius	Lesser bamboo rat	3
Chiropodomys gliroides	Bamboo rat	1
Hylomys suillus	Lesser Gymnura (insectivore)	4
Herpestes javanica	Mongoose	1
Menetes berdmorei	Ground squirrel	22
Mus cervicolor	Mouse	42
Mus famulus	Mouse	14
Mustela sibirica	Himalayan weasel	1
Rattus argentiventer	Ricefield rat	15
Rattus berdmorei	Grey rat	14
Rattus bowersi	Forest rat	6
Rattus exulans	Little house rat	107
Rattus fulvescens	Chestnut rat	18
Rattus muelleri	Mueller's rat	5
Rattus niviventer	Spiny rat	11
Rattus norvegicus	Norway rat	80
Rattus rajah	Rajah's rat	127
Rattus rattus	Black rat	265
Rattus sabanus	Giant spiny rat	7
Rattus sladeni	Forest rat	1
Rhizomys sumatrensis	Greater bamboo rat	1
Suncus murinus	House shrew	19
Tadarida plicata	Bat	111
Taphozous theobaldi	Bat	12
Tamiops macclellandi	Striped squirrel	1
Tupaia glis	Tree shrew	113
	Total	1102

Table 2 Chiggers collected from birds outside Thailand

Countries	Hosts	Chiggers	No. of Chiggers
India	Turdoider caudatus	Schoengastia dartevellei	5
		Lept. (L.) bhattipadense	1
Korea	Emberiza cioides	Lept. (L.) sp. B	1
Malaysia	Pitta brachyura	Walchiella oudemansi	3
		Siseca rara	1
	Pitta moluccensis	Lept. (L.) deliense	22
		Lept. (L.) rapmundi	1
		Siseca rara	2
		Eutrombicula wichmanni	4
Philippines	Coturnix chinensis	Lept. (L.) akamushi	4
	Macropygia phasianella	Toritrombicula asa	1
	Pitta sordida	Toritrombicula asa	1
	Pitta erythrogastre	Neoschoengastia rectangulare	1
	Trichastoma abbotti	Lept. (L.) arenicola	1
	Stachyris poliocephala	Odontacarus audyi	13
	Locustella lanceolata	Lept. (L.) keukenschrijveri	1
Taiwan	Parus ater	Lept. (L.) subintermedia	39
	Parus moticolus	Lept. (L.) subintermedia	12

Table 3 Distribution by Province of Flea Species Collected in Thailand during 1968–69.

	Province \ Flea Species	Macrostylophora hastatus	Lagaropsylla micula	Stivalius sp. nov.	Stivalius aporus	Stivalius klossi	Ctenocephalides felis	Pariodontis subjugis	Pulex irritans	Xenopsylla vexabilis	Xenopsylla cheopis
North	Udon Thani	X				X			X		X
	Chiang Mai	X				X					X
	Mae Hong Son	X				X				X	X
Central	Kanchanaburi									X	X
	Phra Nakhon										X
	Prachin Buri									X	
	Saraburi		X	X		X		X			X
	Nakhon Ratchasima			X		X	X			X	
	Chon Buri			X	X					X	X
	Chantaburi										X
South	Surat Thani						X				X
	4 neighboring provinces*			X							X

*Trang, Yala, Song Khla, Narathiwat

Table 4 Days required for the metamorphosis of Gahrliepia species in the laboratory.

Species	No. of Specimens Observed	Number of Days				Adult
		Larva		Nymph		
		Engorged	Quiescent	Active	Ouinescent	
Gahrliepia (Walchia) dismina	50	3–7	8–13	12–30 2(k)*	14–15	4(D)
Gahrliepia (Walchia) kritochaeta	55	4–7	4–11	2(K)		
Gahrliepia (Walchia) isonychia	65	1–5	6–11	2(K)		
Gahrliepia (Walchia) micropelta	80	2–5	6–10	10–30 1,2(K)	10–14	7(D)**
Gahrliepia (Walchia) disparunguis disparunguis	23	3–7	5–12	2(K)		
Gahrliepia (Walchia) disparunguis pinque	16	2–7	7–10	1,2(K)		
Gahrliepia (Walchia) sp. C	48	1–7	9–12	1,2(K)		
Gahrliepia (G.) fenestrulata	76	5–8	6–10	2(K)		
Gahrliepia (Schoengastiella) ligula	12	2–6	10–12	2(K)		

* (K) Killed and mounted on the day indicated
** (D) Maximum number of days of life