

OCCURRENCE OF ECTOPARASITES ON RODENTS IN SUKHOTHAI PROVINCE, NORTHERN THAILAND

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Abstract. A survey of ectoparasites on rodents was carried out bimonthly from April 2008 to March 2009 in 3 districts of Sukhothai Province, northern Thailand. A total of 130 rodents comprising 8 species of hosts were captured and examined for ectoparasites. The hosts examined were *Bandicota indica*, *Bandicota savilei*, *Rattus losea*, *Rattus rattus*, *Rattus exulans*, *Rattus norvegicus*, *Menetes berdmorei* and *Tamiops mccllellandii*. Ninety-seven ectoparasites were collected: 1 species of tick (*Hemaphysalis bandicota*), 2 species of mites (*Laelaps nuttali* and *Laelaps echidninus*), and 1 species of flea (*Xenopsylla cheopis*) were identified. The infestation rates by ticks, mites and fleas on the rodents were 0.77, 5.38 and 6.15%, respectively. Monitoring the rodent population and their ectoparasites is important for future planning of prevention and control of zoonotic diseases in the area.

Key word: ectoparasite, rodent, survey, Thailand

INTRODUCTION

Rodents play an important role as hosts for ectoparasites and reservoirs for various kinds of viruses, bacteria, rickettsia, protozoa and helminthes causing zoonotic diseases (Cavanaugh *et al*, 1969; Durden and Page, 1991; Namue and Wongsawad, 1997; Azad and Beard, 1998; Coleman *et al*, 2003; Salibay and Claveria, 2005; Rafique *et al*, 2009). Some examples of such diseases are

rodent-borne hemorrhagic fever, plague, Lyme disease, leptospirosis, salmonellosis, murine typhus, scrub typhus, toxoplasmosis, shistosomiasis, nematodes and tapeworms. The close association between commensal rodents and humans and domestic animals is a risk factor for transmission of these diseases (Kia *et al*, 2009).

There is no documented survey of ectoparasites on rodents in Sukhothai Province, Thailand. However, various studies have been conducted on ectoparasites of rodents and other small mammals in other parts of Thailand (Lerdthusnee *et al*, 2008; Wootta *et al*, 2008; Thanee *et al*, 2009). The objective of this study was to obtain data on the distribution of rodents and their ectoparasites in Sukhothai Province, Thailand for future planning of prevention and

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control measures for zoonotic diseases in the area.

MATERIALS AND METHODS

Trapping of rodents

Trapping of rodents with wire traps was carried out on various occasions bimonthly from April 2009 to March 2010 in three districts of Sukhothai Province: Thung Saliam, Si Samrong and Kong Krailat (Fig 1). The trap sites were placed in the same types of habitats at each location, such as in and around houses of local people, in the woodlands and rice fields. Traps were randomly baited with banana, papaya, pumpkin, coconut, snail or dried fish based on the common available food in the area. A total of 30 traps (13x30x12 cm) were set per night at each district. Traps were placed for 1-2 consecutive nights per survey. Checking of traps was done early in the morning.

Collection of ectoparasites

Caught animals were kept individually, then euthanized with ether or isoflurane before examination of their ectoparasites. The species of animals caught were identified using keys provided by Francis (2008). The euthanized animals were placed in a white enamel tray and combed vigorously from the tail forward with a fine comb. Dislodged ectoparasites that fell from the host to the bottom of the enamel tray were collected with a fine pointed forceps or a moisten end of an applicator stick. Ectoparasites on the body of animal were also extracted. Ear and nasal canals were examined for chiggers. All extracted ectoparasites were placed in labeled collection tubes for further processing. A separate tube was used for each animal host.

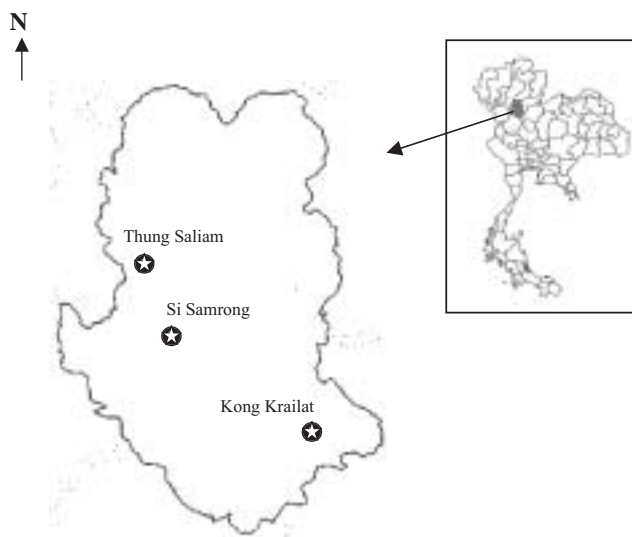


Fig 1—Map showing study districts of Thung Saliam, Si Samrong and Kong Krailat, Sukhothai Province, Thailand.

Preservation and mounting of ectoparasites

All of the ectoparasites were preserved in 70% alcohol. All preserved ectoparasites, excluding ticks, were later mounted for identification. Fleas and mites were mounted in Hoyer's medium (Krantz, 1978). Mounted slides were then incubated at 40°C for a week and coverslips were ringed with paint to prevent desiccation of medium during storage.

Identification of ectoparasites

Ticks were identified directly under a stereoscope, while fleas and mites were mounted prior to identification. All ectoparasites were identified to the species level using available taxonomic keys (Tanskul and Inlao, 1989; Lane and Crosskey, 1993).

RESULTS

A total of 130 animals comprising 8 species of rodents were caught in

Table 1
Ectoparasitic infestation rates on rodents in Sukhothai Province, Thailand
(April 2008 to March 2009).

Host species	No. of hosts caught (%)	No. of hosts infested by ectoparasites		
		Acari		Siphonaptera
		Ticks	Mites	Fleas
<i>Bandicota indica</i>	33 (25.4)	-	2	-
<i>Bandicota savilei</i>	40 (30.8)	1	1	-
<i>Rattus losea</i>	1 (0.8)	-	-	-
<i>Rattus rattus</i>	33 (25.4)	-	4	7
<i>Rattus exulans</i>	10 (7.7)	-	-	1
<i>Rattus norvegicus</i>	7 (5.4)	-	-	-
<i>Menetes berdmorei</i>	2 (1.5)	-	-	-
<i>Tamiops mccllellandii</i>	4 (3.1)	-	-	-
Total	130	1	7	8
Infestation rate (%)		0.77	5.38	6.15

Table 2
Number of ectoparasites found on rodents in Sukhothai Province, Thailand
(April 2008 to March 2009).

Species	<i>Bandicota indica</i>	<i>Bandicota savilei</i>	<i>Rattus losea</i>	<i>Rattus rattus</i>	<i>Rattus exulans</i>	<i>Rattus norvegicus</i>	<i>Menetes berdmorei</i>	<i>Tamiops mccllellandii</i>
Tick								
<i>Hemaphysalis bandicota</i>	-	2	-	-	-	-	-	-
Mites								
<i>Laelaps nuttali</i>	5	7	-	64	-	-	-	-
<i>Laelaps echidninus</i>	-	-	-	5	-	-	-	-
Flea								
<i>Xenopsylla cheopis</i>	-	-	-	12	2	-	-	-

Sukhothai Province and examined for ectoparasite infestation. Two families of rodents identified were Muridae (subfamily: Murinae) and Sciuridae (subfamily: Callosciurinae). The species of rodents the

infestation rates with ectoparasites are shown in Table 1. *Bandicota savilei* was the dominant rodent caught (30.8%) followed by *Bandicota indica* (25.4%), *Rattus rattus* (25.4%), *Rattus exulans* (7.7%), *Rattus*

Table 3
Number of *Xenopsylla cheopis* fleas, flea indices and range number collected in Sukhothai Province, Thailand.

Rodent species	Number of <i>X. cheopis</i>	Flea index ^a	Range
<i>Bandicota indica</i>	-	-	-
<i>Bandicota savilei</i>	-	-	-
<i>Rattus losea</i>	-	-	-
<i>Rattus rattus</i>	12	0.36	0-5
<i>Rattus exulans</i>	2	0.2	0-2
<i>Rattus novegicus</i>	-	-	-
<i>Menetes berdmorei</i>	-	-	-
<i>Tamiops mccllellandii</i>	-	-	-
Total	14	0.11	0-5

^aaverage number of fleas per host

norvegicus (5.4%), *Tamiops mccllellandii* (3.1%), *Menetes berdmorei* (1.5%) and *Rattus losea* (0.8%). The ectoparasites found were mainly from the Order Acari (ticks and mites) and Siphonaptera (fleas). The species and numbers of ectoparasites found on rodents are shown in Table 2.

Ticks

Only one species of Ixodid tick, *Hemaphysalis bandicota*, was found on a Savile's Bandicoot Rat, *B. savilei*, with an infestation rate of 0.8%.

Mesostigmatid mites

Two species of *Laelaps* were found on three species of rodents with an infestation rate of 5.4%. Both species, *Laelaps echidninus* and *Laelaps nuttali*, were found on the House Rat, *R. rattus*, while the latter species was found on the Greater Bandicoot Rat, *B. indica*, and Savile's Bandicoot Rat, *B. savilei*.

Fleas

Only one species of oriental rat flea, *Xenopsylla cheopis*, was identified on the House Rat, *R. rattus*, and Pacific Rat, *Rattus exulans*. The total number of *X. cheopis*

and the flea index are shown in Table 3.

DISCUSSION

The species of rodents caught in Sukhothai Province are those commonly found in Thailand. However, the dominant species caught were different from those of Lerdtusnee *et al* (2008) and Wootta *et al* (2008); in their studies, *R. rattus* and *R. exulans* were the dominant species found, respectively. In the present study, the most common infestation of ectoparasites seen on rodents was fleas. These results are different from those of Wootta *et al* (2008) who described mites as being dominant. In terms of hosts, infestations of ectoparasites were only found on rats and none occurred on squirrels.

Only one species of tick, *H. bandicota*, was identified. The same species was reported by Tanskul *et al* (1983) infesting other animals such as *B. indica*, *Bos domesticus*, *Herpestes javanicus*, *Rattus sp* and *Tupaia glis*. The spatial distribution of *Hemaphysalis sp* in Thailand has been described by Cornet *et al* (2009). Two species

of Mesostigmatid mites, *L. nuttali* and *L. echidninus*, identified in this study are found worldwide and are important parasites for commensal and wild rodents. Both species can be found on the bodies and in the burrows of rodent hosts (Varma, 1993). They frequently occur on same host species but *L. nuttali* is usually the more abundant species (Chuluun *et al*, 2005). These two species have been reported to bite man and can cause irritation and dermatitis (Azad, 1986).

The oriental rat flea, *X. cheopis*, was most frequently found on *R. rattus*. This is in accordance with other studies that showed similar results (Olson, 1969; Durden and Page, 1991; Parola *et al*, 2003; Ibrahim *et al*, 2006). *X. cheopis* has been identified as the main vector for plague and endemic typhus (murine typhus) and as a possible intermediate host of the tapeworm, *Hymenolepis diminuta* (Lewis, 1993).

The number of fleas species found on the various species of rodents in this survey was used to calculate the flea index (average number of fleas per host), which was then used to estimate human and epizootic risk for plague (Moore and Gage, 2005). For *X. cheopis* on rats, a flea index >1 represents an increase plague risk in humans (Dennis *et al*, 1999). The total flea index found in this study was 0.11, less than the threshold for plague transmission. Although the last human case of plague in Thailand was in 1952, routine surveys of flea indices on rodents should be conducted.

Lice and chigger mites were not found in the study. The absence of lice in our study is in accordance with studies by Lerdthusnee *et al* (2008) and Thanee *et al* (2009) who reported only the presence of ticks, mites and fleas. It was surprising not to recover any chiggers (*Leptotrombidium* sp)

on rodents. The abundance of these ectoparasites on rodents may be due to species of host, location, geography or ecology of an area (Telmadarraiy *et al*, 2007). The presence of chiggers on small mammals in Thailand was reported by Coleman *et al* (2003), Khuntirat *et al* (2003) and Cheewakriengkrai and Parsartwit (2004).

This study provides preliminary findings on the presence of some ectoparasites of rodents in Sukhothai Province, Thailand that can be used to estimate potential public health risks and provide information for prevention and control of zoonotic diseases in the area.

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REFERENCES

- Azad AF, Beard CB. Rickettsial pathogens and their arthropod vectors. *Emerg Infect Dis* 1998; 4: 179-86.
- Azad AF. Mites of public health importance and their control. Vector Control Series Training and Information Guide: XIII. *WHO/VBC/86.931*. 1986.
- Cavanaugh DC, Ryan PF, Marshall JD Jr. The role of commensal rodents and their ectoparasites in the ecology and transmission of plague in Southeast Asia. *Wildl Dis* 1969; 5: 187-92.

- Cheewakriengkrai S, Parsartwit A. Survey of scrub and murine typhus vectors and infection rate at 6 international seaports. *Dis Contr J* 2004; 30: 142-50.
- Chuluun B, Mariana A, Ho T, Kulaimi B. Preliminary survey of ectoparasites of small mammals in Kuala Selangor Nature Park. *Trop Biomed* 2005; 22: 243-7.
- Coleman RE, Monkanna T, Linthicum KJ, *et al*. Occurrence of *Orientia tsutsugamushi* in small mammals from Thailand. *Am J Trop Med Hyg* 2003; 69: 519-24.
- Cornet JP, Demoraes F, Souris M, Kittayapong P, Gonzalez JP. Spatial distribution of ticks in Thailand: a discussion basis for tick-borne virus spread assessment. *Int J Geoinf* 2009; 5: 57-62.
- Dennis DT, Gratz N, Poland JD, Tikhomirov E. Plague manual: epidemiology, distribution, surveillance and control. Geneva: World Health Organization, 1999.
- Durden LA, Page BF. Ectoparasites of commensal rodents in Sulawesi Utara, Indonesia, with notes on species of medical importance. *Med Vet Entomol* 1991; 5: 1-7.
- Francis CM. A field guide to the mammal of Thailand and Southeast Asia. Bangkok: Asia Books, 2008.
- Ibrahim IN, Winoto I, Wongsrichanalai C, Blair P, Stoops C. Abundance and distribution of *Xenopsylla cheopis* on small mammals collected in West Java, Indonesia during rodent-borne disease surveys. *Southeast Asian J Trop Med Public Health* 2006; 37: 932-6.
- Khuntirat B, Lerdthusnee K, Leepitakrat W, *et al*. Characterization of *Orientia tsutsugamushi* isolated from wild-caught rodents and chiggers in northern Thailand. *Ann NY Acad Sci USA* 2003; 990: 205-12.
- Kia EB, Moghddas-Sani H, Hassanpoor H *et al*. Ectoparasites of rodents captured in Bandar Abbas, Southern Iran. *Iranian J Arthropod-Borne Dis* 2009; 3: 44-9
- Krantz GW. A manual of acarology. 2nd ed. Corvallis: Oregon State University Bookstores, 1978.
- Lane RP, Crosskey RW. Medical insect and arachnids. London: Chapman & Hall, 1993.
- Lerdthusnee K, Nigro J, Monkanna T, *et al*. Surveys of rodent-borne disease in Thailand with a focus on scrub typhus assessment. *Integr Zool* 2008; 3: 367-73.
- Lewis RE. Fleas (Siphonaptera). In: Lane RP, Crosskey RW, eds. Medical insects and arachnids. London: Chapman & Hall, 1993: 597-58.
- Moore CG, Gage KL. Surveillance of vector-borne diseases. In: Marquardt WC, ed. Biology of disease vectors. Burlington: Elsevier Academic Press, 2005: 257-73.
- Namue C, Wongsawad C. A survey of helminth infection in rats (*Rattus* spp) from Chiang Mai moat. *Southeast Asian J Trop Med Public Health* 1997; 28 (suppl 1): 179-83.
- Olson WP. Rat-flea indices, rainfall, and plague outbreaks in Vietnam, with emphasis on the Pleiku area. *Am J Trop Med Hyg* 1969; 18: 621-8.
- Parola P, Sanogo OY, Lerdthusnee K, *et al*. Identification of *Rickettsia* spp and *Bartonella* spp in fleas from the Thai-Myanmar border. *Ann NY Acad Sci USA* 2003; 990: 173-81.
- Rafique A, Rana RA, Khan HA, Sohail A. Prevalence of some helminths in rodents captured from different city structures including poultry farms and human population of Faisalabad, Pakistan. *Pakistan Vet J* 2009; 29: 141-4.
- Salibay CC, Claveria FG. Serologic detection of *Toxoplasma gondii* infection in *Rattus* spp collected from three different sites in Dasmariñas, Cavite, Philippines. *Southeast Asian J Trop Med Public Health* 2005; 36 (suppl 4): 46-9.
- Tanskul P, Inlao I. Keys to the adult ticks of *Haemaphysalis* Koch, 1844, in Thailand with notes on changes in taxonomy (Acari: Ixodoidea: Ixodidae). *J Med Entomol*

- 1989; 26: 573-601.
- Tanskul P, Stark HE, Inlao I. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). *J Med Entomol* 1983; 20: 330-41.
- Telmadarraiy Z, Vatandoost H, Mohammadi S, *et al.* Determination of rodent ectoparasite fauna in Sarpole-Zahab District, Kermanshah Province, Iran. *Iranian J Arthropod-Borne Dis* 2007; 1: 58-62.
- Thanee N, Kupittayanant S, Pinmongkholgul S. Prevalence of ectoparasites and blood parasites in small mammals at Sakaerat Environmental Research Station, Thailand. *Thai J Agri Sci* 2009; 42: 149-58
- Varma MGR. Ticks and mites (Acari). In: Lane RP, Crosskey RW, eds. *Medical insects and arachnids*. London: Chapman & Hall, 1993: 597-58.
- Wootta W, Imvithaya A, Pattamadilok S, *et al.* Survey of ectoparasite fauna and associated diseases in the provinces along Thailand-Myanmar, Laos and Cambodia border. *J Health Res* 2008; 22: 181-8.