

A SURVEY OF HELMINTH INFECTION IN RATS (*RATTUS* SPP) FROM CHIANG MAI MOAT

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Abstract. An investigation of helminths in the Norway (brown) rat, *Rattus norvegicus*, and roof rat, *Rattus rattus*, from Chiang Mai Moat during May to August 1995, was done. Thirty-three out of thirty-eight trapped rats were infected (86.84 %); 16 *R. norvegicus* (100 %) and 17 / 22 *R. rattus* (77.27 %). The rat was infected with 10 helminth species; 4 trematodes, *Centrocestus* sp (2.63 %), *Echinostoma ilocanum* (10.52 %), *Echinostoma malayanum* (10.52 %) and *Quinqueserialis quinqueserialis* (39.47 %); 2 cestodes, *Raillietina* sp (36.64 %) and *Taenia* sp (cysticercus) (7.89 %); and 4 nematodes, *Angiostrongylus cantonensis* (42.10 %), *Nippostrongylus* sp (34.21 %), *Rictularia* sp (52.63 %) and egg of *Capillaria hepatica* (7.89 %). The helminths were found in the small intestine (84.21 %), large intestine (42.10 %), lung (36.64 %), stomach (28.94 %), heart (23.94 %), and liver (15.78 %). The female Norway rats were infected with 10 species of helminths and the males with 6 species. In the roof rat, 7 species of helminths were found in females and 6 species in males.

INTRODUCTION

Helminths parasitized rats are of special interest due to the role of rat as reservoirs of many important parasites of man. There have been a number of reports of helminthic infection in rats in Thailand, but few have been reported from Chiang Mai (Titasut and Poonvit, 1969; Bhaidikul *et al*, 1984). The present study carried out species identification, determination of prevalence and intensity of helminths. The investigation was carried out for the purpose of securing additional information on the helminths of local rats and the possibility that the information may contribute to public health or veterinary interest.

MATERIALS AND METHODS

Rats were collected from Chiang Mai Moat during May to August 1995. Their visceral organs, heart, lungs, livers, stomach, small intestine, and large intestine were examined for helminths. The worms were removed, counted, fixed and preserved in 10 % formalin. For identification, trematodes and cestodes were stained with Borax's carmine or hematoxylin, counter-stained with fast-green and mounted in Canada balsam. Nematodes were cleared and temporarily mounted in alcohol - glycerine.

RESULTS

Thirty-eight rats consisting of 16 Norway (brown) rats, *Rattus norvegicus*, and 22 roof rats, *Rattus rattus*, were trapped. The results are shown in Table I. A total of 33 specimens (86.84 %) were found to be positive for parasites; 16 *R. norvegicus* (100 %) and 17 *R. rattus* (77.27 %). Ten species of helminths were recovered; 4 trematodes, 2 cestodes, and 4 nematodes. The number of helminthic species found in female and male *R. norvegicus*, were 10 and 6 respectively while 7 and 6 were found in female and male *R. rattus*.

Table 1

Prevalence of helminths infection in rats collected from Chiang Mai Moat.

Species of rat	No. examined	No. positive (%)
<i>Rattus norvegicus</i>	16	16 (100.00)
Female	10	10 (100.00)
Male	6	6 (100.00)
<i>Rattus rattus</i>	22	17 (77.27)
Female	13	9 (88.89)
Male	9	8 (69.23)
Total	38	33 (86.84)

The prevalence and intensity of helminths are shown in Table 2. The parasites were dominated by nematode *Rictularia* sp (Figs 1-4), the other parasites frequently found were *Angiostrongylus cantonensis*, *Quinqueserialis quinqueserialis* (Fig 5), *Raillietina*

sp *Nippostrongylus* sp, *Echinostoma ilocanum*, *E. malayanum*, *Taenia* sp (cysticercus), *Capillaria hepatica* (eggs) and *Centrocestus* sp (Fig 6). The worms were found in small intestine (84.21 %), large intestine (42.10 %), lung (36.64 %), stomach (28.94 %), and liver (15.78 %).

Table 2

Site of infection, prevalence and intensity of helminth infection in rats collected from Chiang Mai Moat.

Helminth species	Site of infection	Prevalence (%)	Intensity range (average)
Trematode			
<i>Centrocestus</i> sp	SI	2.63	0-3 (0.080)
<i>Echinostoma ilocanum</i>	SI	23.68	1-23 (1.50)
<i>Echinostoma malayanum</i>	SI	10.52	1-261 (7.70)
<i>Quinqueserialis quinqueserialis</i>	Li	39.47	1-231 (25.70)
Cestode			
<i>Raillietina</i> sp	SI	36.84	1-6 (1.10)
<i>Taenia</i> sp (cysticercus)	Li	7.89	0-1 (0.080)
Nematodes			
<i>Angiostrongylus cantonensis</i>	H, L	42.10	1-53 (5.90)
<i>Nippostrongylus</i> sp	SI	34.21	1-21 (2.10)
<i>Rictularia</i> sp	Li, SI, ST	52.63	1-102 (12.6)
<i>Capillaria hepatica</i> (eggs)	Li	7.89	-

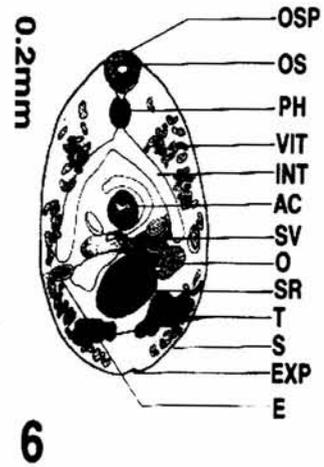
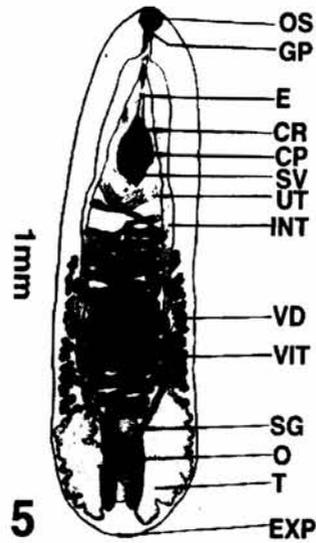
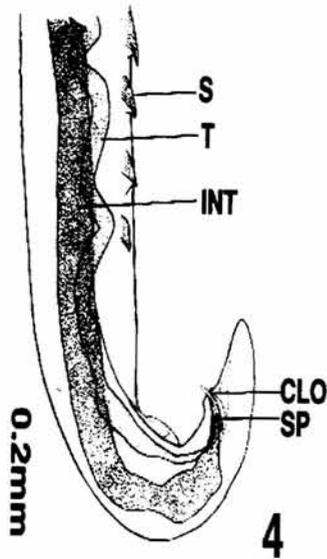
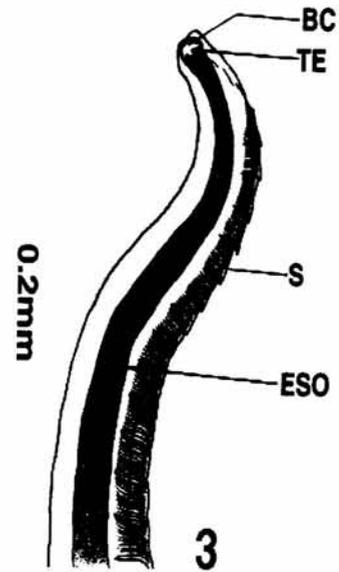
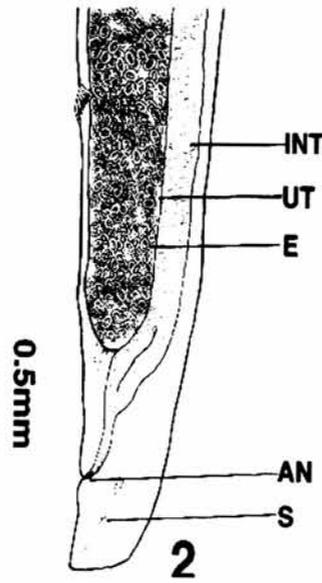
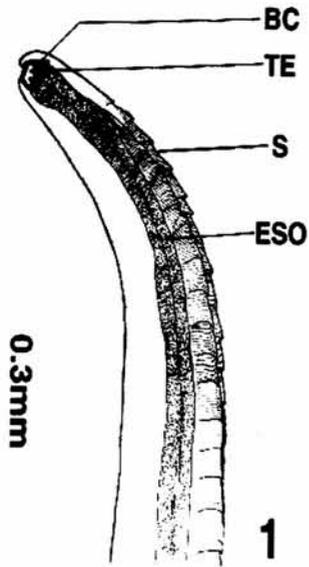
* H = Heart, L = Lung, Li = Liver, LI = Large intestine, SI = Small intestine, ST = Stomach

DISCUSSION

Trapped rats in this study area belonged to two species, *R. norvegicus* and *R. rattus*. The high prevalence rate of individual infection (86.84 % in *R. norvegicus* and 77.27 % in *R. rattus*) and rather high susceptibility to helminthic infections (10 species) indicate that rats in this area are highly infected with various parasites, some of which are transmittable to man such as *E. ilocanum* (Radomyos *et al*, 1982; Cross and Basaca-Sevilla, 1986), *E. malayanum* (Sornmani, 1969; Cross and Basaca-Sevilla, 1981), and *A. cantonensis* (Margono and Ilahude, 1974).

The parasitic infection of two species of rats appeared to be dominated by nematode *Rictularia* sp (Figs 1-4). Twenty of 38 rats (52.63 %) contained this

worm in the small intestine, large intestine and stomach. The identification of *Rictularia* of mammals and rodents was based mainly on comblike spines, oral papillae, buccal capsule and caudal papillae. Only two species of *Rictularia* were found in rats (*Rattus* sp): *Rictularia ratti* (in *R. norvegicus*) and *Rictularia tani* (in *R. norvegicus* and *R. whartoni*) (Yamaguti, 1961). Our specimens were compared in detail, number of combs and spines, caudal papillae, and spicules, with *R. tani* and males *R. taterilii* (Linguist and Li, 1954), they were closest to *R. tani*. However, the difference between the size of *R. tani* and the present materials difficult to determined to species. In addition, *R. tani* was first reported from *R. r. diardii* and *R. bartelsii* (Wiroreno, 1978). Our study also shows the first record of *Rictularia* infection in *R. rattus* in Chiang Mai.



Figs 1-4 *Rictularia* sp : 1-2. Anterior and posterior part of female 3-4. Anterior and posterior part of male

Fig 5 - *Quinquerseralis quinquerseralis* WM

Fig 6 - *Centrocestus* sp WM

AC = Acetabulum, AN = Anus, BC = Buccal capsule, CLO = Cloaca, CR = Cirrus, CP = Cirrus pouch, E = Egg, ESO = Esophagus, EXP = Excretory pore, GP = Genital pore, INT = Intestine, O = Ovary, OS = Oral sucker, OSP = Oral spine, PH = Pharynx, S = Spine, SG = Shell gland, SP = Spicule, SR = Seminal receptacle, SV = Seminal vesicle, T = Testes, TE = Teeth, UT = Uterus, VD = Vas deferens, VIT = Vitellaria

Angiostrongylus cantonensis, a rat lung worm causing eosinophilic in man and widely distributed in Southeast Asia and Pacific area, was found highly prevalent (42.10 %) in rats examined. In this survey, the worms were recovered from lungs (36.64 %) and heart (23.68 %). *A. cantonensis* has been reported in 3 species of rats, *R. exulans*, *R. rattus* and *Bandicota indica*, in some districts of Chiang Mai and Lumpoon Province (Titasut and Poonvit, 1969), and in *R. rattus* and *B. indica* from Phitsanulok and Khon Khaen Province, Thailand (Impand *et al*, 1983). The larvae of this worm have been observed in terrestrial and aquatic mollusc; *Achatina fulica*, *Laevicaulis alte* and *Pila scutata* (Margono and Ilahude, 1974). The high prevalence of *A. cantonensis* in this study indicates that the snails, the intermediate host, are highly infected, so the life cycle and host-parasite relationship of this worm in Chiang Mai should be studied further.

Nematode of family Heligmonellidae, *Nippostrongylus* sp were found in 34.21 % of the rats examined. The parasite (small red worm, forming flat counter clockwise coils, ventral side located inside, the anterior end with cephalic vesicle) were recovered in the small intestine. There are some reports of *Nippostrongylus* in Thailand. *N. brasiliensis* infection was found 9 % in *R. rattus*, *R. argentiventer*, *R. losea* and *B. indica* from Phitsanulok and Khon Khaen Province (Impand *et al*, 1983) and occurred 26.66 % in *R. argentiventer* and 31.55 % in *B. indica* collected from Nakhon Pathom Province (Achavakom, 1981). In this study, for identification, the descriptions given by Hasegawa (1990) were used.

Capillaria hepatica is cosmopolitan and is found in the liver of many species of rodents. The worms has been reported as the cause of liver disease in a wide variety of mammals including man (Neva and Brown, 1994). The prevalence of this worms can be detected by locating the characteristic eggs with bipolar plugs in the livers of infected rats. In the present study, 7.89 % (12.50 % in *R. norvegicus* and 4.54 % in *R. rattus*) of rats examined were found to be infected. No adult worms were recovered but numerous eggs were seen in squashed liver and in stained sections. *C. hepatica* was found highly prevalence in *R. norvegicus* from different locations in Malaysia (Lim *et al*, 1977).

Four species of intestinal flukes, *Q. quinquesequalis*, *E. ilocanum*, *E. malayanum* and *Centrocestus* sp, occurred in 39.47%, 23.68%, 10.52%, and 2.63%, respectively. The monostome trematode, *Q. quinquesequalis*, which is easy to recognize by the monostome holdfast organ, oval shaped, transverse uterus, position of genital pore and filamentous eggs (Fig 5),

has been found in muskrats, *Ondatra zibethica*, meadow voles, *Microtus pennsylvanicus*, and jumping mice, *Zapus hudsonius*, in the United States and Canada, and the worm are able to mature in 15 species of rodents (Olsen, 1974). In Thailand, the worm has been reported from Nakhon Pathom Province as a natural infection in the cecum of *R. argentiventer* and *B. indica* (Achavakom, 1981). There is no report of *Q. quinquesequalis* infecting in man in Thailand before, and this is the first report of *Q. quinquesequalis* in *R. norvegicus* and *R. rattus* in Chiang Mai Province.

By studying the morphology of adult *Echinostoma* worms, we have identified them as *E. ilocanum* and *E. malayanum*. Intestinal echinostomiasis caused by *E. ilocanum* is reported from several Asian countries. The parasite is common in Ilocano, Northern Luzon, in the Philippines and sporadically found elsewhere in the country. The snails, *Gyration* sp and *Pila luzonica* were found to be first and second intermediate hosts in the Philippines (Cross and Basaca-Sevilla, 1986). In Thailand, the first infection in man of this worm was reported from ten patients in the Northeast (Radomyos *et al*, 1982). And *E. malayanum* has been reported infecting man in Thailand. The life cycle of *E. malayanum* has been completed in the laboratory; snails, *Indoplanorbis exustus*, served as the first intermediate host, either *I. exustus*, *Lymnea rubiginosa* or tadpoles were second intermediate host and the metacercaria developed to adults within 21 days in mice (Sornmani, 1969). In Indonesia, freshwater snails, *Viviparous javanicus* and *Pila scutata* were reported as the secondary intermediate host of *E. malayanum* (Hadidjaja and Oemijati, 1969). Little is known about echinostome larva in Chiang Mai, so that the snails in the moat should be searched for *Echinostoma* larva.

Only one of all rats (2.63 %) was found infected with *Centrocestus* sp (Fig 6). This is the first time that the minute intestinal fluke *Centrocestus* sp has been found in a rat in Chiang Mai. The worm is commonly found in mammals and birds, with the infective stage, metacercaria, in freshwater fish (Yamaguti, 1958).

The cestodes infections, including 2 species, *Raillietina* sp (36.64 %) and *Taenia* sp (cysticercus) (7.89 %), were found in both rats. The larval form (cysticercus) of *Taenia* sp was found in the liver of 3 rats. Our observation, show that this parasite is common in *R. norvegicus*.

Forty-two adults, of *Raillietina* sp were recovered from the small intestine of 10 *R. norvegicus* (62.50 %) and 4 *R. rattus* (18.18 %). This cestode is commonly found in birds (Yamaguti, 1959). The infection of *Raillietina* sp in man in Thailand has been reported

(Areekul and Radomyos, 1970).

In the present study, the environment appears to have influence the helminths in rats. Trematodes and nematodes were commonly recovered more than cestodes. This is probably due to the food of rats, especially snails, influencing the type of parasites acquired by rats. And it seems that the female rats are more infected than the male in both rats. The prevalence of helminthic infections between two species of rats, suggested that *R. norvegicus* were heavily infected with many helminth species of medical significance to man (100 %). However, the number of rats examined was small because of difficulty to collect them.

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REFERENCES

- Ahcavakom T. A study on parasites in the rice field rat (*R. argentiventer*) and the great Bandicoots (*Bandicota indica*). Kasertsart University, Bangkok 1981; 105 pp (MSc Thesis).
- Areekul S, Radomyos P. Preliminary report of *Raillietina* sp infection in man and rats in Thailand. *Southeast Asian J Trop Med Public Health* 1970; 1: 559.
- Bhaidikul V, Upatham ES, et al. Study on *Schistosoma sinensium* in Fang District, Chiang Mai Province, Thailand. *Southeast Asian J Trop Med Public Health* 1984; 15: 141-7.
- Cross JH, Basaca-Sevilla V. Intestinal parasite infection in Southeast Asia. *Southeast Asian J Trop Med Public Health* 1981; 12: 262-74.
- Cross JH, Basaca-Sevilla V. Studies on *Echinostoma ilocanum* in the Philippines. *Southeast Asian J Trop Med Public Health* 1986; 17: 23-7.
- Hasegawa H. Nematodes of the family Heligmonellidae (Trichostrongyloidea) collected from rodents of the Ryukyu Archipelago and Taiwan. *J Parasitol* 1990; 76: 470-80.
- Hadidjaja P, Oemijati S. *Echinostoma* infection in Indonesia with a special study on *Echinostoma malayanum*. Proceeding of the Fourth Southeast Asian Seminar on Parasitology and Tropical Medicine, Schistosomiasis and other snail transmitted helminthiasis. Bangkok: Thai Watana Panich, 1969: 167-70.
- Impand P, Thirachadra S, et al. Helminth faunas of rats and domestic animals and their zoonotic potential role in north and northeast Thailand. *J Parasitol Trop Med Thailand* 1983; 6: 105-16.
- Lim BL, Fong YL, et al. *Capillaria hepatica* infection of wild rodents in Peninsular Malaysia. *Southeast Asian J Trop Med Public Health* 1977; 8: 354-8.
- Linguist WD, Li SY. Some nematodes of rats from Guam, MI and notes on a species of *Rictularia*. *J Parasitol* 1955; 41: 194-7.
- Margono SS, Ilahude HD. *Angiostrongylus cantonensis* in rats and intermediate hosts in Jakarta and its vicinity. *Southeast Asian J Trop Med Public Health* 1974; 5: 236-40.
- Neva FA, Brown HW. Basic Clinical Parasitology, 6th ed. East Norwalk, Connecticut: Appleton and Lange, 1994: 356 pp.
- Olsen OW. Animal Parasites : Their Life Cycles and Ecology. Baltimore, Maryland: University Park Press, 1974; 562 pp.
- Radomyos P, Bunnag D, et al. *Echinostoma ilocanum* (Garrison, 1908) Odhner, 1911, infection in man in Thailand. *Southeast Asian J Trop Med Public Health* 1982; 13: 265-9.
- Sornmani S. Echinostomiasis in Thailand : A review. Proceedings of the Fourth Southeast Asian Seminar on Parasitology and Tropical Medicine, Schistosomiasis and other snails - transmitted helminthiasis. Bangkok: Thai Watana Panich Press, 1969: 171-75.
- Titasut P, Poonvit V. A study on *Angiostrongylus cantonensis* (adult) in rat in Chiang Mai and Lumpoon, in the Northern part of Thailand. *Chiang Mai Bulletin* 1969; 8: 219-28.
- Wiroreno W. Nematode parasites of rats in West Java, Indonesia. *Southeast Asian J Trop Med Public Health* 1978; 9: 520-5.
- Yamaguti S. Systema Helminthum. Vol I. The Digenetic Trematodes of Vertebrates. New York : Interscience Publishers, 1958: 1575 pp.
- Yamaguti S. Systema Helminthum. Vol II. The Cestodes of Vert brates . New Y ork : Interscience Publishers , 1959: 860 pp.
- Yamaguti S. Sytema Helminthum. Vol III. The Nematodes of Vertebrates. New York : Interscience Publishers, 1961: 1261 pp.