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# SEASONAL PREVALENCE OF THE HELMINTH FAUNA OF THE WOOD RAT RATTUS TIOMANICUS (MILLER) IN WEST MALAYSIA

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**Abstract.** A helminthological examination of 367 wood rats, *Rattus tiomanicus*, in an oil-palm estate 24 miles north of Kuala Lumpur conducted during 1973 revealed 8 species of helminths: 5 nematodes, *Angiostrongylus malaysiensis* (54.2 % of the rats infected), *Hepatojarakus malayae* (48.5 %), *Nippostrongylus braziliensis* (48.0 %), *Gongylonema neoplasticum* (0.3 %), *Syphacia muris* (17.7 %); 3 cestodes, *Hymenolepis diminuta* (6.0 %), *Hymenolepis nana* (7.6 %), *Hydatigera taeniaeformis* (cysticercus) (12.0 %) and 1 pentastomid, *Armillifer* sp. (nymph) (0.8 %). Overall helminthic infection rates seemed to be higher than those previously reported in this host species.

Surveys and ecological studies of rodents and the prevalence of parasites have been carried out in Malaysia (Adams 1933, Audy et al. 1950, Sandosham 1953, Yeh 1955, Lim and Heyneman 1965, Dunn 1966; Dunn et al. 1968). Schacher and Cheong (1960) summarized the parasites of three species of common house rats. Surveys of helminth parasites in house rats from Singapore and Malaya were carried out by Gatha (1966) and Mulkit Singh and Cheong (1971) studied the incidence of nematode infections in various species of feral rats in Malaysia. Ow-Yang (1971), Lim and Muul (1970) and Lim et al. (1976) reported on nematode parasites of Malysian rodents which were found in oil-palm plantations and other habitats.

Since most of the oil-palm estates in Malaysia are heavily infested with rats which are capable of transmitting a number of parasites to man, a survey was conducted to study the seasonal prevalence of helminth parasites of the wood rat, *Rattus tiomanicus*.

## MATERIAL AND METHOD

In an oil-palm estate situated 24 miles north of Kuala Lumpur, rats were trapped for one week every month in 1973. Helminths recovered from various organs of the animals were fixed, counted and preserved in 70 % glycerine alcohol for identification. Nematodes were cleared and studied in lactophenol. Cestodes and pentastomids were stained in Mayer's paracarmine, counter stained in fast green, dehydrated in ethanol, cleared in methyl salicylate and mounted in permount.

Specimens collected were measured and identified by using the following text: *Angiostrongylus malaysiensis* (Bhaibulaya and Cross 1971), *Hepatojarakus malayae* (Yeh 1955), *Gongylonema neoplasticum* (Quentin and Krishnasamy 1975) and *Syphacia muris* (Ow-Yang 1971). Identification of *Nippostrongylus braziliensis* was confirmed by Dr. Marie-Claude Durette Desset, Museum National d'Histoire Naturelle, Paris and the identification of *Hymenolepis diminuta*, *H. nana* and *Hydatigera taeniaeformis* was confirmed by Dr. J.-Cl. Quentin, of the same Museum. Professor Teaque Self, Department of Zoology, University of Oklahoma, confirmed the identification of the pentastomid.

## RESULTS

Out of a total of 367 rats (191 males and 176 females) examined, 346 (180 males and 166 females) were infected with helminths thereby giving an infection rate of 94 %. The infection rate in males (94 %) was similar to that in females (94 %).

**Table 1.** Seasonal prevalence of different helminths in *Rattus tiomanicus*

| Parasites | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | No. of animals infected (%) | Total number of helminths (%) | Means intensity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nematodes | | | | | | | | | | | | | | | |
| *Angiostrongylus malaysiensis* | 12 | 17 | 21 | 24 | 20 | 15 | 17 | 16 | 16 | 16 | 11 | 14 | 199 (54.2) | 1.350 (18.3) | 6.7 |
| *Hepatojarakus malayae* | 23 | 16 | 20 | 20 | 19 | 9 | 11 | 11 | 11 | 13 | 14 | 11 | 178 (48.5) | 2.744 (37.2) | 15.4 |
| *Nippostrongylus braziliensis* | 18 | 18 | 20 | 27 | 15 | 12 | 14 | 14 | 4 | 7 | 14 | 13 | 176 (47.9) | 2.628 (35.6) | 14.9 |
| *Gongylonema neoplasticum* | — | — | 1 | — | — | — | — | — | — | — | — | — | 1 (0.3) | 6 (0.1) | 6.0 |
| *Syphacia muris* | 1 | — | — | 6 | 11 | 4 | 11 | 12 | 3 | 4 | 11 | 2 | 65 (17.7) | 507 (6.8) | 7.8 |
| Cestodes: | | | | | | | | | | | | | | | |
| *Hymenolepis diminuta* | 1 | 4 | 1 | 1 | 3 | — | 4 | — | 2 | 5 | — | 1 | 22 (5.9) | 33 (0.4) | 1.5 |
| *Hymenolepis nana* | — | — | — | — | — | 5 | — | 5 | 4 | 5 | 7 | 2 | 28 (7.6) | 41 (0.6) | 1.4 |
| *H. taeniaeformis* | 1 | 2 | 2 | 2 | 3 | — | 2 | 7 | 9 | 8 | 1 | 7 | 44 (11.9) | 69 (0.9) | 1.5 |
| Pentastomida | | | | | | | | | | | | | | | |
| *Armillifer* sp.* | — | 1 | — | 1 | — | — | — | — | 1 | — | — | — | 3 (0.8) | 5 (0.1) | 1.6 |
| Number of rats examined | 27 | 32 | 31 | 34 | 35 | 30 | 32 | 29 | 27 | 30 | 33 | 27 | | | |

* *Armillifer* sp. later determined as *A. moniliformis*

Eight different species of helminths were identified among 7,383 worms recovered from *R. tiomanicus*. These consisted of five species of nematodes and three species of cestodes. One species of pentastomid was also discovered. No trematodes were found (Table 1). The intensity of invasion was higher for nematodes than cestodes and was only one to two for pentastomids. The nematodes totalling 7,235 worms belonged to five different families: Metastrongylidae: *Angiostrongylus malaysiensis*, Trichostrongylidae: *Hepatojarakus malayae* (Yeh Liang—Sheng, 1955), Heligmosomatidae: *Nippostrongylus braziliensis* (Travassos, 1914), Spiruridae: *Gongylonema neoplasticum* (Fibiger et Diklevsen, 1914) and Oxyuridae: *Syphacia muris* (Yamaguti, 1935).

The worm load varied with different families. Though a large number of rodents were infected with *A. malaysiensis* (199), a chi-square test indicated that it was not significantly greater than those infected with *H. malayae* (178) or *N. braziliensis* (176). The remaining 148 helminths belonged to two cestode families, Hymenolepididae: *Hymenolepis diminuta* (Rudolphi, 1819), *Hymenolepis nana* (Siebold, 1852), and Taeniidae: *Hydatigera taeniaeformis* (Batsch, 1786). *H. taeniaeformis* was the most frequent cestode found followed by *H. nana* and *H. diminuta* (Table 1).

The majority of the helminth species were found in the intestine, lungs and liver, except for *G. neoplasticum*, which was found in the stomach wall, *Armillifer* sp. was found in the liver mesentery. The extent of infection varied from 1—42 for *A. malaysiensis*, 1—65 for *H. malayae*, 1—205 for *N. braziliensis*, 1—40 for *S. muris*, 1—3 for *H. diminuta*, 1—5 for *H. nana* and 1—5 for *H. taeniaeformis*. Of the total number of *R. tiomanicus* trapped, 28 % were infected by a single helminth species. No differences were observed in the occurrence of single or multiple infections in relation to the sex of the host.

Seasonal patterns of infestation with the 7 helminth species in *R. tiomanicus* were studied. The incidence of *A. malaysiensis* during the year was not significantly different from a random fluctuation while the incidence of *H. malayae* and *N. braziliensis* showed significant changes (Table 1). Infections were more frequent with *A. malaysiensis* than *H. malayae* infections during all months except January and November. The number of *H. malayae* was higher in the first half of the year while the incidence of *N. braziliensis* was higher in the first half of the year, and had a significant relationship to rainfall. Infections with *N. brazilliensis* dropped markedly during May when rainfall was highest and remained low throughout the rest of the year. The cause for this has not been investigated. The percentage of rats infected with *N. braziliensis* was higher than those with *S. muris* during the whole period of the survey except the months of August and September when infections with both parasites were nearly the same. Infection rates with *H. diminuta*, *H. nana* and *H. teaniaeformis* were very low throughout the year.

## DISCUSSION

Mulkit Singh and Cheong (1971) reported that the overall helminth infection in *Rattus tiomanicus* (= *jalorensis*) in Malaysia was 33.3 %. The overall infection rate of 94 % in *R. tiomanicus* in the present study was much higher than that obtained by these workers. The difference may be due to the different habitats from which *R. tiomanicus* were caught in the two studies. Mulkit Singh and Cheong (1971) caught *R. tiomanicus* from scrub while in the present study rats were trapped in an oil-palm plantation.

Ow-Yang (1971) found *Strongyloides ratti* and *Syphacia muris* in *R. tiomanicus* caught from rice fields, oil-palm and rubber plantations, grassland and scrub habitats,

while Mulkit Singh and Cheong (1971) found *S. ratti, Capillaria hepatica, Physaloptera* sp., and *Rictularia tani* in rats caught from scrub habitat. Except for *S. muris*, none of the other parasites reported by these investigators was found in rats in the present study. On the other hand, *H. diminuta, H. nana, H. taeniaeformis* and *Armillifer* sp. were found. This again might be due to the different habitats from which *R. tiomanicus* were caught in the three studies.

The high prevalence of *A. malaysiensis* infections in *R. tiomanicus* is in confirmity with the findings of Lim and Heyneman (1965) and this is mainly due to the abundance of slugs in the oil-palm estates as they are the intermediate hosts of this parasite. The prevalence of *H. malayae* and *N. braziliensis* infections was very low in the studies of Mulkit and Cheong (1971); in the present investigations *R. tiomanicus* carried large number of the worms. Infections with *S. muris* were also high as compared to the findings of Ow-Yang (1971). Some of these observed differences may be due to differences in collecting techniques.

Eosinophilic meningitis caused by *Angiostrongylus* has been regarded as a public health problem as it has been reported in Malaysia (Sarawak) and in neighbouring countries (Watts 1969, Smit 1962, Punyagupta 1965) while *S. muris* has been reported from children in the Philippines (Dunn 1966). *H. diminuta* and *H. nana* are of public health importance and infections in man in Malaysia have been reported recently (Sinniah et al. 1978). In the present study 54 %, 17 %, 6 % and 7 % of the rats were infected with *A. malaysiensis, S. muris, H. diminuta* and *H. nana* respectively. The fact that *R. tiomanicus* has been found to be the host of these parasites provides evidence that it is a potential or a possible source of human infection.

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## СЕЗОННОЕ РАСПРОСТРАНЕНИЕ ГЕЛЬМИНТОФАУНЫ *RATTUS TIOMANICUS* (MILLERS) В ЗАПАДНОЙ МАЛАЙЗИИ

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**Резюме.** При гельминтологическом обследовании 367 крыс вида *Rattus tiomanicus* в плантации масличной пальмы 24 милей к северу от Куала Лумпур в 1973 г. обнаружено 8 видов гельминтов: 5 нематод, *Angiostrongylus malaysiensis* (54,2 % зараженных крыс), *Hepatojarakus malayae* (48,5 %), *Nippostrongylus braziliensis* (48,0 %), *Gongylonema neoplasticum* (0,3 %), *Syphacia muris* (17,7 %); три цестоды, *Hymenolepis diminuta* (6,0 %), *Hymenolepis nana* (7,6 %), *Hydatigera taeniaeformis* (цистицерк) (12,0 %); и одна пентастомида, *Armillifer* sp. (нимфа) (0,8 %). Общая зараженность гельминтами казалась выше, чем раньше приведенная зараженность этого вида.

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**REFERENCES**

ADAMS A. R. D., Report on a collection of Nematodes from the Federated Malay States. Ann. Trop. Med. Parasitol. 27: 1—13, 1933.

AUDY J. R., HARRISON J. L., WYATT-SMITH J., A survey of Jarak Island. Bull. Raffles Museum, Singapore 23: 230—261, 1950.

BHAIBULAYA M., CROSS J. H., *Angiostrongylus malaysiensis* (Nematoda: Metastrongylidae), a new species of rat-lung worm in Malaysia. Southeast Asian J. Trop. Med. Pub. Hlth 2: 527—533, 1971.

DUNN F. I., Observation on the fauna of Pulau Tioman and Pulau Tulai. II. Notes on the endoparasites. Bull. National Museum, Singapore 34: 141—149, 1966.

—, LIM B. L., YAP L. F., Endoparasites patterns in mammals of the Malayan Rain Forest. Ecology 49: 1179—1184, 1968.
GATHA S., A study of the helminth parasites of Singapore house rats. A thesis submitted to the University of Singapore for the degree of Master of Science, 1966.
LIM B. L., HEYNEMAN D., Host-parasites studies of *Angiostrongylus cantonensis* (Nematoda, Metastrongylidae) in Malaysian rodents: natural infection of rodents and molluscs in urban and rural areas of central Malaya. Ann. Trop. Med. Parasitol. 59: 425—433, 1965.
—, MUUL I., Helminth infections and reproductive rates in Malaysian wood rats. Southeast Asian J. Trop. Med. Pub. Hlth 1: 421—422, 1970.
—, LIM T. W., CHEAH W., YAP L. F., *Angiostrongylus malaysiensis* from Tuaran, Sabah, with reference to the distribution of the parasite in Malaysia. Southeast Asian J. Trop. Med. Publ. Hlth 7: 384—389, 1976.
MULKIT SINGH, CHEON C. H., On a collection of Nematode parasites from Malayan rats. Southeast Asian J. Trop. Med. Publ. Hlth 2: 516—522, 1971.
OW-YANG C. K., Studies on the Nematode parasites of Malayan Rodents. I. The Rhabdiasidea, Trichuridea and Oxyuridae. J. Helminthol. 45: 93—109, 1971.
PUNYAGUPTA S., Eosinophilic meningoencephalities in Thailand: summary of nine cases and observations on *Angiostrongylus cantonensis* as a causative agent and *Pila ampullacea* as a new intermediate host. Amer. J. Trop. Med. Hyg. 14: 370—374, 1965.
QUENTIN J.—Cl., KRISHNASAMY M., Nematodes *Spirura* parasites des Tupaia et du Nycticebe en Malaisie. Ann. Parasit. hum. comp. 50: 795—812, 1975.
SANDOSHAM A. A., Malaysian parasites. II. Preliminary note on the incidence of worm infection in common hosts. Stud. Inst. Med. Malaya 26: 23—28, 1953.
SCHACHER J. F., CHEONG C. H., Nematode parasites of three common house rat species in Malaya, with notes on *Rictularia tani* Hoeppli, 1929. Stud. Inst. Med. Res. Malaya 29: 209—216, 1960.
SINNIAH B., SINNIAH D., SINGH M., POON G. K., Prevalence of parasitic infections in Malaysian oil-palm estate workers. Southeast Asian J. Trop. Med. Publ. Hlth. 9: 272—276, 1978.
SMIT A. M., Eosinophilic meningitis at the Kisaran (Indonesia) and the problem on its aetiology. Bull. Soc. Path. Exot. 55: 722—733, 1962.
WATTS M. B., Five cases of eosinophilic meningitis in Sarawak. Med. J. Malaya 24: 89—93, 1969.
YEH L. S., A new bursate nematode *Hepatojarakus malayae* gen. et sp. nov. from liver of *Rattus rattus jarak* (Bonhote) on Pulau Jarak, Straits of Malacca. J. Helminthol. 29: 44—48, 1955.

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## 50th birthday of Professor Dr. František Tenora, D.Sc.

Professor Dr. Františel Tenora, D. Sc., a prominent Czechoslovak scientist, zoologist and parasitologist, Head of the Department of Zoology at the University of Agriculture in Brno, celebrates this year his 50th birthday and 25 years of fruitful scientific activities.

He was born on 22th September 1930 in a small Moravian town of Letovice, where he lived through his childhood and adolescence. Having passed the secondary school in 1949 he started to study at the Faculty of Sciences, J. E. Purkyně University in Brno. He finished the university studies with excellent results in 1953. He specialized in zoology-anthropology under the guidance of Prof. Dr. S. Hrabě, D.Sc. All his further life and work are associated with the University of Agriculture in Brno where he started to work as an assistant of Prof. Dr. J. Kratochvíl, D.Sc. at the Department of Zoology in 1953. Here he became involved in the study of parasitic worms infecting free-living vertebrates and domestic animals. His attention was particularly focused on theoretical and practical aspects of rodent helminths. He has become a world-known specialist in this problem, as well as in many others. In 1962 he was awarded the C.Sc. degree in biology on the basis of his thesis "Parasitic worms of *Apodemus*" defended at the Institute of Parasitology, Czechoslovak Academy of Sciences. He received the RNDr. degree from the Charles University, Faculty