

ANGIOSTRONGYLUS MALAYSIENSIS FROM TUARAN, SABAH, WITH REFERENCE TO THE DISTRIBUTION OF THE PARASITE IN MALAYSIA

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INTRODUCTION

Angiostrongylus malaysiensis is common among the commensal rats, *Rattus rattus diardii*, *R. tiomanicus* (= *jalorensis*), *R. argentiventer* and *R. exulans* and some of the more common molluscan intermediate hosts, *Microparmarion malayanus*, *Laevicaulis alte*, *Achatina fulica*, *Microchlamys resplendens* and *Pila scutata* in Peninsular Malaysia and Sarawak (Lim *et al.*, 1965; Lim and Heyneman, 1965; Lim, 1967, 1970). In August 1975, the authors visited Sabah to investigate the occurrence of *Angiostrongylus* in wild rats and molluscan hosts in Tuaran, 21 miles northeast of Kota Kinabalu. Hospital records of suspected cases of eosinophilic meningitis were examined at the Queen Elizabeth General Hospital, Kota Kinabalu. The objectives of the present study were to determine the species of rodent and molluscan hosts of the parasite, to establish whether *A. malaysiensis* or other *Angiostrongylus* spp. occur in Sabah, and to investigate clinical records of human angiostrongyliasis.

MATERIALS AND METHODS

Rats were trapped in and around occupied quarters, experimental food crops within the Central Agricultural Research Station, Tuaran and within the vicinity of Tuaran town. Captured rats were killed with chloroform and processed at the laboratories of the Central Agricultural Research Station. Brain, spinal cord, heart, lungs and pulmonary

arteries were searched for adult worms of *Angiostrongylus*. The recovered worms were fixed and preserved in 70% alcohol and later transferred to 5% glycerol in 70% alcohol. For examination they were temporarily mounted in lactophenol. Measurements were made with the aid of an ocular micrometer.

Land and freshwater molluscs were collected from the same locations where the rats were trapped. Some of the molluscs were processed in the field while others were examined at the Institute for Medical Research, Kuala Lumpur. The snails and slugs were minced into fine pieces with scissors in 0.85% physiological saline and examined for infective stage larvae of *Angiostrongylus* under a dissecting microscope. Samples of larvae were fed to laboratory-bred albino rats to confirm species identity.

RESULTS

Twenty-six rats consisting of three species of commensal rats (*Rattus r. diardii*, *R. exulans*, *R. argentiventer*) and three species of forest rats (*R. cremoriventer*, *R. rajah*, *R. annandalei*) were examined for *Angiostrongylus*. A total of 382 molluscs comprising a species of freshwater snail, *Pila scutata*, a species of African land snail, *Achatina fulica*, and two species of land slugs, *Laevicaulis alte* and *Microparmarion malayanus*, were also examined. Results are shown in Table 1.

A total of 40 adult worms comprising 22 females and 18 males were recovered from three species of infected rats. Measurements

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Table 1

Results of rats and molluscs examined for *Angiostrongylus* in Tuaran, Sabah.

Species	No. exam.	No. pos. (%)	Mean worm-load (range)
<i>Rattus rattus diardii</i>	19	3	3.6 (1-9)
<i>R. exulans</i>	2	1	2 (immature)
<i>R. argentiventer</i>	1	1	27
<i>R. cremoriventer</i>	1	0	-
<i>R. rajah</i>	1	0	-
<i>R. annandalei</i>	2	0	-
<i>Pila scutata</i>	186	14 (5.9)	35 (14-111)
<i>Achatina fulica</i>	40	5 (12.5)	279.8 (54-350)
<i>Laevicaulis alte</i>	132	31 (23.5)	224.8 (28-784)
<i>Microparmarion malayanus</i>	24	6 (25.0)	193.5 (15-490)

Table 2

Experimental infection in laboratory albino rats with *Angiostrongylus* and worms recovered 25 days after initial infection.

No. of larvae per rat	Source of larvae	No. of rats fed with larvae	Total number of worms recovered			Per cent worms recovered
			Brain	Heart	Lung	
100	<i>Pila scutata</i>	1	4	7	18	29
100	<i>Achatina fulica</i>	1	3	5	21	29
100	<i>Laevicaulis alte</i>	1	2	9	22	33
100	<i>Microparmarion malayanus</i>	1	3	6	19	28

of these worms were consistent with those of Bhaibulaya and Cross (1971).

Third-stage larvae from molluscan intermediate hosts were fed to laboratory-bred albino rats. Four rats each were fed 100 larvae recovered from each species of molluscs (Table 2). All the rats were killed 25 days after infection and adult worms identified as *A. malaysiensis* were recovered from the brains, hearts and lungs. The results thus confirmed that all the four species of molluscs harboured third-stage infective larvae of *A. malaysiensis*.

Table 3 lists the different species of molluscan intermediate and final hosts found naturally infected with *A. malaysiensis* in the three geographical regions in Malaysia. Fig. 1 indicates localities where the parasite has been recovered from the rat hosts.

Pila scutata is known to the Kadazan people in Tuaran as gelupok and in Penampang as tungol. This snail is commonly found in disused ponds and drainage of padi fields and occasionally in padi fields. Information obtained from some of the Kadazans indicates that it is not uncommon to eat this snail.

Table 3

Molluscan intermediate hosts and mammalian definitive hosts
of *Angiostrongylus malaysiensis* in Malaysia.

Peninsular Malaysia	Kuching, Sarawak	Tuaran, Sabah
Molluscan intermediate hosts		
<i>Microparmarion malayanus</i>	<i>Microparmarion malayanus</i>	<i>Microparmarion malayanus</i>
<i>Girasia peguensis</i>	<i>Laevicaulis alte</i>	<i>Laevicaulis alte</i>
<i>Laevicaulis alte</i>		
<i>Macrochlamys resplendens</i>	<i>Macrochlamys resplendens</i>	<i>Achatina fulica</i>
<i>Quantula striata</i>	<i>Achatina fulica</i>	
<i>Achatina fulica</i>		
<i>Pila scutata</i>	<i>Pila scutata</i>	<i>Pila scutata</i>
<i>Bellamyia ingallsiana</i>		
<i>Indoplanorbis exustus</i>		
Mammalian definitive hosts		
<i>Rattus rattus diardii</i>	<i>Rattus rattus diardii</i>	<i>Rattus rattus diardii</i>
<i>Rattus tiomanicus</i>	<i>Rattus tiomanicus</i>	<i>Rattus argentiventer</i>
(= <i>jalorensis</i>)	<i>R. argentiventer</i>	<i>R. exulans</i>
<i>R. argentiventer</i>	<i>R. exulans</i>	
<i>R. exulans</i>		
<i>Rattus sabanus</i>		
<i>R. muelleri</i>		
<i>R. bowersi</i>		
<i>R. surifer</i>		
<i>R. annandalei</i>		
<i>R. cremoriventer</i>		
<i>R. whiteheadi</i>		
<i>Tupaia glis</i>		

There are several ways of preparing the snail for consumption, such as, after cleaning and killed in boiling water, it is sucked out from the shell and eaten with some spicy or chilli sauce; it is seasoned with lime juice and/or spices and eaten raw or fried, and after the abdominal part is removed, it is cooked with some spicy ingredients.

Hospital records, from January 1974 to June 1975, were scrutinized and a total of 573 cases of eosinophilia were found. Of these, 16 possible cases of eosinophilic meningo-

cephalitis were analysed. Only 2 cases were found with neurological signs and symptoms, suggestive of eosinophilic meningoencephalitis of angiostrongyliasis aetiology. Both cases had other manifestations, e.g., long standing epilepsy in one and subarachnoid haemorrhage in the other.

DISCUSSION

This study reports *Angiostrongylus* sp. for the first time in molluscan and rat hosts in

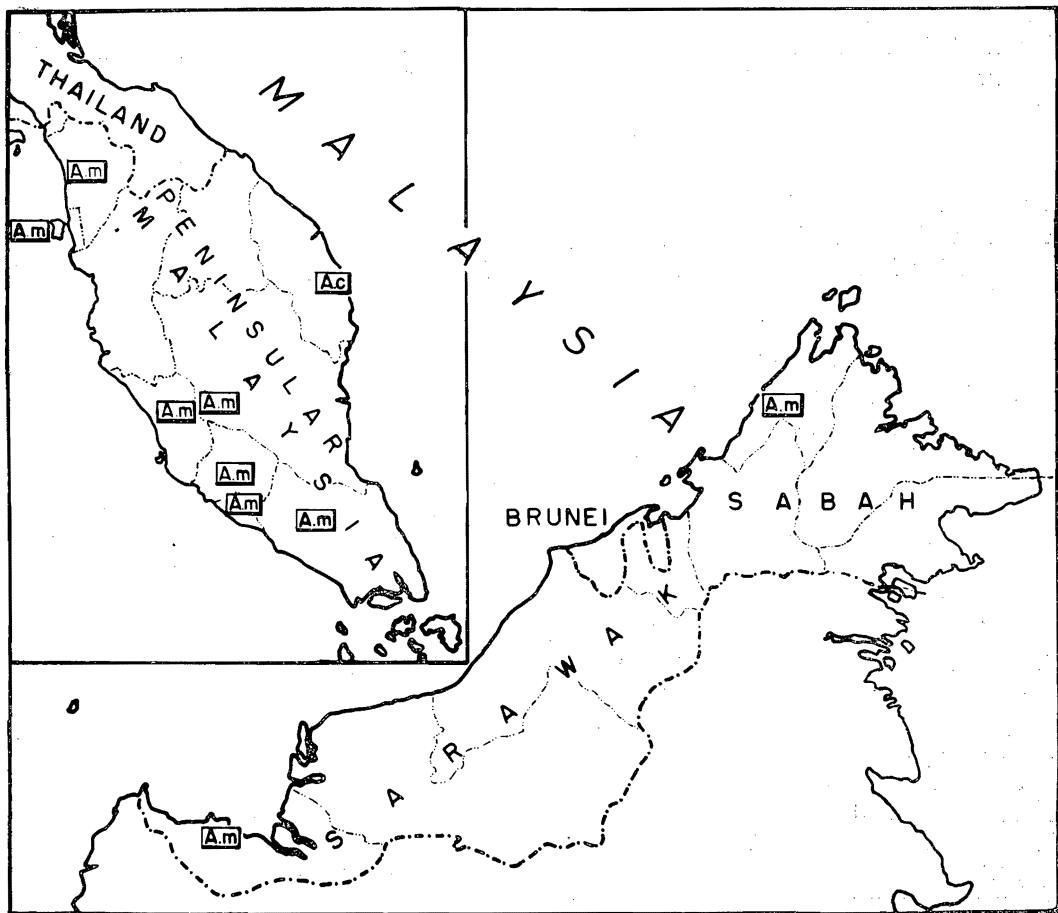


Fig. 1—Localities where *Angiostrongylus* (A.m.) and *A. cantonensis* (A.c.) were distributed throughout Malaysia.

Tuaran, Sabah. Morphologically the adult worms recovered from naturally infected commensal rats agreed with descriptions of *A. malaysiensis*. Adult worms from laboratory-bred albino rats experimentally infected with third-stage larvae recovered from naturally infected molluscs confirmed the parasite as *A. malaysiensis*.

A. malaysiensis is found commonly in molluscan and rat hosts throughout Peninsular Malaysia. At least nine species of land and aquatic molluscs were found to be the natural intermediate hosts of the parasite (Lim *et al.*, 1965; Lim and Heyneman, 1965; Lim, 1974).

In Kuching, Sarawak, five species of land and fresh water molluscs were known intermediate hosts (Lim, 1967, 1970) and in the present study four species of molluscs were confirmed as intermediate hosts of this parasite (Table 3). The smaller number of molluscan intermediate hosts recorded in Sabah and Sarawak, 4 and 5 respectively, compared to 9 in Peninsular Malaysia was probably due to the limited areas sampled and the short time spent on the investigation.

In Peninsular Malaysia, four species of commensal rats, seven species of forest rats and one species of primitive primate (Table 3)

were found to be natural hosts of the parasite (Lim *et al.*, 1965; Lim and Heyneman, 1965), in Sarawak four species of commensal rats (Lim, 1967, 1970), and in the present study in Sabah three species of commensal rats were found infected. In previous studies of small mammals in Sabah and Sarawak (Lim and Heyneman, 1968; Muul and Lim, 1974) large samples of various species of forest rats and primitive primates were examined for *Angiostrongylus* sp. without success. The commensal rats, *R.r. diardii*, *R. exulans*, *R. argentiventer* and *R. tiomanicus* were found to be more susceptible hosts than the forest rats in Peninsular Malaysia (Lim *et al.*, 1965; Lim and Heyneman, 1965). This suggests that the commensal rats are the primary hosts of the parasite in the three geographical regions.

In Sarawak, five cases of human eosinophilic meningoencephalitis were reported (Watts, 1969). *A. cantonensis* (= *malaysiensis*) was allegedly implicated as the aetiological agent in all these cases and larvae, presumably *A. malaysiensis*, were recovered from one patient. The source of infections in all these cases was reported to have been derived from eating raw food or vegetables contaminated by infected molluscs. Although it is not known how extensively the freshwater snail, *P. scutata*, is eaten by the populace in Sabah, the fact that these snails have been found to be intermediate hosts of the parasite provides evidence that they should not be overlooked as a potential source of human infection.

The fact that the two suspected eosinophilic meningoencephalitis cases also suffered other manifestations such as epilepsy and subarachnoid haemorrhage posed a doubtful diagnosis of angiostrongyliasis. It does appear that clinical angiostrongyliasis, e.g. eosinophilic meningoencephalitis, is almost non-existent. However, this study has stimulated the interest of clinicians and pathologists and no doubt in the future they shall be on the look out for this disease. Perhaps we

might then see some cases of human angiostrongyliasis as was observed in Sarawak (Watt, 1969).

Lim (1975) reported *A. cantonensis* (Chen, 1935) in *R. exulans* in the East coast of Peninsular Malaysia. Mixed infections of *A. malaysiensis* and *A. cantonensis* in rat hosts were observed in Thailand by Bhaibulaya and Techasopanmani (1972). Although *A. cantonensis* was not found in the present study, it is quite possible that the parasite would be co-existent in some hosts.

SUMMARY

A survey of *Angiostrongylus malaysiensis* among wild rodent and molluscan hosts was made in the Tuaran Central Agricultural Research Station and within the vicinity of Tuaran, Sabah. Three of 19 *Rattus rattus diardii*, one of 2 *R. exulans* and one *R. argentiventer* were found naturally infected with the parasite.

In this survey 56 of 382 molluscs comprising of *Pila scutata*, *Achatina fulica* and two species of land slugs, *Laevicaulis alte* and *Microparmarion malayanus*, were found naturally infected with the parasite. Samples of larvae from each of these molluscs were experimentally transferred to laboratory albino rats and adult worms consistent with *A. malaysiensis* were recovered.

Comparison of the rat hosts and the molluscan intermediate hosts of the parasite in Peninsular Malaysia, Sarawak and Sabah was made, and the finding of *A. malaysiensis* in Tuaran is the first report of the parasite from Sabah. The distribution of the parasite throughout Malaysia is discussed.

Observation on the human consumption of the freshwater snail, *P. scutata*, was made. Although the infection rate of this snail is low compared with other molluscan hosts examined. The importance of this mollusc as

a potential source of human infection should not be overlooked. Hospital records for 1974 and 1975 were examined and clinical human angiostrongyliasis was rarely recorded in Sabah.

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