BRIEF NOTE

**Observations on the Development of *Angiostrongylus cantonensis*
in Mastomys and Mongolian Gerbils**

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The rat (*Rattus norvegicus*) has been usually employed as an animal model for the experimental studies on *Angiostrongylus cantonensis* since this animal is not only a definitive host for the parasite but also easily available in laboratories. However, another susceptible laboratory animal model other than rats would be required for better understanding of the host-parasite relationships of *A. cantonensis*. It has been reported that adult *A. cantonensis* could be harvested from the lungs of experimentally infected Mongolian gerbil (*Meriones unguiculatus*) [3], although no detailed information is available. Recently, Lämmler and Weidner [5] used the mastomys (*Praomys natalensis*) as an animal model to assess the larvicidal activity of several anthelmintics against *A. cantonensis* and suggested that this model infection would be useful for the comparative evaluation of anthelmintics against some extra-intestinal nematodes. The purpose of this study is to compare mastomys with gerbils in development of *A. cantonensis*, and to determine which ani-

mals are more suitable for an experimental animal model.

Twelve mastomys (♂ 3, ♀ 9), weighing 35–60 g and aged 5–8 months, and 9 gerbils (♂ 4, ♀ 5), 60–80 g in weight and 3–8 months old, were used. These animals were obtained from the animal colony from the Institute of Physical and Chemical Research, Wako-shi, Saitama, Japan. Ten Wistar strain rats (♂ 5, ♀ 5) weighing 220–265 g served as controls. Animal infection with *A. cantonensis* was performed as previously described [7]. The number of the 3rd stage larvae fed per animal was 7–15 for mastomys, 4–14 for gerbils and 22–33 for rats, respectively. The methods for worm recovery from the brain, heart and lungs of the infected animals as well as the measurement of the recovered worms have been described previously [6]. The percent worm recovery rate was taken as a measure of each animal's susceptibility to infection with *A. cantonensis* since the number of larvae fed was variable in individuals of the animals. Statistical analyses for differ-

短報：マストミスとスナネズミにおける広東住血線虫の發育について：吉村堅太郎（順天堂大学医学部寄生虫学教室），川島由次（琉球大学農学部畜産学科）

Table 1. Recovery of *A. cantonensis* from experimentally infected mastomys, gerbils and rats

Animal species	No. of animals examined	Days infected	No. of larvae fed	No. of worms recovered			Statistical significance in worm recovery rate
				Brain	Heart and lungs	Total (%±SD)*	
Earlier than 29 days postinfection							
Mastomys	4	24—26	50	14	8	22 (43.5± 8.31)	
Gerbil	3	25, 29	36	17**	1	18 (50.0± 8.30)	
Later than 33 days postinfection							
Mastomys	5	36—104	52	6	12	18 (34.1± 7.83) ^a	a vs b p<0.05
Gerbil	6	33—105	61	5***	5†	10 (15.9±13.02) ^b	b vs c p<0.001
Rat	10	33, 105	280	0	145	145 (52.0±18.06) ^c	

Remarks.

*: Mean % worm recovery ± standard deviation.

**: Two of them were found dead.

***: Four of them were disintegrated.

†: One of them was disintegrated.

ence in worm recovery rate and worm body length between these animals were performed by the use of Student's t-test.

Three mastomys which had died during the course of the experiments were discarded since they could not be used for worm recovery due to damages by cannibalism.

Previously, Bhaibulaya [4] described that some young adult *A. cantonensis* in the rat brain had reached the lungs 26–29 days postinfection. In order to determine the time when the young adult worms migrate from the brain to the lungs in mastomys and gerbils, therefore, worm recovery data were assessed by dividing into two stages of infection, i.e., pre-29 days and post-33 days of infections (Table 1).

When a comparison was made between mastomys and gerbils 24–29 days postinfection, it was found that 36% (8/22) of the worms recovered from mastomys had already reached the lungs, whereas only 6% (1/18) of the worms from gerbils reached the organs. These results suggest that migration of the intracranial young adult worms to the lung occurs in these animals at almost the same time as that in the rat [4]. It is also of interest to note that 2 of

5 worms recovered from the gerbil's brain at Day 29 postinfection were found dead and partially disintegrated. At this stage of infection, however, there was no significant difference in worm recovery rate between mastomys (44%) and gerbil (50%) (Table 1).

On the other hand, worm recovery data obtained at later than 33 days postinfection indicated that no worms could be detected in the rat brain, whereas 33% (6/18) and 50% (5/10) of the worms recovered still remained in the brains of mastomys and gerbils, respectively. Additionally, it is noticeable that in gerbils, all the worms recovered from both the brain and lungs at 104–105 days postinfection were found partially disintegrated. The worm recovery rate was highest in rats (52%), followed by mastomys (34%) and gerbils (16%). The recovery rate of the gerbils was significantly lower than those of rats and mastomys, while no significant difference was noted between mastomys and rats (Table 1).

Growth of *A. cantonensis* (Fig. 1) revealed that the worms obtained from mastomys were significantly smaller than those from rats throughout the course of the observations. This may be ascribed to either the

Fig. 1. Growth of *A. cantonensis* in experimentally infected mastomys, gerbils and rats

development of *A. cantonensis* is worse in mastomys than in rats, or the parasite can not grow sufficiently in mastomys due to the narrowness of the pulmonary artery. The latter supposition may be supported by the fact that in mastomys, the majority of the adult worms were mostly detected in the main trunks of the artery and not in the small branches.

Stool examinations by direct smears method revealed that mastomys were positive for *A. cantonensis* 1st stage larvae 45 days postinfection, while gerbils were negative even at 81 days postinfection. The length ($284 \pm 22.3 \mu\text{m}$; $N=10$) of the 1st stage larvae from mastomys was almost equivalent to that ($280 \pm 24.6 \mu\text{m}$; $N=10$) from rats. When rats were fed with the 3rd stage larvae harvested from *Biomphalaria glabrata* snails which had been previously exposed to the 1st stage larvae shed from the infected mastomys, these rats later yielded the adult *A. cantonensis*.

The above data clearly indicate that in both mastomys and gerbils, the young adult *A. cantonensis* in the brains can migrate to

the lungs, confirming the previous results [3, 5]. It seems reasonable to infer, however, that gerbils would be less susceptible to *A. cantonensis* than mastomys since, to the present experiments, the excretion of the 1st stage larvae into the stool could not be observed in gerbils and the majority of the worms died shortly after the migration to the pulmonary artery. Contrarily, *A. cantonensis* developed to sexual maturity in the pulmonary artery of mastomys and the output of the 1st stage larvae into the stool could be demonstrated. As Lämmler and Weidner [5] have previously pointed out, it was noted that a few young adult worms occasionally remained in the brains even at 75–104 days postinfection. Nevertheless, it is conceivable that the mastomys would become a useful experimental animal model for assessing the immunobiological aspects of the host-parasite relationships in *A. cantonensis* infections.

The majority (58% = 7/12) of the infected mastomys showed a variety of nervous symptoms such as paraplegia of the hind legs, torticollis and circling, all of which appeared at later stages than 20 days postinfection. This finding is also in agreement with the results reported previously [5]. In contrast, the appearance of such symptoms was found in only 22% (2/9) of the infected gerbils; one individual represented circling at Day 24 and the other showing torticollis at Day 48 postinfection. Mastomys may be thus an excellent model for better understanding of the neuro-pathological and clinical aspects of *A. cantonensis* infections.

Alicata [1] made a survey on *A. cantonensis* infection in *Mastomys natalensis* (syn. *Praomys natalensis*) captured on Kenya, Mozambique and Tanzania and reported that the animal was negative for the parasite. When one considers, however,

that the mastomys is a definitive host for *A. sandarsae*, which is a related species to *A. cantonensis* [2], it is of quite interest that this animal can serve as an experimental final host for *A. cantonensis*.

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