

Parasitic infestation in laboratory rat strain, Long-Evans (*Rattus norvegicus* Berkenhout, 1769)

Md. Abdul Gofur¹, Hamida Khanum¹, Milka Patracia Podder¹ and Zaibun Nessa²

¹Department of Zoology, University of Dhaka, ²Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka

Abstract: In the present investigation, 30 Long-Evans were examined. Out of 30, 23 rats were infected by helminth parasites, two species of helminth parasites from two taxonomic groups were identified, cestode *Hymenolepis nana* and nematode *Syphacia muris*. The prevalence and intensity of parasites were quite different in different groups of helminth parasites in hosts. The prevalence and intensity of infestation of cestodes were 26.67% and 5.57 ± 1.5 while higher of nematodes 66.67% and 60.85 ± 8.1 in the Long-Evans respectively. *Hymenolepis nana* was found in small intestine and *Syphacia muris* in all parts of the alimentary tract. The prevalence and intensity of infestation was 36.67% and 5.09 ± 1.6 respectively in small intestine. The prevalence of infestation was similar both in large intestine and caecum (63.33%), and in rectum (63.33%). The intensity of infestation was 24 ± 3.30 and 39.16 ± 4.10 in large intestine and caecum, and in rectum respectively.

Key words: Long-Evans, *Rattus norvegicus*, cestodes, nematodes, prevalence, intensity.

Introduction

Helminthes parasitized rats are studied to identify the species and for determination of prevalence and intensity of helminthes (Stanley & Virgin, 1993). Mice and rats are the most common laboratory animals used in research and testing. Long-Evans is one of the important strains of laboratory rat *Rattus norvegicus*, Berkenhout, 1769, harbored in most of the animal houses in Bangladesh. Throughout the world, necessary steps have been taken in order to detect and identify the parasites of laboratory animals to keep them physically fit by controlling or eradication of parasites.

Parasitic studies on rats and mice have been done in most countries and reported that rats and mice harbor a number of helminth parasites such as trematodes, cestodes, nematodes and acanthocephalan (Singh 1962, Gupta & Trivedi, 1985). In developing countries, where conditions are more suitable for these hosts where awareness to control them is less than to that of the developed countries this information is of particular importance because of the role which they have as reservoir hosts of some parasites infecting man.

The presence of rats and mice therefore, represents a potential epizootiological problem (Spatafora & Platt, 1982). The rats and mice live very intimately with humans and ubiquitously distributed in natural environment (Seo *et al.* 1981). In addition, during the daily promenade,

they contaminate human food and clothing both with their feces and urine and also by physical contact. This behaviour is enough to lend support to the idea that they not only maintain but also disperse some of the human parasites as well as diseases.

Various diseases caused by helminth parasites are significant health problem in both veterinary and human medicine. Nematode parasites alone are estimated to produce infections over more than three millions farm and pet animals in the United States (Wiroreno, 1978). Both domestic and wild animals are subject to a variety of parasites. Cestode and nematode parasites in rat have been reported from all parts of the world. *Vampirolepis nana* and *Hymenolepis diminuta* are commonly found in rats and mice and potentially transmissible to man (Jawdat & Mahmoud, 1980).

The occurrence of *Hymenolepis diminuta*, *Vampirolepis nana* in certain rodents is of interest since the possibility exists that rats and mice may served as reservoir hosts and aid in the dissemination of these worms to domestic animals and man (Jawdat & Mahmoud, 1980), causing zoonoses. Spindler (1930) recovered *Vampirolepis nana* in 3.6% of 2152 people examined from South-West Virginia. Senekiji *et al.* (1940) recorded that the incidence of *Vampirolepis nana* was 2.1% of 1000 people examined in Iraq. Salem *et al.* (1968) reported that the presence of *Vampirolepis nana* was 42.4% of 204 young people from Mosul area of Iraq.

Infection with *Syphacia muris* shows symptoms which are poor condition, rough hair coats, reducer growth rate, rectal prolapsed (Hoag, 1961). Experimentally *Syphacia muris* infected animals grew slower than uninfected animals (Wagner, 1988). Increase in resistance of pinworm infection with advancing age of rats (Wagner, 1988). Pinworms of laboratory rodents are generally not considered pathogens (Flynn, 1973).

In Bangladesh, very few studies have been carried out on identification of the parasites and worm burden of rats and mice. These include the work of Huq (1969), Shaha (1974), Bhuiyan *et al.* (1996), Khanum *et al.* (2001), Khanum *et al.* (2009), Alam *et al.* (2003), Khanum & Arefin (2003) and Muznebin *et al.* (2009). The present study was undertaken to identify prevalence and intensity of helminth parasites of the Long-Evans (*Rattus norvegicus* Berkenhout, 1769).

Materials and Methods

The hosts were reared in cages and special type of food and water were supplied. Food materials supplied for the rearing of long-evans were rice polish, wheat bran, maize, protein, soyabean pulses, coarse flour, salt, soyabean oil, g.s. vitamin, treacle etc. After measuring the length and weight of the hosts, the parasites were collected.

The cestodes were dipped quickly in a dish of hot fixation (AFA) when the scolices were in extended condition. After 10 minutes cestodes were then preserved in 70% ethyle alcohol. Cestodes were cleared and accomplished more rapidly when Lacto-phenol was used. Worms with thick cuticle required over night to be fairly cleaned.

The nematodes were washed thoroughly in the saline solution and were cleared in Lacto-phenol. Finally the nematodes were preserved in 70% ethyle alcohol. The parasites were identified following the key given by Yamaguti (1959 and 1961). Like other helminthes nematodes were cleared and studied satisfactorily as temporary whole mount in Lacto-phenol. The smaller forms required overnight and the larger forms required more than 7 days to be fairly cleaned.

Results

A total of 1256 helminth parasites were collected from 30 hosts, Long-Evans. Each worm was examined for taxonomic identification. Two species of helminth parasites were identified from two taxonomic groups, *Hymenolepis nana*

(Siebold, 1852) and nematode *Syphacia muris* (Yamaguti, 1935).

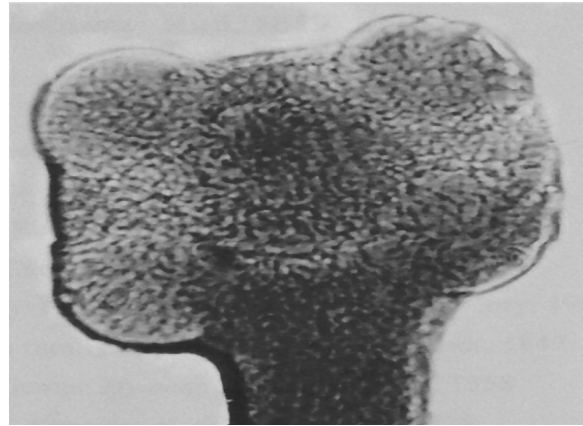


Fig. 1. Scolex of *Hymenolepis nana*(40×10)

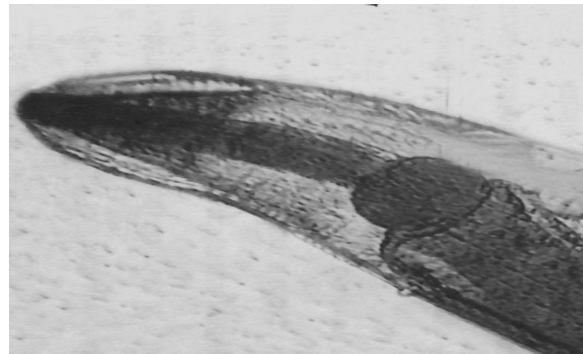


Fig. 2. Anterior portion of *Syphacia muris*(40×10)



Fig. 3. Posterior portion of female *Syphacia muris*(40×10)

Prevalence and intensity of helminth parasitic infestation in male and female hosts:

The prevalence of helminth parasites infection was 76.67% and the percentage intensity of infestation was 54.60 ± 7.3 in Long-Evans. The prevalence of

infestation in male was 80% and in female was 73.33% whereas the intensity of infestation was

comparatively higher (63.17 ± 9.2) in male and lower (45.27 ± 6.60) in female, (Table-1).

Table 1. Prevalence and intensity of infestation of helminth parasites according to sex of the hosts.

Host	Sex of the host	No. of hosts examined	No. of hosts infected	Prevalence (%)	Total no. of parasites collected	Intensity (\pm SD)
<i>Rattus norvegicus</i>	Male	15	12	80	758	63.17 ± 9.2
	Female	15	11	73.33	498	45.27 ± 6.60
	Total	30	23	76.67	1256	54.60 ± 7.3

The percentage of infection varied from host to host and also parasite to parasite. The prevalence of cestodes and nematodes were 26.67% and 66.67% respectively. Prevalence of nematodes

were higher than the cestodes. Intensity of cestodes and nematodes were 5.57 ± 1.5 and 60.85 ± 8.1 respectively, (Table-2).

Table 2. Prevalence and intensity of infestation of different groups of parasites.

Groups	Total no. of hosts examined	Total no. of hosts infected	Prevalence (%)	Total no. of parasites collected	Intensity (\pm SD)
Cestodes	30	8	26.67	39	5.57 ± 1.5
Nematodes	30	20	66.67	1217	60.85 ± 8.1

The prevalence of each species of helminth parasite in male and female slightly varied but percentage intensity greatly varied. The prevalence of *H. nana* was higher (40%) in female than in male (13.33%). But the prevalence of *S. muris* was higher (73.33%) in male than in female (60%).

The intensity of *H. nana* was higher (8.5 ± 2.1) in male than in female (3.67 ± 1.1). But the intensity of *S. muris* was higher (73.54 ± 10.7) in male than in female (45.33 ± 5.40), (Table-3).

Table 3. Prevalence and intensity of each species of helminth according to sex of the hosts.

Sex of the hosts	Name of the parasites	Total no. of hosts examined	Total no. of hosts infected	Prevalence (%)	Total no. of parasites collected	Intensity (\pm SD)
Male	<i>Hymenolepis nana</i>	15	2	13.33	17	8.5 ± 2.1
	<i>Syphacia muris</i>	15	11	73.33	809	73.54 ± 10.7
Female	<i>Hymenolepis nana</i>	15	6	40	22	3.67 ± 1.1
	<i>Syphacia muris</i>	15	9	60	408	45.33 ± 5.40

The occurrence of parasites was most abundant in large intestine and caecum and in rectum. No parasites were found in esophagus and stomach. So the prevalence in esophagus and stomach is absent. 11 (36.67%) parasites were collected from small intestine, 19 (63.33%) parasites were collected from both the large intestine, caecum and the rectum. The highest prevalence of infestation was found in both the large intestine,

caecum and the rectum (63.33%). The lower prevalence was recorded in small intestine (36.67%).

Comparatively lower intensity of infestation was found in small intestine (5.09 ± 1.6). The higher intensity was found in rectum (39.16 ± 4.10), slightly higher intensity was found in large intestine and caecum (24 ± 3.30), (Table-4).

Table 4: Prevalence and intensity of organ wise helminth parasites in Long-Evans.

Location	Total no. of hosts examined	Total no. of hosts infected	Prevalence (%)	Total no. of parasites collected	Intensity (\pm SD)
Esophagus	30	0	0	0	0
Stomach	30	0	0	0	0
Small Intestine	30	11	36.67	56	5.09 \pm 1.6
Large Intestine Caecum	30	19	63.33	456	24 \pm 3.30
Rectum	30	19	63.33	744	39.16 \pm 4.10

The prevalence and intensity of cestodes in small intestine 26.67%, 3.75 \pm 1.1, and in large intestine and caecum were 3.33%, 6 \pm 1.8. The cestode in esophagus and stomach was absent. In small intestine, the prevalence and intensity of nematodes were 10% and 8.67 \pm 1.9 respectively,

whereas in large intestine and caecum were 60% and 25 \pm 3.4 respectively. The cestode was also absent in rectum, whereas the prevalence and intensity of nematodes were highest in rectum 63.33% and 39.16 \pm 4.10 respectively, (Table-5)

Table 5: Prevalence and intensity of different groups of parasites in Long-Evans.

Organs	No. of the hosts examined	Cestodes				Nematodes			
		No. of hosts infested	Prevalence (%)	No. of parasites collected	Intensity (\pm SD)	No. of hosts infected	Prevalence (%)	No. of parasites collected	Intensity (\pm SD)
Small Intestine	30	8	26.67	30	3.75 \pm 1.1	3	10	26	8.67 \pm 1.9
Large Intestine & Caecum	30	1	3.33	6	6 \pm 1.8	18	60	450	25 \pm 3.4
Rectum	30	0	0	0	0	19	63.33	744	39.16 \pm 4.10

Discussion

In the present study, the data showed that the overall prevalence of infestation in Long-Evans was 76.67%. Density dependent effects on the establishment and growth of *H. diminuta* have been reported by (Chandler, 1939). In general there was an inverse relationship between worm size and worm burden, termed the 'Crowding effects' (Read, 1951). Similar relationship was observed between worm fecundity and worm burden (Hager, 1941). Density dependent effects both worm dry weight and egg production and at highest dose both dry weight and egg production decreases significantly (Quinnell, 1988). Chappel & Pike (1976) have reported a small difference in the rate of worm rejection and in worm size between adult and juvenile rats which were slightly greater and slightly smaller respectively in the adults.

Huq *et al.* (1985), reported 96.41% prevalence in *Rattus rattus*. Bhuiyan *et al.* (1996), reported that about 83.33% *Bandicota bengalensis* and 82.08% *Rattus rattus* were infected with helminth parasites in Bangladesh. In the present study, the intensity of infestation in Long-Evans was found 54.60 \pm 7.3.

The prevalence of helminth parasites in male was 80% and in female was 73.33%. But the intensity in male was higher (63.17(9.2) than in female (45.27(6.60)). Bhuiyan *et al.* (1996), reported that among the three species of rodents such as *Bandicota bengalensis*, *Rattus rattus* and *M. musculus*, the prevalence of infection was higher in female than male. Khanum *et al.* (2001), observed the incidence of helminth infection and the comparative efficacy of a single 400mg dose of Albendazole, 600 mg dose of Mebendazole and Neem extract (*Azadirachta indica*) in the treatment of roundworm, hookworm and whipworm infestations. Khanum & Arefin (2003), reported that the prevalence of infestation of helminth groups were almost similar with slightly higher prevalence of cestodes in Swiss albino mice. Khanum *et al.* (2009), reported that the prevalence of infection was found highest in caecum (95.83%) and intensity of infection was highest in anterior part of intestine. From the present result it appears that the cestodes and nematodes are most common in laboratory rats and mice, due to its special type of feeding habits.

The feeding habit, non-sterilized water and food supply, overcrowding, inadequate ventilation and improper handling by lab attendant may be some

contributing factors for high worm burden in Long-Evans in the present animal house. Such an infected individual causes zoonotic disease and also remains completely unfit for use in any kind of scientific work. But throughout the world Long-Evans are widely used for experimental works. The result in the present study emphasized that the living condition of the animal house belonging to the IFST of BCSIR should be improved.

References

- Alam, M.S., Khanum, H. & Zaibunnesa 2003. Helminth infection in laboratory rat strain, Long-Evans (*Rattus norvegicus* Berkenhout, 1769). *Bangladesh J. Zool.* **31**(2):221-225.
- Bhuiyan, A.I., Ahmed, A.T.A. & Khanum, H. 1996. Endoparasitic Helminths in *Rattus rattus* Linnaeus & *Bendicota bengalensis* Gray. *J. Asiat. Soc. Bangladesh, Sci.* **22**:189-194.
- Chandler, A.C. 1939. The effects of number age of worms on development of primary and secondary infections with *Hymenolepis diminuta* in rats and an investigation into the true nature of 'Premonitions' in tapeworm infection. *American J. Hygiene.* **29**:105-114.
- Chappell, L.R. & Pike, A.W. 1976. Loss of *H. diminuta* from the rat. *International J. Parasitol.* **6**:333-339.
- Flynn, R.J. 1973. *Nematode Parasites of Laboratory Animals*, Iowa State University. Press, Ames Iowa. pp. 203-320.
- Gupta, S.P. & Trivedi, K.K. 1985. Nematode parasites of vertebrates. A new nematode, *Gongylonema fotedari* sp.nov (Family: Spiruridae Oreley, 1985) from Indian mole rat *Bandicota bengalensis* from Lucknow, U.P. *Indian J. Helminthol.* **37**(11):100-108.
- Hager, A. 1941. Effects of dietary modifications of host rats on the tapeworm *Hymenolepis diminuta*. Iowa State College. *J. Sci.* **15**:127-135.
- Hoag, W.G. 1961. Oxyuriasis in laboratory mouse colonies. *Am. J. Vet. Res.* **22**:150-153.
- Huq, M.M. 1969. A survey of the helminth parasites of roof rats *Rattus rattus*, digger rats *Bendicota bengalensis* and mole *Scalopus scalopus* in Mymensingh district, East Pakistan, *Pak. J. Vet. Sci.* **3**:65-68.
- Huq, M.M., Karim, M.J. & Sheikh, H. 1985. Helminth parasites of rats, house mice and moles in Bangladesh. *Pak. J. Vet. Sci.* **5**(3):143-144.
- Jawdat, S.Z. & Mahamoud, S.N. 1980. The incidence of cestodean and acanthocephalan parasites of some rodents in Iraq. *Bull. Nat. Hist. Res. Centre.* **7**(4):55-71.
- Khanum, H. & Arefin, N. 2003. Helminth Burden in Laboratory mice, *Mus musculus*. *Bangladesh J. Zool.* **31**:117-123.
- Khanum H, Muznebin, F. & Nessa Z. 2009. Nematode and Cestode prevalence, Organal distribution and histological effects due to parasitic infection in Laboratory rat strain, Long-Evans (*Rattus norvegicus* Berkenhout, 1769). *Bangladesh J. Sci. Ind. Res.* **44**(2):207-210.
- Khanum H, Chowdhury S, & Sen A. 2001. Comparative efficacy of Albendazole, Mebendazole and neem leaf extract in the treatment against human intestinal helminth. *Trans. Zool. Soc. East. India.* **5**(1):65-69.
- Muznebin F, Khanum H, Nessa Z, & Islam D. 2009. Endoparasitic Infection and Histopathological Effects in Laboratory Rat Strain, Long-Evans (*Rattus norvegicus* Berkenhout, 1769). *Bangladesh J. Sci. Ind. Res.* **44**(1):109-116.
- Quinnell, R.J. 1988. Host age and the growth and fecundity of *Hymenolepis diminuta* in the rat. *J. Helminthol.* **62**:158-162.
- Read, C.P. 1951. The "Crowding effects" in tapeworm infections. *Parasitol.* **37**:174-178.
- Salem, H., Hayatee, G., Awanees, A.M. & Al-Allaf, G. 1968. Evolution of the anthelmic activity of Thiobenolozole in man. *J. Trop. Med. Hyg.* **71**:1-7.
- Senekiji, H.A., Boswell, C. & Beattie, C. 1940. The incidence of intestinal parasites in Iraq. *Trans. Roy. Soc. Trop. Med. Hyg.* **33**:349-352.
- Seo, B.S., Cho, S.Y., Hong, S.T., Hong, S.J. & Lee, S.H. 1981. Studies on parasitic helminthes of Korea. *J. Parasitol.* **19**(2):131-136.
- Shaha, J.G. 1974. Taxonomy of some of the helminthes of house rats, house mice and house shrews of Dacca city. M. Sc. Thesis. University of Dhaka, Bangladesh. 120 pp.
- Singh, K.S. 1962. Parasitological survey of Kumaun region. Part XI. Four nematodes from the rat, *Rattus norvegicus*. *Indian J. Helminthol.* **14**(2):98-111.
- Spatafora, G.A & Platt, T.R. 1982. Survey of the Helminth Parasites of the rat, *Rattus norvegicus*, from Maymont Park, Richmond, Virginia. *Virg. J. Sci.* **32**:3-6.
- Spindler, L.A. 1930. On the occurrence of the tapeworm (*Hymenolepis diminuta*) and the dwarf tapeworm (*Hymenolepis nana*) in South-West Virginia. *J. Parasitol.* **16**:38-40.
- Stanley, S.L.Jr. & Virgin, I.V.H.W. 1993. Scid mice as models for parasitic infections. *Parasitol. Today.* **9**:406-411
- Wagner, M. 1988. The effect of infection with the pinworm (*Syphacia muris*) on rat growth. *Lab. Anim. Sci.* **38**:476-478.
- Wirreno, W. 1978. Nematode parasites of rats in West-Java, Indonesia. *South-East Asian J. Trop Med Public Health.* **4**:520.
- Yamaguti, S. 1959. "Systema Helminth". Vol. II. Cestodes of Vertebrates. Inter. Science Publisher Inc., New York. 860 pp..
- Yamaguti, S. 1961. "Systema Helminth". Vol. II. Nematodes of Vertebrates. Inter Science Publisher Inc., New York. 1261 pp.