Pakistan J. Zool., vol. 44(6), pp. 1737-1741, 2012

A Study on Morphology and Morphometry of *Haemonchus contortus*

Javid Ahmad Kuchai,* Fayaz Ahmad, Mohammad Zahoor Chishti, Hidayatullah Tak, Javid Ahmad, Shabir Ahmad and Muzaffar Rasool

Post Graduate Department of Zoology, University of Kashmir, Srinagar-190 006

Abstract.- *Haemonchus contortus* has posed a great problem to researchers and has created confusion among them regarding its identification. In this study an attempt has been made to study the morphology and morphometry of *Haemonchus contortus* recovered from the ruminants and to relate it with some parameters like study area, host, intensity, methodology, age and sex of the host. It was observed that all these factors have some minor intraspecific effects on the morphology and morphometry of the parasites. These variations were of minor importance because they were found within the range of similarity and were not good enough to label it as a new species as was expected. Also some of the parameters with regard to morphology and morphometry of this parasite were described for the first time which were not described by the previous authors and these could be of great taxonomic importance for the identification of this parasite which is being confused many times and is being labeled a new species.

Keywords: Morphology, Morphometry, *Haemonchus contortus*, Ruminants, Ladakh.

INTRODUCTION

Haemonchus contortus is one of the most prevalent and pathogenic parasite infesting the stomach of ruminants irrespective of age, gender, and breed of the host throughout the world leading to tremendous loss in variety of ways. So, several attempts have been made to study this parasite by a number of researchers (Rudolphi, 1802; Franklin, 1935; Ksull, 1939; Almedia, 1945; Silverman and Patterson, 1960; Sahai and Deo, 1964; Altaif and Issa, 1983; Masud and Jamil, 1887; Gelaye and Wossene, 2003, Muzaffar, 2010, Kuchai, 2011a, 2012b) from time to time in order to gain more and more knowledge regarding this parasite for an effective treatment. After a century of research into their biology and control, this parasite continues to be an important constraint on ruminant production. Modern anthelmintics, together with an understanding of the morphology and epidemiology of parasitism, the immune response and nutritional requirements of ruminants, currently enable satisfactory management of the problem. However, the increasing incidence of resistance by the parasite to available anthelmintics is challenging task for producers to maintain high levels of productivity in livestock industry. Novel developments for the management of nematode parasites such as vaccines, biological anthelmintics, genetic markers and selective breeding of goats may, in the future, provide additional or alternative means of parasite control. However, such alternative control methods are likely to be more dependent on a sound understanding of the species, lifecycle and population dynamics of the parasites involved and the epidemiology of disease they cause than current methods that rely heavily on broad-spectrum anthelmintics. Despite the immense progress made to control parasitosis, people of Ladakh continue to incur significant losses due to insufficient availability of information and aid regarding helminthosis as only little work has been carried in this region (Dhar and Sharma, 1979). Keeping the same in view the present study was taken into consideration.

MATERIALS AND METHODS

Different parts of the study area were surveyed and a number of gastrointestinal tracts of different slaughtered ruminants were collected from different slaughter houses. The various organs were separated from each other, placed individually in shallow plastic jars containing normal saline (0.85%) and were examined for helminth parasites followed by standard methods of Boomker *et al*. (1989). The digestive tract was divided into rumen and reticulum, omasum and abomasa, small and large intestines. The rumen and reticulum were opened and their contents carefully removed. Visible parasites were collected in plastic jar containing normal saline. The abomasa, the small

* Corresponding author: kuchayjk@gmail.com
0030-9923/2012/0006-1737 $ 8.00/0

and large intestines were opened. Each organ was rinsed twice in a small quantity of water, which was added to the respective ingesta. The washed organs were retained for further processing. The ingesta from each part of gastrointestinal tract was thoroughly mixed separately, put in plastic jar with one liter capacity and preserved in 10% formalin for further processing in the laboratory.

In the laboratory, the contents of the abomasa, small and large intestine were put into separate plastic containers of two liters capacity and each was made up to 1000ml with water. Using a glass pipette the contents were thoroughly mixed and $1/10^{th}$ aliquot (100ml) was taken. The digest of abomasa and small intestine were sieved through a sieve with 25 µm mesh size and those of large intestines over a sieve with 90 µm mesh size.

The various aliquots of the ingesta and the entire digests were taken into petridishes and were examined under the microscope for parasites. The parasites after their recovery from the hosts were washed in normal saline to free them from mucus. Then they were fixed in hot 70% alcohol after fixation the nematode parasites were preserved in glycerin alcohol (glycerin: 70% alcohol, 1:3) and were mounted in glycerin and glycerin jelly. Faecal samples were collected in collection tubes containing 10% formalin and were examined by direct smear, flotation and sedimentation techniques for the presence of eggs (Urquhart *et al.*, 1996). The drawings of the parasites or parts of parasites were made with the help of prism type camera lucida and the measurements were made with the help of objective (stage) micrometer only and objective and ocular micrometer. Photographs of the permanent mounts were taken with the help of Olympus Digital Camera under Olympus CX21 microscope. Identification of adult parasites as well as eggs was done on the basis of various morphological and morphometric characters (Sahai and Deo, 1964; Soulsby, 1982).

RESULTS AND DISCUSSION

During the present study 316 nematodes belonging to the genus *Haemonchus* (Rudalphi, 1802) were recovered from the stomach of goats, sheep, cattle and buffalo from different areas of Ladakh. In addition, the eggs of this species were also observed from the feces of yak and pashmina goats. The specimens were examined in detail and assigned to *Haemonchus contortus* Cobb, 1898. However several intraspecific variations in size ratio of various body organs were also recorded. It was observed that the parasite was comparatively larger when the intensity was less; also the parasites recovered from the female host species were larger than those recovered from the male host species; accordingly the various internal organs of these parasites were variable; larger in large specimens and smaller in small specimens. Since the parasites compete for food and shelter the parasites which get plenty of food, when the number is less they become large compared to the situation when the number is high. One possible reason for large size of this parasite in male hosts compared to those recovered from the females could be that males have comparatively strong immune system which could have checked the growth of these parasites or it may be due to some female hormonal effects or some other physiological factors. Another possible reason could be nutrient rich diet being fed to females during the pregnancy period and the same (nutrient rich) food is being utilized by the parasites thereby resulting in more growth. It was also observed that fixation had a direct effect on the size of the body and other body organs as the parasites fixed in too hot or too cold fixative shrink to different lengths as compared to those fixed in alcohol with optimum temperature. The reason could be that too hot fixative cause's shrinkage of the parasite while as the parasite does not stretch fully in cool fixative and in both the cases the parasite appears shorter. However the coloration was slightly changed depending on the food of the host. The comparatively small variation in the size of the present specimens could be due to the effect of environmental factors of the study area as it is the only cold desert of the World, where the environment is all together different or due to some other unknown reasons.

Morphology and morphometry

Comparative characteristics (measurements in mm) have been given in Table I. The parasites are of yellow colour. Body is filliform (slender)

Table I.- Comparative characteristics (measurements in mm) of *Haemonchus contortus* (Rudolphi, 1802) Cobb, 1898.

Particulars	Sahai and Deo (1964)	Soulsby (1982)	Zahida (1992)	Reyaz (2005)	Present specimens
Body length	14-17 (M) 20-27 (F)	10-12 18-30	10.75-12.05 16.79-18.64	10.75-12.05 16.79-18.64	10.70 (9.55-11.85) 21.44 (18.38-24.50)
Max Width	0.199-0.265 0.215-0.332	.....	0.23-0.25 0.3-0.5	0.23-0.25 0.3-0.5	0.22(0.15-0.29) 0.48 (0.32-0.64)
Esophagus	1.444-1.743 1.162-1.662	.....	.....	.....	2.415(1.44-2.86) 1.935(1.29-2.58)
Spicules	0.398-0.448	0.46-0.506	0.3-4.7	0.37	0.39 (0.26-0.52)
Gubernaculum	0.199-0.349	.....			0.244 (0.185-0.304)
Dist. b/w Post end to Vulva	3.81-5.31	3.06-3.10	3.06	3.06	3.49 (2.11-4.45)
Dist. b/w Post- anus	0.415-0.513	0.49-0.55	0.49	0.49	0.52 (0.35-0.69)
Eggs	0.0660.074X 0.033-0.049	70-80X41-48µ	0.05-0.07x0.03-0.04	0.54-0.7x0.03-0.04	0.75x0.45 (0.55-0.95X0.3-0.6)
Host	Sheep and goats	Domestic animals	Sheep and goats	Ruminants	Ruminants
Locality	India	London	Ladakh	Kashmir	Ladakh

tapering towards the anterior end in male and towards both ends in female. Anterior end is relatively wide and blunt. Buccal cavity is small with a conspicuous tooth extending from dorsal wall. Buccal capsules absent. In addition to transverse striations longitudinal lines are also present on the body.

Male

It measures 9.55-11.85 mm in length and 0.15- 0.29 mm in width. The tail end bears a bursa. The bursa consists of three lobes, two large lateral lobes and a poorly developed dorsal lobe. Dorsal ray is asymmetrical and bifurcated. Externo dorsal ray is thin and long. Lateral rays arise from a common trunk; ventral rays are fused proximally and separated dorsally. Spicules are two in number measuring 0.25-0.52 mm in length.

Female

It measures 18.38-24.50 mm in length and 0.32-0.64 mm in width. Vulva is situated in the posterior third of the body at a distance of about 2.11-4.55 mm from the posterior end. The vulvular lips are inconspicuous but a linguiform process is invariably present. Vulva is covered with valves. Tail is with out a spine. Anus is situated at a distance of 0.35-0.69 mm from the posterior end. Eggs measure 0.45-0.09 mm X 0.03-0.06 mm in dimensions.

Remarks

From the existing species of genus *Haemonchus* Cobb, 1898, the present form is found to be close to the description of *Haemonchus contortus* (Rudolphi, 1802) Cobb, 1898 as given by Sahai and Deo (1964), Soulsby (1982) and Reyaz (2005) as regards its morphological and morphometric characters including: colour, total length, maximum width, shape of bursal lobes, female genetal apparatus, shape and size of spicules and eggs, with some intraspecific variations in size ratio as mentioned in comparative table which are of less taxonomic importance, hence assigned to *Haemonchus contortus* (Rudolphi, 1802) Cobb, 1898. The parasite has already been reported from sheep and goats of this region by previous workers (Zahida, 1992; Syeda, 1992), however the presence of this parasite species were recorded for the first time in case of cattle, buffalo, yak and pashmina goats of Ladakh region.

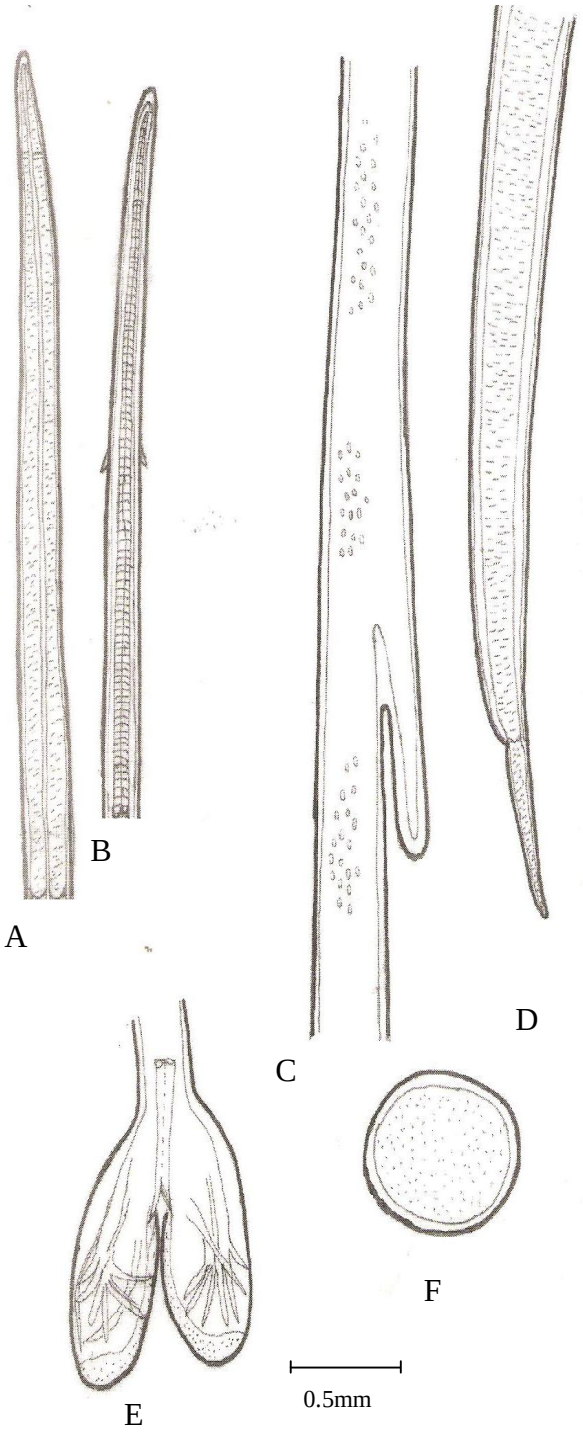

Fig. 1. *Haemonchus contortus* (Rudolphi, 1802) Cobb, 1898; A, anterior end of female; B, anterior end of male; C, vulva of female; D, bursa of male showing spicules; E, posterior end of female; F, egg.

CONCLUSIONS

From the present study it is clear that ruminants of Ladakh are no exception from the rest of the world regarding *Haemonchus* infection. However study area, intensity, methodology, age and sex of the host as well as parasite has an effect on the morphology and morphometry of the parasite which could sometimes create a confusion regarding the identification of the species. Therefore it is believed that the present study will be of some use to avoid this confusion regarding identification of this parasite.

ACKNOWLEDGEMENTS

The authors would like to thank the people of Ladakh for their kind support and interest which they showed during the entire period of study. Thanks are also due to Haji G. M. Kuchay for his financial support.

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(Received 20 April 2012, revised 8 June 2012)