



RESEARCH ARTICLE

OBSERVATION ON MORPHOLOGY AND MORPHOMETRY OF *HAEMONCHUS CONTORTUS*, A ROUNDWORM OF SMALL RUMINANTS

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ABSTRACT

The present paper describes the morphology and morphometry of *Haemonchus contortus* (Rudolphi, 1803) Cobb, 1898, a roundworm parasitizing sheep and goat. External morphology of male and female worms alongwith measurements of important body parts is studied. Cervical papillae, longitudinal cuticular ridges, buccal lancet, spicules, bursal rays, gubernaculum, excretory pore, genital openings of male and female worms, anal aperture and size of various body organs was analysed for morphometric characteristics.

Key words:

Haemonchus contortus, Nematoda,
Morphology, Morphometry,
Helminths.

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INTRODUCTION

Helminth parasitism of domestic animals cause significant economic losses throughout the globe. Parasitic infections cause morbidity and mortality in many animal species but infection of ruminants particularly sheep is of much importance to livestock producers (Skykes, 1994). A number of helminthes parasitize ruminants but *Haemonchus contortus* is of paramount importance due to its deleterious effects on the host. The gastrointestinal nematode, *Haemonchus contortus* (Rudolphi, 1803) Cobb, 1898 commonly known as Barber's pole worm or twisted worm is a major pathogen of small ruminants throughout the temperate and tropical regions of the world and is a significant cause of production losses. It is a highly pathogenic blood feeder helminth that causes acute anaemia, edema (bottle jaw), diarrhoea and ultimately death. Over the years, attempts have been made to study the various aspects of *Haemonchus* spp. from different parts of the world (Sood, 2006). The present paper deals with the light microscopic study of the basic morphology and morphometrics of this parasite. Previously the morphological studies on this roundworm were performed by Sahai and Deo (1964), Soulsby (1965 and 1982) Skykes (1994) and Rahman and Hamid (2007).

The present paper deals with the light microscopic study on the basic morphology and morphometrics of this pathogenic nematode. This study will be helpful to solve the confusions regarding identification of this parasite.

MATERIALS AND METHODS

Collection of parasites

Naturally infected stomachs of sheep (*Ovis aries*) were collected from the abattoirs from different parts of Punjab, India. Abomasum portion of stomachs were taken to the laboratory, cut open along greater curvature and searched for adult male and female *Haemonchus contortus*. Motile active worms were collected in petri dishes containing normal saline.

Preservation of parasites

The male and female worms were preserved in 70% alcohol. Higher concentration of alcohol was avoided which may result in structural artifacts due to shrinkage. The morphological and morphometric study requires minimum body surface distortions and shrinkage. Some samples were also preserved in glycerin and 70% alcohol in the ratio of 1:3.

Microscopic studies

After preservation, the worms were cleared in lactophenol. For studying some of the external and internal characters of the

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blue at 60 degree centigrade for 18 hours. The specimens were differentiated in 80% alcohol and cleared in lactophenol. The parasites were finally mounted in Kaiser's glycerin jelly or lactophenol. The male and female worms as well as eggs were thoroughly examined for morphological and morphometric characteristics. Faecal samples of infected ruminants were collected in collection tubes containing 10% formalin. The eggs were studied by direct smears, flotation and sedimentation techniques (Urquhart *et al.*, 1996). Photomicrographs of the whole mounts were taken with the help of Olympus camera.

RESULTS AND DISCUSSION

The body of *Haemonchus contortus* is slender tapering towards anterior end in both the sexes. The posterior end is tapering in case of female worms and is provided with a large copulatory bursa in male worms. The colour of the parasite is yellowish. The red and white appearance of the female is due to the coiling of white ovaries around the blood-filled intestine. Buccal capsule is absent. The buccal cavity is provided with a conspicuous buccal lancet due the blood sucking habit of this nematode. A pair of cuticular expansions in the form of cervical papillae, located at a distance of about 375 μm from the anterior end is present on the lateral sides of the body in both the sexes. The second type of cuticular modification is in the form of longitudinal ridges running antero-posteriorly along the longitudinal axis of the body. The total number of these ridges counted from a transverse section is 26-32 and the distance between the two successive ridges is 26 μm . The buccal cavity is 13.3 μm long and 6-9 μm wide. The buccal lancet is 13 μm long and 3 μm wide. At about 9 μm anterior to the base, it bends dorsally thus giving a slightly curved appearance. Oesophagus extends through the anterior 1/5th of the body. It is about 870 μm long and has a maximum width of 98 μm . The small sized rectum measures only 93 μm in length. The excretory pore is present mid-ventrally at a distance of 300 μm from the anterior end of the body (Figs. 1, 2, 3 and 4).

Table 1. Morphometric characteristics of *Haemonchus contortus* (Rudolphi, 1803) Cobb, 1898

Particulars	Measurements
Body length (male)	10-20mm
Body length (female)	18-30mm
Width (male)	300-400 μm
Width (female)	350-500 μm
Number of cuticular ridges	26-32
Oesophagus	870 μm
Spicules	420-440 μm
Gubernaculum	200-230 μm
Distance between tip of anterior end and cervical papillae	375 μm
Distance between tip of anterior end and Excretory pore	300 μm
Distance between tip of posterior end and anal aperture	450 μm
Distance between tip of posterior end and vulva	930-960 μm
Eggs	0.75 X 0.46mm
Host	Sheep
Locality	Punjab (India)

Male: The male is easily distinguished from the female by its size being smaller than the female and also by the presence of a well developed copulatory bursa at its posterior end. The male is 10-20 mm long and 300-400 μm broad. A pair of spicules each measuring 420-440 μm in length is present. The gubernaculum is another cuticularized accessory copulatory structure associated with the spicules. It is 200-230 μm long and 25-30 μm wide. A large trilobed copulatory bursa is present at the posterior end of male worms. It consists of two

asymmetrically. An inverted Y-shaped dorsal ray supports the dorsal lobe. Two sets of lateral rays having a common trunk support each of the lateral lobes. A pair of externo-dorsal rays arises from the base of the dorsal stem at each side and spans the outer margins of the lateral lobes. In each lateral lobe, the lateral stem is divided into two main stalks of ventral and lateral rays. Ventral stalk is further divided into two rays, both directed towards the inner margin of the bursal lobe. The lateral stalk divides into an externo-lateral, medio-lateral and postero-lateral rays (Figs. 5, 6, 7 and 8).

Female: The female is 18-30 mm long and 350-500 μm broad. The posterior end of female is tapering and pointed. The anal aperture is at a distance of about 450 μm from the tip of the tail. The female genital pore or vulva is at a distance of 930-960 μm from the tip of the tail. Two muscular ovijectors, each measuring 40 μm in length and 25 μm in diameter meet to form a common vagina. The vagina open to outside at the base of a long vulvar flap. Tail of female is without a spine. Eggs measure 0.75 X 0.46 mm in size (Figs. 9, 10, 11 and 12). All the above morphometric characteristics are summarized in the Table 1. Litchenfels *et al.* (1986) described that morphometrics of cervical papillae, vulvar flap and spicules are reliable tool for species identification. They also stated that spicule length is the easiest character for separating the populations of *H. contortus* and *H. placei*. These structures were minutely observed during present investigation. The morphometric characteristics including body length, width, colour, position of cervical papillae, cuticular ridges, shape and size of spicules, gubernaculum, bursal lobes, and eggs show similarity with the previous findings of Sahai and Deo (1964), Soulsby (1982) and Rahman and Hamid (2007). Some intraspecific variations are found in the morphometry are of less taxonomic importance.

PLATE I: Fig. 1 to 4: *Haemonchus contortus* (All stained with methylene blue, mounted in lactophenol)

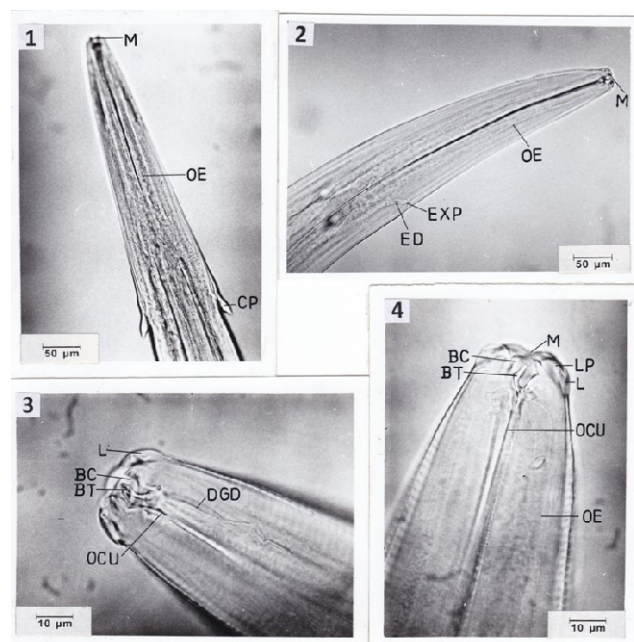


Fig. 1: Anterior region showing cervical papilla (CP), mouth (M) and oesophagus (OE).

Fig. 2: Anterior region showing excretory duct (ED), excretory

Fig. 3: Anterior end revealing the presence of buccal lancet (BT), buccal cavity (BC), lip (L), oesophageal cuticular lining (OCU), dorsal oesophageal gland duct (DGD).

Fig. 4: Anterior region showing mouth (M), lip (L) bearing lip papilla (LP), buccal lancet (BT), buccal cavity (BC), oesophageal cuticular lining (OCU) and oesophagus (OE).

PLATE II: Fig. 5 to 8: *Haemonchus contortus* (All stained with methylene blue, mounted in lactophenol)

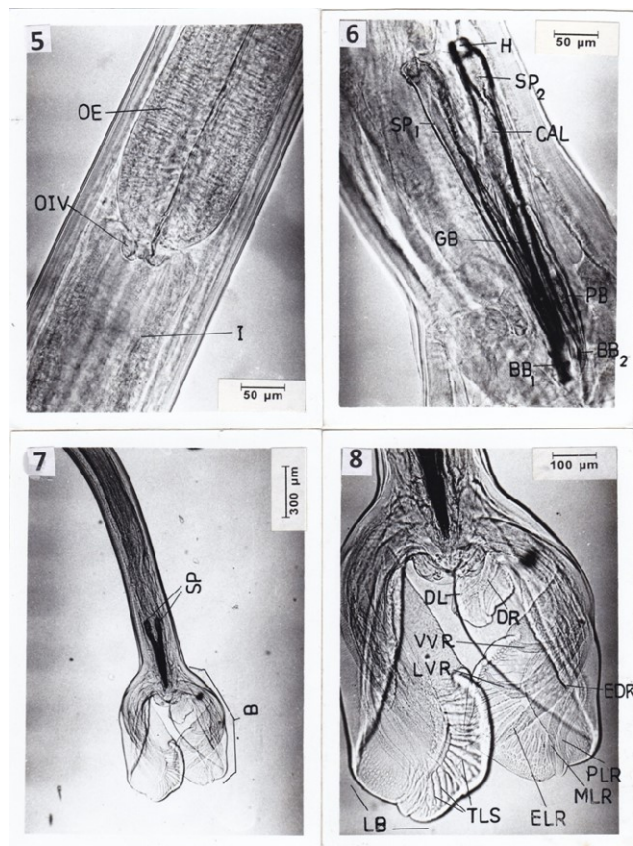


Fig. 5: Anterior region showing oesophagus (OE), oesophago-intestinal valve (OIV) and intestine (I).

Fig. 6: Posterior end of male showing spicules (SP₁ and SP₂), head of spicule (H), calamus (CAL), padded blade (PB), barb of first spicule (BB₁), barb of second spicule (BB₂), gubernaculum (GB).

Fig. 7: Posterior end of male showing copulatory bursa (B) and spicules (SP).

Fig. 8: Bursa of male showing retriangular lateral lobe (LB) having externo dorsal ray (EDR), externo-lateral ray (ELR), latero-ventral ray (LVR), medio-lateral ray (MLR), postero-lateral ray (PLR), ventro-ventral ray (VVR) and a small dorsal lobe (DL) having dorsal ray (DR), fine tube like structures (TLS).

PLATE III: Fig. 9 to 12: *Haemonchus contortus* (All stained with methylene blue, mounted in lactophenol)

Fig. 9: Vulvar region of female showing vulva (V) and vulvar flap (VF).

Fig. 10: Vulvar region of female showing ovijectors from the anterior set (OJ₁) and posterior set (OJ₂) to form a common vagina (VG), vulva (V) and vulvar flap (VF).

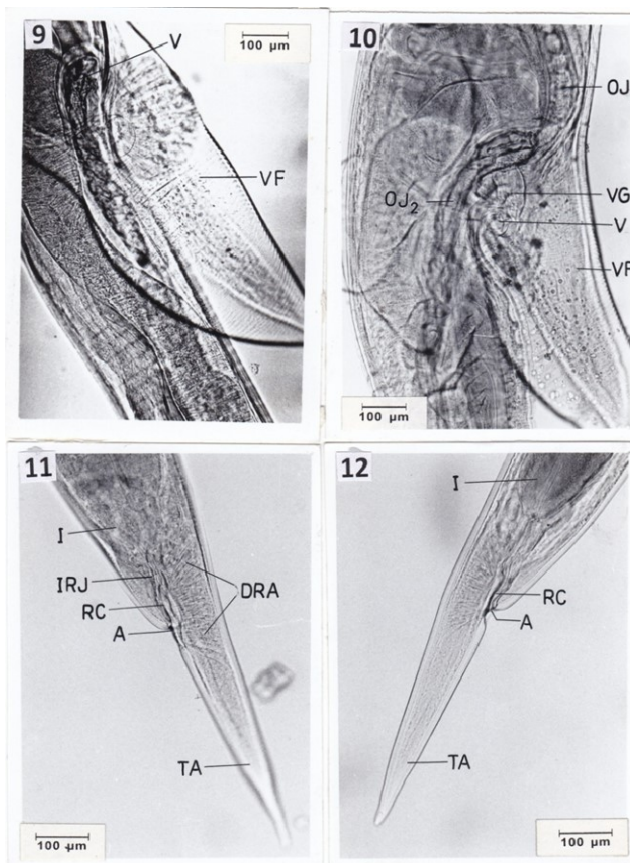


Fig. 11: Posterior region of female worm showing tapering tail (TA), intestine (I), rectum (RC) and anal opening (A), intestino-rectal junction (IRJ), depressor ani muscles (DRA).

Fig. 12: Posterior region of female worm showing tapering tail (TA), intestine (I), rectum (RC) and anal opening (A).

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