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SCANNING ELECTRON MICROSCOPIC (SEM) STUDY OF NEMATODE PARASITES OF GOAT IN LUCKNOW DISTRICT UTTAR PRADESH

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The goat is a vital milk and meat production source in India and contributes to the national and international economy. Goat production faces multiple challenges; one major problem is parasites leading to high mortality and economic losses. Nematode parasites are major problems to livestock globally, characterized clinically by enteritis, anaemia, emaciation, dehydration, and death. This study revealed the morphological identification of nematode parasites (*Haemonchus sp.*, *Oesophagostomum sp.*, and *Trichuris sp.*) in goats in the Lucknow region (India). Morphological identification was done by SEM (Scanning Electron Microscope) with the help of Souls in 1982. Scanning electron microscope exposed some species-specific characters, total body length of parasites, posterior region of *Haemonchus* having well-developed Copulatory Bursa (CB), spicules, Dorsal ray (DR) Anterior region of *Haemonchus* having cervical papillae (CP), vulval flap, knob, and cervical lamina. *Oesophagostomum* showed that the collar region on the mouth part and Buccal Capsule (BC) is surrounded by External Corona Radiate (ECR) and Internal Corona Radiate (ICR). *Trichuris* sp. was showed the anterior end vulva region of the female, and the posterior end of the male was spirally coiled and spicular sheath covered with minute spines (S).

Keywords: Goat; nematode parasites; morphology; SEM (Scanning Electron Microscope).

1. INTRODUCTION

Livestock is an essential source for the small and marginal people worldwide, which is highly significant based on social and economic factors [1]. 70% of poor people depend on animal protein and are primarily raised for milk, meat, hair, and leather [2]. India has the second-largest goat population (117 million) and also meat production (125.7 million) in the world [3]. Meat productions from goats are among

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the fastest-growing and most affordable sources of high protein, which is included in the diet. Meat production averages 0.5% in India 15% in Uttar Pradesh [4]. Gastrointestinal parasitic infection is a major problem of the world, reducing the productivity of the livestock industry in developing countries, including India [5, 6, and 7]. due to the morbidity, cost of treatment and mortality, and control measures on a subclinical and clinical level [1] which led to a high number of economic losses attributable to reduced retarded growth and decreased production of goat farming. Parasitic diseases, anemia, enteritis, and bottle jaw may occur in different study areas [4]. 90% of goats are infected with parasites. Gastrointestinal (GI) parasites, most important including coccidia (protozoa), nematodes (roundworms), cestodes (tapeworms), and trematodes (flukes), were found to be in this area. Surveys indicate that nematode is the most prevalent parasite affecting up to 95% of goats [8].

Nematode parasites are the common and most critical gastrointestinal parasites in livestock [9,10]. Nematodes are slightly flattened cylindrical body; hence it is called roundworm. Nematodes are usually bisexual. These parasites are the most prevalent in this study area, this reason having more loss of productivity and poor growth [11]. Nematodes are also widely distributed in other countries like Asia, Africa, and some Mediterranean countries [12], Kazakhstan [13], Saudi Arabia [14,15[, Namibia [16], and Turkey [17]. Gastrointestinal nematode parasites are epidemics associated with goat infection during the monsoon season, having more diseases than in the winter seasons. These parasites may be overwhelming at the subclinical level [18]. Climatic conditions provide a suitable environment for the transmission of parasitic infection [19 and 20].

Identification of individual worms was with the help of a Scanning Electron Microscope based on species-specific characters, shape, and size of parasites [21]. Scanning Electron Microscopic (SEM) observations of nematode parasites show the general diagnosis characteristics of these species. The various stages and their unique features will be reviewed in more detail as each significant group of helminths is considered [21 and 22]. The present study aimed to perform Scanning Electron Microscopic (SEM) observations of specimens to evidence the characteristics of these species.

2. MATERIALS AND METHODS

2.1 Study Area

The climatic condition of this study area mainly depends on monthly rainfall, ambient temperature, and humidity. These data were obtained from the National Meteorological Services Agency in Lucknow district, Uttar Pradesh (India). The study covers 2,528 square kilometers of area (976 sq mi); average rainfall of 1010 mm (40 in) in Lucknow, June, and July are the hottest months (av. max. and mini. temp. of 40°C and 12 °C temp., respectively). In contrast, December and January are the coldest months (av. max. and mini. temp. of 12 °C and four °C, respectively).

2.2 Parasitological Examination

The nematode parasites are obtained from the gastrointestinal tract of the goat. The intestine was collected from slaughterhouses in Lucknow during study periods from 2018 to 2019. The Gastrointestinal tracts were brought to the Parasitology Laboratory, Department of Zoology (Applied Animal Science), Babasaheb Bhimrao Ambedkar University, and were examined for parasitic infection according to the procedure as described by Cable1958.

2.3 Preservation

The nematodes parasites were washed with physiological saline water (0.9%). To remove mucus. Worms were fixed in hot 70% alcohol (24 hrs.), which straightened out living worms, except those with natural curvatures at the head or the tail. Later, the worms were preserved in fresh glycerol-alcohol (70% alcohol to which 5% glycerin) at room temp for further studies.

2.4 Morphological Study of Parasites by SEM (Scanning Electron Microscope)

The SEM (Scanning Electron Microscope) unit was used to identify nematode parasites and performed at the University Sciences Instrument Centre (USIC), Babasaheb Bhimrao Ambedkar University, Lucknow (Uttar Pradesh). The standard Protocol followed the following Protocol developed by Roy and Tandon (1991) [23].

Parasites were washed into 1% PBS 3 times and fixed in 2.5% Gluterdehyde for 3 to 5 hrs. After selection, parasites were passed three times for 10 minutes each in PBS. After washing, all parasites are put in the Osmium tetraoxide (1%OsO4) overnight. After 12 hours, parasites were washed in PBS in 3 times. The dehydration process was started with different grades (30%, 50%, 70%, 90%, and 100 %) for 15 minutes each. After dehydration, parasites were mounted on the Specimen stubs and viewed under a Scanning Electron Microscope (Joel. Japan; JSM 6490 LV) at 20K.

2.5 Identification

Identification of nematode parasites through their morphological characters as described by Soulsby (1982).

3. RESULTS AND DISCUSSION

This study was carried out to determine the morphology of nematode parasites (*Haemonchus* sp., *Oesphagostomum* sp. and *Trichuris* sp.) by SEM (Scanning Electron Microscope).

Nematodes parasites are morphologically different in shape and size. The morphological results of females (av. length 1.2- 05 mm) were larger than the male parasites (av. length 1.5-04 cm). They are typically elongated, tapered at both ends, dorsoventrally and bilaterally symmetrical. Comparison between different stages of parasites of the various genera and species will enable rapid identification with the minimum number of measurements. It is also necessary to explain the characteristic feature of focus under observation by a Scanning Electron Microscope (SEM).

Haemonchus sp. was recognized as the dominant and most prone species in the small ruminant animals. Achi *et al.* (2003) and Jacquiet *et al*. (1997) were also discussed the morphological identification of males and females parasitic species by Character included size, body length, esophagus length, spicule, left and proper spicule barb length distance of cervical papillae from the head, gubernaculum, esophagus length as a percentage of total body length, Vulval morphology tail length, and the distance of the right and left plasmid from the distal tip of the tail [25, 26, and 27]. Tod, 1965 reported the difference in vulvar structure of female Haemonchus sp. worms examined from the gastrointestinal tract of host (sheep and goats) identified by genetic factors [28]. Similar findings were reported by [26], [29], [21], [30], and [31].

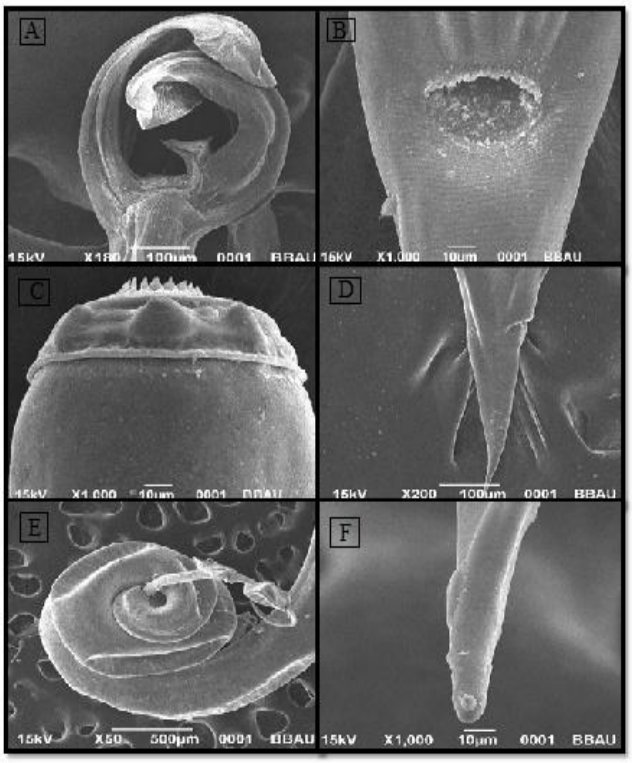

Fig. 1. SEM (Scanning Electron Microscope) Micrograph (A) Posterior part of *Haemonchus* sp. having Capulatory bursa (CB), and dorsal rays (DR) (B) cervical papillae (CP), vulval flap, knob, cervical lamina, and mouth part of *Haemonchus* sp. (C) Buccal Capsule (BC) is surrounded by External Corona Radiate (ECR), amphid (A), leaves of internal corona radiata, (ICR), mouth capsule/ mouth collar (MC) of *Oesophagostomum* sp. (D) Vulva (V) of the female and sharply pointed tail (T) of *Oesophagostomum* sp. (E) Posterior region showing (SP) of the male of *Trichuris* spp. (F) Head (H) of *Trichuris* sp

Oesophagostomum sp. is the second most prevalent parasite in this area, and these parasites are found in the large intestine of the host. The morphological identification of parasites showed that the collar region on the mouth part bounded 14 to 16 elements outside and 28 to 32 elements inside the leaf crown. Whereas appears to show the lobed or bilobed area, and a trilobed is also found having in the head region. Yadav (2006) were also conducted a similar study in that cephalic papilla, external corona radiata, lateral amphid, bursa, genital cone, oral collar, outer dorsal and anterior lateral rays, anus, vulva, and caudal papillae match structurally up with our findings [32]. A similar study is found in this paper [33] and [34].

The Genus of *Trichuris sp.* is a nematode parasite spreading many infectious diseases and is dependent on different climatic and geographic factors [35,36, and 37]. The morphological study revealed the following observations of treacheries like spicule, a thinner distal end, and rounded. The Male *Trichuris* species have proximal spicule sheath and vulvar flap in females. Mohanta *et al*., 2007 reported that the parasitic gastrointestinal infection showed hemorrhagic spots, congestion, and ulcer formation [19]. The mucosa of the caecum has severe inflammation, and sometimes colon was experiential in the host caused by parasites [24,38, and 39].

4. CONCLUSION

The present study was based on the morphological identification of gastrointestinal nematode parasites by SEM (Scanning Electron Microscope), which identified specific characters of parasites like posterior region having well-developed copulatory bursa (CB) and anterior region of showed cervical papillae (CP) and cervical lamina of *Haemonchus* sp. *Oesophagostomum* showed that the collar region on the mouth part and Buccal Capsule (BC) is surrounded by External Corona Radiate (ECR) and Internal Corona Radiate (ICR). *Trichuris* sp. was showed vulva (V) region of the female, posterior end of the male was spirally coiled and spicular sheath covered with minute spines (S).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Muluneh J, Bogale B, Chanie M. Major gastrointestinal nematodes of small ruminants in Dembia District, Northwest Ethiopia. Europ. J. Appl. Sci.2012;6:30-36.
2. Nwosu CO, Madu PP, Richards WS. Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of north-eastern Nigeria. Veterinary Parasitology. 2007;144(1-2):118-124.
3. Food and Agriculture Organization (FAO). Breeding strategies for sustainable management of animal genetic resources. Animal Production and Health Guidelines, No.3. Food and Agriculture Organization of the United Nations, Rome, Italy; 2010.
4. Sharma D K, Agrawal N, Mandal A, Nigam P, and Bhushan S. Coccidia and gastrointestinal nematode infections in semi-intensively managed Jakhrana goats of the semi-arid region of India. Tropical and Subtropical Agroecosystems. 2009;11:135- 139.
5. Biu AA, Maimunatu A, Salamatu AF, Agbadu ET. A faecal survey of gastrointestinal parasites of ruminants on the University of Maiduguri Research Farm. Int. J. Biomed. Health Sci. 2009;5(4):175-179.
6. Gall C. Goat Production. Academic Press, London/New York; 1981.
7. Jegede OC, Rabiu BM, Obeta SS, Malang SK, Ejiofor CE. Gastrointestinal parasites of ruminants slaughtered in Gwagwalada Abattoir, Federal Capital Territory, Abuja, Nigeria. Nigerian Jouirnal of Parsitology. 2013;34(1):55-59.
8. Rey B. Small ruminant genetic resources and parasite challenge in sub-Sahara, Africa. In: Proceedings of the Research Planning Workshop Held at ILCA on Resistance to Endo-helminthes in Small Ruminants, Addis Ababa, Ethiopia. 1991:23-32.
9. Waruiri RM, Mbuthia PG, Njiro SM, Ngatia TA, Weda EH, Ngotho JW, Kanyati PN, Munyua WK. Prevalence of gastrointestinal parasite and lungworms in wild and domestic ruminants in game ranching farm in Kenya. Ibull. Anim. *Health Product*. Afri. 1995;43:253-259.
10. Maingi N. Epidemiology and Control of Gastrointestinal Nematodes of Ruminants in Kegna. 6th Symposium on Helminth and Control. October 6, 1995. Faculty of Veterinary Medicine, Utrechet Univeristy, the Netherlands. 1995:49-51.

11. Pedreira J, Paz-Silva A, Sánchez-Andrade R, Suarez JL, Arias M, Lomba C, Morrondo P. Prevalences of gastrointestinal parasites in sheep and parasite-control practices in NW Spain. Preventive Veterinary Medicine. 2006;75(1-2):56-62.
12. Sharkhuu T. Helminths of goats in Mongolia. Veterinary Parasitology. 2001; 101(2):161-169.
13. Morgan ER, Torgerson PR, Shaikenov BS, Usenbayev AE, Moore ABM, Medley GF, Milner-Gulland EJ. Agricultural restructuring and gastrointestinal parasitism in domestic ruminants on the rangelands of Kazakhstan. Veterinary Parasitology. 2006;139(1-3):180-191.
14. El-Azazy O. Absence of hypobiosis inabomasal nematodes of sheep and goats in Egypt. Veterinary Parasitology. 1990;37: 55-60.
15. Magzoub M, Omer OH, Haroun EM, Mahmoud OM. Effect of season on gastrointestinal nematode infection in Saudi Arabian camels (Camelus dromedarius). Journal of Camel Practice and Research. 2000;7(1):107-108.
16. Krecek RC, Boomker J, Penzhorn BL, Scheepers L. Internal parasites of giraffes (Giraffa camelopardalis angolensis) from Etosha National Park, Namibia. Journal of Wildlife Diseases. 1990;26(3):395-397.
17. Yukari I, Kurabuchi T, Takahashi J, Endo T. Study on characteristics of wind over the buildings and airflows in cross-ventilated and air-conditioned rooms based on measurements. Journal of Environmental Engineering (Transaction of AIJ). 2005;(589):9-14.
18. Barger IA, Siale K, Banks DJD, Le Jambre LF. Rotational grazing for control of gastrointestinal nematodes of goats in a wet tropical environment. Veterinary Parasitology. 1994;53(1-2):109-116.
19. Mohanta UK, Anisuzzaman, Farjana T, Das PM, Majumder S, Mondal MMH. Prevalence, population dynamics. J Vet Med. 2007:563-569.
20. Varadharajan A, Vijayalakshmi R. Prevalence and seasonal occurrence of gastrointestinal parasites in small ruminants of coastal areas of Tamil Nadu. International Journal of Scientific and Research Publications. 2015;5(2), February 1 ISSN 2250-3153.
21. Rahman WA, Hamid SA. Morphological characterization of *Haemonchus contortus* in goats (*Capra hircus*) and sheep (*Ovis aries*) in Penang, Malaysia. Tropical Biomedicine. 2007;24(1):23-27.
22. Campbell RA. Biology and Development of *Cotylurus flabelliformis* (Trematoda: Strigeidae); 1971.
23. Roy B, Tandon V. Usefullness of tetramethylsilane in the preparation of helminth parasites for scanning electron microscopy. Riv Parasitol. 1991;8(L2):405–413.
24. Soulsby EJL. Helminths, arthropods and protozoa of domesticated animals. Bailliere Tindall London. 1982;7:186–191.
25. Achi YL, Zinsstag J, Yao K, Yeo N, Dorchies P, Jacquiet P. Host specificity of Haemonchus spp. for domestic ruminants in the savanna in northern Ivory Coast. Veterinary Parasitology. 2003;*116*(2):151-158.
26. Jacquiet P, Humbert JF, Comes AM, Cabaret J, Thiam A, Cheikh D. Ecological, morphological and genetic characterization of sympatric *Haemonchus* spp. parasites of domestic ruminants in Mauritania. Parasitology. 1995;110(4):483-492.
27. Vadlejch J, Lukešová D, Vašek J, Vejl P, Sedlák P, Čadková Z, Salaba O. Comparative morphological and molecular identification of *Haemonchus* species in sheep. Helminthologia. 2014;51(2):130-140.
28. Tod E. On the morphology of Haemonchus contortus (Rudolphi) Cobb (Nematoda: *Trichostrongylidae*) in sheep and cattle. Australian Journal of Zoology. 1965;13(5):773-782.
29. Kuchai JA, Ahmad F, Chishti MZ, Tak H, Javid A, Ahmad, S., & Rasool, M. A study on morphology and morphometry of *Haemonchus contortus*. Pakistan Journal of Zoology. 2012:44(6).
30. Akkari H, Gharbi M, Awadi S, Mohamed AD, Kumsa B. New sublinguiform vulvar flap of *Haemonchus* species in naturally infected domestic ruminants in Béja Abattoir, North Tunisia. Veterinarski Arhiv. 2013;83(3):281-291.
31. Kumsa B, Wossene A. Abomasal nematodes of small ruminants of Ogaden region, eastern Ethiopia: prevalence, worm burden and species composition. Revue de Médecine Vétérinaire. 2007;158(1):27.
32. Yadav AK, Tandon V. Stereoscan studies of two species of the genus *Oesophagostomum* (Nematoda, Chabertiidae) Acta Parasitol. 1992;37(3):135–137.
33. Goodey T. The anatomy of *Oesophagosto-mum dentatum* (Rud.) a nematode parasite of the pig, with observations on the structure and bi-ology

of the free-living larvae. Journal of Helminthology .1924;2:1.

34. Neuhaus B, Bresciani J, Christensen CM, Sommer C. Morphological variation of the corona radiata in Oesophagostomum dentatum, O-quadrispinulatum, and *O-radiatum* (Nematoda: Strongyloidea). Journal of the Helminthological Society of Washington. 1997;64(1):128-136.
35. Anderson RC. Nematode parasites of vertebrates: their development and transmission. Folia Parasitologica, Cabi publishing. 2000:47-314:650.
36. Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, Hotez PJ. Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. The lancet. 2006;367(9521):1521-1532.
37. Ghai RR, Chapman CA, Omeja PA, Davis TJ, Goldberg TL. Nodule worm infection in humans and wild primates in Uganda: cryptic species in a newly identified region of human transmission. Trop. Dis. 2014;8: 26-41.
38. Bowman DD. Georgi's Parasitology for Veterinarians. Saunders Company. 2002; 7.
39. Taylor MA, Coop RL, Wall RL. Parasites of dogs and cats. Veterinary Parasitology. 2007;3:429-430.

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