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Morphology and morphometry of *Haemonchus Contortus* in goat from Nandurbar (MS), India

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ABSTRACT

Gastrointestinal nematode infections are a serious economic and health burden to small ruminant production worldwide, with significant impacts on animal productivity, body condition, anemia and mortality. *Haemonchus contortus* is considered one of the most virulent and economically important strongyle nematodes due to its high parasitic potential, feeding behavior, reproductive capacity and short developmental cycle. The current study aimed to identify and characterize the morphologically *H. contortus* isolated from local domestic goats (*Capra hircus*) from Nandurbar district, Maharashtra, India.

The abomasums of the slaughtered animals were opened and helminths were removed. The parasites were identified using a standard light microscope. The worms' permanent slides were prepared and studied at 40x and 100x magnification. The females were identified by the typical barber's pole appearance, linguiform vulvar flap and small buccal capsule with a dorsal chitinous lancet. The males possess a well-developed bilobed copulatory bursa, large and elongated dorsal lobe of the bursa, Y-shaped dorsal ray and long brown spicules with barbed tips. Morphometric measurements of *H. contortus* were taken, and body length of the male ranged from 15-20 mm while that of females was 24-30 mm, with spicules length of 0.47-0.51 mm. A typical vulvar morphotype (linguiform) and knobbed/button and smooth types of females were recorded. This study reports the presence of *H. contortus* from Nandurbar district and adds to the existing knowledge on the morphology of the parasite. The present findings provide baseline information on the occurrence of helminth parasites in western Maharashtra and demonstrate the applicability of traditional morphological keys for the identification of helminths in routine veterinary parasitology.

Keywords: *Haemonchus contortus*, *Capra hircus* (goat), Gastrointestinal nematode, Morphology, Abomasum, Nandurbar, Maharashtra

Introduction

Livestock rearing, mainly of small ruminants, constitutes an important component of livelihood for marginal farmers and landless laborers from the rural economy of India, providing a sustainable source of food. Small ruminants such as goats (*Capra hircus*) are one of the contributors to livestock farming in terms of meat and milk production, (Texas Journal of Multidisciplinary Studies, 2021) [1], but are highly subjected to parasitic infections which are detrimental to the livestock industry. Among the wide range of parasitic nematodes dwelling within the gastrointestinal tract of the host, *Haemonchus contortus* (otherwise known as barber's pole worm) is the most economically significant and pathogenic for the goat (Sambodo *et al.*, 2019) [2]. Normally located within the abomasum, adult worms penetrate the wall of the stomach and feed on its blood. A single female worm can

ingest as much as 0.05 ml of blood per day and multi-thousand infestations cause severe anemia followed by hypoproteinemia, edema ("bottle jaw") and high mortality, especially in young animals (Mannan *et al.*, 2023; Kuchai *et al.*, 2012) [3, 4].

The epidemiology of *Haemonchus contortus* is significantly influenced by agroclimatic conditions. Hot, humid tropical and sub-tropical monsoon climate provides the most congenial temperature and moisture conditions for the rapid development and survival of the free-living pre-infective and infective third-stage larvae (L₃) on pastures (Flay *et al.*, 2022; Niciura *et al.*, 2023) [5, 6]. Nandurbar district, situated in the northernmost area of Maharashtra, experiences highly variable seasonal temperatures with extreme summer heat and long humid monsoon periods, which create congenial conditions for perennial nematode transmission. Goats in the area are mostly raised in extensive and semi-intensive grazing system, resulting in constant exposure to infected pastures.

Accurate identification of parasite species is the basis for understanding the local epidemiology and the design of effective and specific control programs. The morphological characterization of species is based on

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the description of crucial taxonomical structures (e.g., spicules and bursal rays in males and the cuticular vulvar flaps in females). Female *H. contortus* present particular morphotypes (e.g., linguiform, knobbed/button and smooth types) that can be used as phenotypic markers of population structuring related to the biogeographical distribution of the parasite (Singh, 2012; Gareh *et al.*, 2021) [7, 8]. Molecular approaches are currently available, but the classical identification of parasites based on morphological and morphometric criteria using adult worm keys remains the most accurate, accessible and affordable method (Santos *et al.*, 2019) [9]. Despite the high population on the morphometric parameters and vulvar morphotypes of *Haemonchus contortus*. This study aimed to describe the morphology and morphometry of *Haemonchus contortus* collected from goats slaughtered at Nandurbar, Maharashtra.

Materials and study Methods study area



Fig-Maharashtra Map Highlighted With Nandurbar District Materials and Study Methods Study Area

The research was conducted in the Nandurbar district of Maharashtra, India. This district is a part of the state’s northern transitional zone and is represented by a hilly area with a considerable number of tribal livestock farms. The region has a tropical climate with a well-defined rainy season, which is dominated by southwest monsoon airflows, bringing abundant precipitation throughout the year.

Collection, recovery and microscopic examination of parasites

Abomasal tissues were harvested from animals at slaughter and transported to the laboratory. The abomasums were dissected, ligated, opened along the greater curvature and thoroughly washed in physiological saline (0.9% NaCl). The mucosal lining was gently scraped to remove any adhering adult nematodes. The washings were then passed through a fine 100-mesh sieve (with 150 µm pores) and the worms were rinsed, counted and preserved in 70% ethanol with 5% glycerol to prevent contraction artifacts (Das *et al.*, 2023) [10]. Temporary and permanent mounts were made and examined under a high-resolution light and compound microscopes for detailed morphological examination with the help of ocular stage micrometer. Photographic images of selected anatomical features such as anterior buccal structures, cervical spines, female reproductive tracts, vulvar flaps (classified as linguiform, knobbed, or smooth morphotypes) and male copulatory bursae were captured using digital microscopic cam-

era systems. Morphometric measurements including body length, width, spicule length and vulvar distance were taken and compared to key diagnostic features (Khan *et al.*, 2025; contortus *et al.*, 2026) [11, 12].

Results and Discussion

Worm recovery and localization

The laboratory results showed that strongylid nematodes were found only in the abomasum. The researchers found no helminthes in the rumen, reticulum, omasum, small intestine and large intestine. The scientists determined that the detected parasites had the typical appearance of *Haemonchus contortus*. In particular, the worms had a lanceolate buccal capsule and four pairs of papillae were present at the level of the neck. The vulva flap in females was found in several forms: linguiform, knobbed and others. Moreover, the males of the species had a bursa that was not symmetrical and equipped with a Y-shaped dorsal ray and fused-barb spicules.

Morphological and morphometric characterization female Haemonchus contortus

Females were significantly larger than males and had a distinct barber's pole appearance due to the white ovaries and uteri that were coiled around the bright red, blood-filled intestine. Body length ranged from 24 to 30 mm (mean 27 mm); maximum width ranged from 0.40 to

55. mm. They possessed a small, rudimentary buccal capsule containing a signature dorsal chitinous lancet (tooth) for puncturing mucosal capillaries. Two prominent, wedge-shaped cervical papillae were positioned from the anterior extremity. The vulva was located in the posterior body third and was covered by distinct cuticular flaps. Examination of the females showed prominent phenotypic variations in vulvar architecture, primarily represented by the thumb-like linguiform flap (having longitudinal furrows and various cuticular inflation subtypes) and the reduced, smooth knobbed/button type, plus minor occurrences of smooth morphotypes. The tail was sharply pointed with the anus located (Tak *et al.*, 2014; Ndosi *et al.*, 2023; Unknown, 2021; Naaz *et al.*, 2025; Tevathiya *et al.*, 2026) [13, 14, 15, 16, 17].

Male Haemonchus contortus

Smaller than females, uniformly pinkish-red in fresh specimens. The body length ranged from 15 to 20 mm (mean 17 mm); the maximum width ranged from 0.28 to 0.40 mm. They were well-developed with two symmetrical lateral lobes and one asymmetric dorsal lobe displaced towards the left. The typical Y-shaped bifurcation of the rays was present, which can be used as a diagnostic character for the species. Two long, equal, brownish spicules with strong, fused barbed tips (contrary to the split tips of *Haemonchus placei*) were present. A small, wing-like gubernaculum was also present (Tak *et al.*, 2014; Ndosi *et al.*, 2023; Unknown, 2021; Naaz *et al.*, 2025) [13, 14, 15, 16].

Haemonchus contortus

Table 1. Comparative Morphometric and Morphological Features of Female and Male

Characters	Female <i>Haemonchus contortus</i>	Male <i>Haemonchus contortus</i>
Body Length	24.0 – 30.0 mm	15.0 – 20.0 mm
Maximum Body Width	0.40 – 0.55 mm	0.28 – 0.40 mm
Gross Appearance	"Barber's pole" look (white ovaries wound around the vivid red, blood-filled intestine)	Uniform pinkish-red to bright red in color; smaller and more slender
Anterior Extremity	Rounded, small buccal capsule bearing a dorsal chitinous lancet (tooth)	Rounded, resembling the female, with a small buccal cavity and dorsal lancet

(continued on next page)

Characters	Female <i>Haemonchus contortus</i>	Male <i>Haemonchus contortus</i>
Cervical Papillae	Located ~0.5 mm from the anterior end and having wedge- shaped spines	Located around ~0.5 mm from the anterior end
Esophagus	Clavate (club-shaped), 0.90 – 1.10 mm in length	Clavate (club-shaped), 0.85 – 1.05 mm in length
Posterior Extremity	Tail gently tapered and pointed; anus positioned 0.6 – 0.8 mm from the tip	Possesses a well-developed, bilobed copulatory burssa
Diagnostic Structures	Vulva situated 4.0 – 6.0 mm from the tail tip; shielded by a conspicuous linguiform (thumb-like) vulvar flap	Dorsal lobe asymmetric and shifted to the left; dorsal ray Y-shaped
Spicules & Gubernaculum	NA	Two identical, brownish spicules (0.47 – 0.51 mm) whose tips are fused and barbed; a small wing-like gubernaculum is present

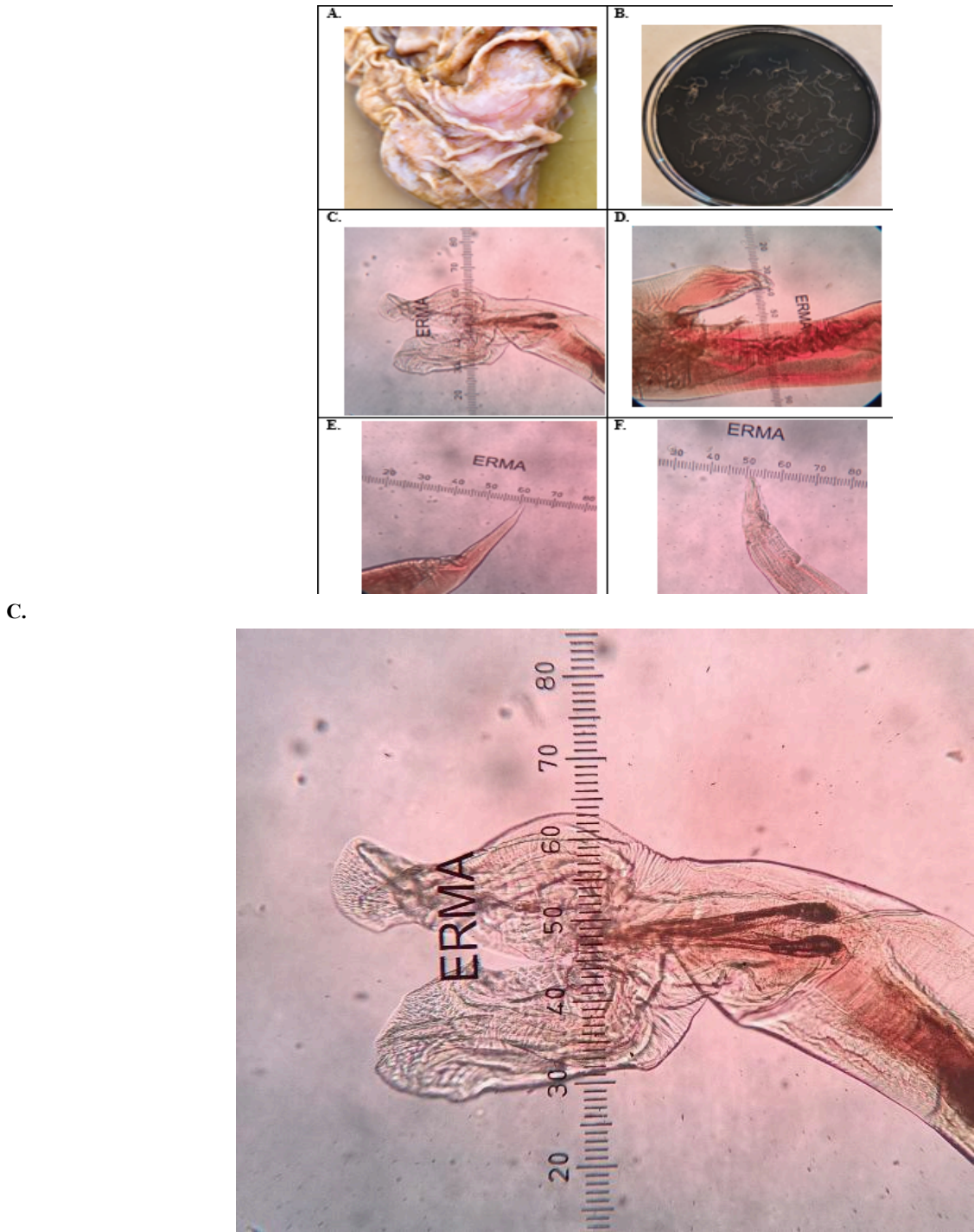


Figure 1. Gross collection, general morphology and morphometry using of adult *Haemonchus contortus* under light microscopy by using ocular micrometer.

A.	Gross photograph of the host abomasal mucosal lining showing adult <i>H. contortus</i> specimens adhered in situ.
B.	Isolated adult worms were collected in a Petri dish containing physiological saline for sorting and clearing.
C.	Male Copulatory Bursa with Well-developed symmetrical lateral lobes
D.	Female Vulvar Region — Linguiform Morphotype
E.	Female Posterior Tail End
F.	Anterior extremity highlighting the oral opening, dorsal lancet, cervical papillae and longitudinal cuticular ridges
G.	Female Vulvar Region — Knobbed Morphotype
H.	Female Vulvar Region — Smooth Morphotype

The identification of diverse female vulvar morphotypes supports findings from regional studies in which linguiform, knobbed and smooth types occur together within local isolates, acting as significant phenotypic markers that mirror environmental and host adaptations. The microscopic images captured in this study clearly reveal the internal reproductive structure, cuticular striations and posterior extremity profiles. These visual confirmations strengthen the dependability of classical light microscopy for distinguishing strongyle parasites at the species level without immediately depending on costly molecular sequencing. Because of this parasite's high pathogenicity and the growing problem of anthelmintic resistance, accurate morphological baseline mapping continues to be essential for local veterinary monitoring (KumsA *et al.*, 2008; Widiarso *et al.*, 2018; Liu *et al.*, 2023; Slathia *et al.*, 2019) [18, 19, 20, 21].

Conclusion

This study successfully isolated, identified and morphologically characterized *Haemonchus contortus* from goats in Nandurbar district, Maharashtra. A thorough light microscopy and morphometric analysis verified all diagnostic parameters, such as body dimensions, spicule lengths and vulvar flap configurations, which matched standard taxonomic descriptions (Nikolaou *et al.*, 2006; Gharamah *et al.*, 2011) [22, 23]. Traditional morphological examination remains an economical and highly reliable tool for routine diagnostic parasitology, providing a solid basis for future epidemiological and control studies in the region.

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