

International Multidisciplinary  
Research Journal

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RNI MAHMUL/2011/38595

ISSN No.2231-5063

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DESCRIPTION OF PROTOZOAN CILIATE *ENTODINIUM SIMULANS*  
*F.LOBOSPINOSUM* (LUBINSKY, 1957) AS A FIRST HOST RECORD  
FROM RUMEN OF CATTLE IN INDIA. (*BOS INDICUS*)



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ABSTRACT

Rumen fluid samples of adult Indian cattle (*Bos indicus*) were collected and observed to study the morphology of rumen ciliate protozoa belonging to genus *Entodinium*. The present paper deals with the morphology of species *Entodinium simulans f. lobospinosum* (Lubinsky, 1957) from the rumen of Indian cattle. The body measurement, frequency distribution and variation in the character are recorded. Critical comments are made on its specific identity. The observations are based on a study of 50 specimens taken at random from different samples. This species is observed as a first host record from the rumen of cattle in India (*Bos indicus*)

**KEYWORDS :** Cattle, Ciliates, Rumen, Entodinium, protozoa.

**INTRODUCTION :**

Ruminants have a very complex ecosystem harboring a variety of microorganisms which are capable of bringing out diverse types of fermentation. Rumen, the largest of the four compartments of stomach in ruminants, serves as a closed fermentation vat in which ingested feed is attacked by the microflora.

Protozoa are unicellular animals. The body of a protozoa is morphologically a single cell and manifests all characteristics common to living things. The various activities which make up the phenomenon of life are carried on by parts within the body or cell.

The great majority of ciliates are free living, but a number are parasitic. The protozoa placed in the phylum ciliophora possess cilia, cirri or other compound ciliary structures which serve as organelles of locomotion. Two kinds of nuclei are present in all without exception. Nutrition is holozoic or saprozoic. Asexual reproduction is by binary fission or budding and sexual reproduction is by conjugation or autogamy in which micronuclei play an important role. The ciliates of rumen belong to the families Buetchliidae, Isotrichidae, Paraisotrichidae, Blepharocarythidae, Ophryoscolecidae, and cyclopostidae. The ciliates vary in size from a few micron to 2 mm or more in length. The anterior and posterior extremities are permanently differentiated, the rumen ciliates are obligate anaerobes.

The rumen microflora consist of mainly of bacteria, protozoa and fungi, which have a

significant role to play in rumen fermentation. Of the total microbial biomass existing in rumen 40 to 80 percent is of protozoal origin (Jouney -1991, Punia et al, 1992), Protozoa living in the rumen are essentially ciliates, flagellates are often less numerous, not well known and are often confused with the flagellate stage of fungi (Jonney - 1988) Fermentation of starch and soluble sugars is regulated by rumen protozoa (Mackie et al 1978) and they are held in controlling acidosis in the rumen. Rumen protozoa are generally proteolytic (Balaraman, 1996).

The ciliates are established in the rumen within three weeks after the birth of a calf (Kurar, 1996) provided that the pH is above 6.0. *Entodinium* population is abundant in the rumen. It increases when the diet is rich in starch. Protozoa contributes about 40 to 60 percent of total hydrolytic enzyme activity in rumen. In ruminants, protozoa were first observed by Gruby and Dalafond in 1843 (Hungate, 1978) Since then a number of protozoal species have been reported in rumen. Subsequently the taxonomic studies on the rumen protozoa was done by various workers in different parts of the world; only a few studies have been carried in domesticated Indian ruminants. Kofoid and Mac Lennan (1930, 1932, 1933) in *Bos Indicus*, Das Gupta (1935) in Indian Goat, Ajit Banerjee (1955) in Indian Buffalo, Sanghai et al, (2010) in India Cattle. There is much scope to do work on the taxonomy of rumen ciliates. The taxonomical work on rumen ciliates of Cattle in India is very scanty. The present research work deals with study of taxonomy of rumen protozoa from Indian cattle.

## MATERIAL AND METHODS

Rumen fluid samples were collected for the present study from Indian adult cattle (*Bos indicus*) slaughtered at abattoirs in Hingoli district of Maharashtra state in India. On the removal of stomach, rumen was slightly punctured and 10ml. rumen fluid was collected in a vial. It was centrifuged and preserved adding 1:1 glycerine:alcohol solution. A drop of this material was taken on a glass slide for observing ciliates in living condition under research microscope. The permanent slides of the samples were made in duplicate, stained by tungstophosphoric haematoxylin stain. The staining procedure of Krier and Becker, 1987 was followed. The stained slides of ciliates were observed under research microscope for their identification and morphology.

The general features used to classify the rumen protozoa into genus *Entodinium* are as follows : (Dehority - 1993)

1. The Presence of single adoral zone.
2. Lack of skeletal plates.
3. Position of the macronucleus which lies between micronucleus and closest body side.

Body measurements such as length, width, L/W ratio, diameter, length of the nucleus etc. were recorded with an ocular micrometer. Frequency distribution, body shape, location of contractile vacuole, rectum mouth were also recorded, based on a study of 50 specimens (n=50) taken at random from different slides. All the measurements are in microns.

### Taxonomical position of *Entodinium* Stein, 1858.

Subkingdom	:-	Protozoa
Phylum	:-	Ciliphora
Class	:-	Kinetofragminophorea
subclass	:-	Vestibuliferia
order	:-	Entodinimorphida

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Family	:-	Ophryoscolecidae
Subfamily	:-	Entodniinae
Genus	:-	Entodinium

The following parameters were considered for observation.

- 1) Shape of the body
- 2) Length of the body
- 3) Width of the body
- 4) L/W ratio
- 5) Shape of nucleus
- 6) Length of nucleus
- 7) Position of micronucleus
- 8) Position of contractile vacuole
- 9) Location rectum and anus

## RESULTS AND DISCUSSION

*Entodinium Simulans f. lobospinosum* (Lubinsky, 1957) (fig 1a, 1b)

During the present study *Entodinium simulans f. lobospinosum* (Lubinsky, 1957) is recorded for the first time from the rumen of Indian cattle (*Bos indicus*) in India. Its morphology is described, the body dimensions and other measurements are recorded Table.1. The Variation in the body characters are recorded and critical comments are made on its specific identity. The observation are based on a study of 50 specimens taken at random from different rumen fluid samples of Indian Cattle.

### Morphology of : *Entodinium Simulans f. lobospinosum* (Lubinsky, 1957)

The Body of this species is elongated and measures 38.04µm in length. Oral area is set at right angle to the main body axis. The adoral lips are prominent, apex of left lateral groove is extending as a narrow furrow to anterior edge of outer adoral lip. Mouth is 8.92µm in length. The L/w ratio is 1.43. Both the body surfaces are flat to slightly convex; their convexity increases posteriorly. The maximum diameter of the body is in the posterior half (26.51µm). Posteriorly the body is terminated into one large spine and one lobe. The dorsal spine is large (21.88µm), plough shaped, broad based with a narrow pointed flexible end. The left ventral lobe is pointed (8.32µm) curving dorsally. Left lateral groove is prominent in this species. It is slightly broad and long. Anteriorly it is a narrow slit like groove reaching the anterior margin of the outer adoral lip. The groove behind the macronucleus is broad.

The endoplasmic sack is clearly differentiated by the distinct boundary layer closely applied with the body surfaces. Thick ectoplasm is present anteriorly near the oral area and posteriorly near the lobe. Rectum is situated at the base of left ventral to lobe of terminates into a small anus. Macronucleus is club shaped (19.30µm) with a broad anterior end (4.14 µm) and narrow posterior end (3.02 µm). It is nearly triangular in side view, closely applied to the dorsal body surface. Its anterior end reaches the outer adoral furrow and posteriorly extends upto middle of the body. It is nearly 51 per cent of the body length. Micronucleus is a small ellipsoidal body situated near the left ventral margin of the anterior third of macronucleus. Contractile vacuole is located at the level of micronucleus ventrally to the left lateral groove.

**COMMENTS :**

*Entodinium simulans f. lobospinosum* was firstly described by Lubinsky in 1957 from sheep and Goat in Pakistan, This species has not been described by any othe workers. Dehority has redrawn, the figure and given the vales of dimensions which were described by Lubinsky in 1957 (Dehority, 1993). A comparison of the dimensions of the species described here and those given by Lubinsky (1957) are shown in Table-2.

The table reveals that the dimensions of the species are similar in respect of body length and diameter to the dimensions given by Lubinsky (1957). The length of macronucleus and the length of dorsal spine observed here are slightly longer than the length reported by Lubinsky (1957). However the diameter of month is smaller than the diameter described by Lubinsky (1957).

This species has been recorded as a first host record from the rumen of Cattle in India.

**TABLE – 1**

The Body Dimensions and other measurements of *E. Simulans f. lobospinosum* are given below.  
(All the measurements in microns)

Sr. No.	Parameters	Minimum	Maximum	Average
<b>1.</b>	<b>Body</b>			
	Length	<b>29.96</b>	<b>44.94</b>	<b>38.04</b>
	Width	<b>19.26</b>	<b>34.24</b>	<b>26.51</b>
	Length width ratio	<b>1.56</b>	<b>1.31</b>	<b>1.43</b>
<b>2.</b>	<b>Macronucleus</b>			
	Length	<b>14.98</b>	<b>25.68</b>	<b>19.38</b>
	Percent length of body	<b>50.00</b>	<b>57.14</b>	<b>50.95</b>
	Dia. Ant. end.	<b>4.28</b>	<b>6.42</b>	<b>4.14</b>
	Dia. post. end.	<b>2.14</b>	<b>4.28</b>	<b>3.02</b>
<b>3.</b>	<b>Mouth</b>	<b>6.42</b>	<b>12.84</b>	<b>8.92</b>
<b>4.</b>	<b>Lobe/Spine</b>			
<b>5.</b>	<b>Dorsal Spine</b>	<b>17.12</b>	<b>25.68</b>	<b>21.88</b>
<b>6.</b>	<b>Ventral Spine</b>	<b>6.42</b>	<b>8.56</b>	<b>8.32</b>

**TABLE – 2**

Comparative Body of *Entodinium simulans f. lobospinosum* (Lubinsky,1957) and the present dimensions (in microns)

Parameters	Authors	
	<i>Lubinsky (1957)</i>	Present Author (2015)
<b>Length</b>	25-46 (38)	29.96-44.94 (38.04)
<b>Width</b>	22-34 (27)	19.26-34.24 (26.51)
<b>L/W ratio</b>	1.1-1.50 (1.36)	1.56-1.31 (1.43)
<b>Macronucleus</b>	12-23 (17)	14.98-25.68 (19.38)
<b>Month</b>	11-16 (14)	6.42-12.84 (8.92)
<b>Dorsal Spine</b>	10-17 (14)	17.12-25.68 (21.88)
<b>Lobe</b>	6-9 (7)	6.42-8.56 (8.32)



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