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DESCRIPTION OF PROTOZOAN CILIATE *Entodinium caudatum forma caudatum* (*Stein,1859*) FROM THE RUMEN OF INDIAN CATTLE, (*Bos indicus*)

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Abstract:-Rumen fluid samples of were collected and observed belonging to genus *Entodinium*. morpholosy of species *Entodinium caudatum* forma caudatum *(Stein*, 1859),The body measurements, frequency distribution and variations in the characters are recorded. Critical comments are made on it's special identity. During the present study some of the specimens belonging to *Entodinium caudatum f. caudatum* showed remarkable variations in the body characters particularly in the size, shape and position of macronucleus and shape of the body. Such as club shaped macronucleus, broad anterior end nearly triangular in side view, general body shape varied from large oral to small elongated shape.

Keywords:*Cattle, Cilites, Rumen, Entodinium, Protozoa, Entodinium.*

INTRODUCTION

Protozoa are unicellular animals. 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. The ciliates of rumen belongs to the families Buetchliidae, Isotrichidae, Paraisotrichidae, Blepharocarythidae, Ophryoscolecidae, and Cyclopostidae. The ciliates vary in size from a few micron to 2 µm or more in length. The anterior and posterior extremities are permanently differentiated, the rumen ciliates are obligate anaerobes.

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.

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 protozoa 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 (Jouney - 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 proteolytis (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 MacLennan (1930,1932,1933) in Bos indicus, Das Gupta (1935) in Indian Goat, Ajit Banerjee (1955) in Indian Buffalo; Kulkarni and Kshirsagar (2004, 2005, 2006, 2008) in *Bos indicus*, Kulkarni (2012, 2013) in *Bos indicus*. 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 haemotoxylein 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, length of the nucleus etc. were recorded with an ocular micrometer. Frequency distribution, body shape, location of contractile vacuole, rectum, mouth are also recorded.

Taxonomical position of *Entodinium* Stein, 1858.

Subkingdom	:-	Protozoa
Phylum	:-	Ciliphora
Class	:-	Kinetofragminophorea
subclass	:-	Vestibuliferia
order	:-	Entodinimorphida
Family	:-	Ophryoscolecidae
Subfamily	:-	Entodniinae
Genus	:-	Entodinium

RESULTS AND DISCUSSION

Entodinium caudatum f.caudatum (stein, 1859)
(Fig.1a, 1b)

a protozoan ciliate *Entodinium caudatum f. caudatum* belonging to genus *entodinium*, It's morphology is described and the body measurements are recorded (Table 1), special comments are made on the variation of the characters for its identity. The observations are based on a study of 50 specimens taken at random from different rumen fluid samples.

MORPHOLOGY OF *Entodinium caudatum f.caudatum (Stein,1859) :*

The body is oval in shape with moderate size, Average body length is 38.18?m. The oral area is set nearly at right angles to main body axis. Outer adoral lips are deep and prominent. L/w. ratio is 1.16.

Both the dorsal ventral body surfaces are convex interiorly and become slightly flat in the middle, convexity increases in the posterior half of the body; where the maximum diameter of the body occurs (32.90?m). This species is identified by the presence of one elongated dorsal spine and two short ventral lobes, one right ventral and the other left nevtral; with a shorter left lateral grove, The dorsal spine is long (20.67?m) with broad base and flexible, narrow and pointed tip which curves slightly dorsally. The right ventral lobe is triangular and fleshy (5.95?m) with acute apex curving dorsally. The left ventral lobe is small (3.21?m) slanting dorsally. The left lateral groove is short.

The boundry lager is distinct, which surrounds the endoplasmic sack in the middle of the body. Thick ectoplasm is present near the oral area and posterirly near the lobes and spine. Rectum is located at the base of left ventral lobe terminating into a small anal opening.

It the side view, macronucleus appears triangular but it is club shaped. In many species it is closely applied with the dorsal body surface and in some specimens there is a gap between dorsal body surface and the macronucleus. Its apex lies just below the adoral lip and posteriorly it passes middle half of the body. It is 20.67?m in length and is 54.14 percent of the body length. The anterior end of macronucleus is broader. The micronucleus is ellipsoidal and is situated on the left edge of anterior third of macronucleus. The contractile vacuole is located on the dorsal side at the left of anterior end of macronucleus.

COMMENTS :

Stein (1858) established the genus Entodinium and he has described three species.

Entodinium caudatum f.caudatum is one of the three species. *Dogiel* (1927), *Becker* and *Talbot* (1927) *Hsing* (1932), *Das Gupta* (1935), *Banerjee* (1955), *Lubinsky* (1957) repoted this species from cattle, Goat, buffalo sheep etc.

Similarly in the recent years the species was reported by several workers. Dehority, (1979, 1986) from Brazilian buffalo, and cattle, Imai etal (1982) from Bali cattle and buffalo in Indonesia and Zebu cattle from Sri Lanka (1985), Shimizu etal (1983) from zebu cattle in Philippines, Han Kang et al (1984, 1989) from Korean cattle, Tung etal (1989) from cattle in Taiwan, Wang etal (1990) from Goat in Taiwan, Ito and Imai and Ito etal (1990, 1994) From Japanese Cattle, Mukherjee, (1990) from Indian Goat, Sadhana etal (1992) from Indian cattle selim etal (1999) from sheep, Cattle and camel in Libya. A camparision of dimensions of the species described here and those given by earlier workers is shown in Table 2; which reveals that the mean body dimensions of the species described here are slightly larger than the values reported by Dehority (1993), However the maximum range of body dimesions is small than the range of dimensions reported by Lubinsky (1957) and Dehority (1993) the mean L/W ratio reported by Dehority (1993) is 1.25 with a wide range, where as in the present studies the mean L/W ratio is 1.16 with a narrow range, which indicates the more oval shape of this species.

During the present study some of the specimens belonging to *E.caudatum f.caudatum* showed remarkable variation in the body characters particularly in the size, shape and position of macronucleus and shape of the body. The macronucleus of this species observed in most of the specimens is club shaped with a broad anterior end nearly triangular in side view, closely applied to the dorsal body surface and reaches the middle half of the body.

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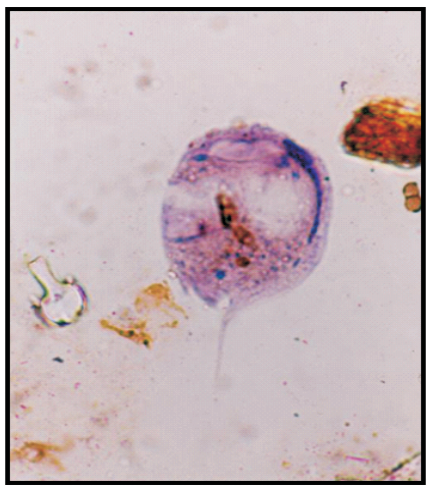
TABLE – 1.0
The Body Dimensions and other measurements of Entodinium caudatum f.caudatum are given below.
(All the measurements in microns)

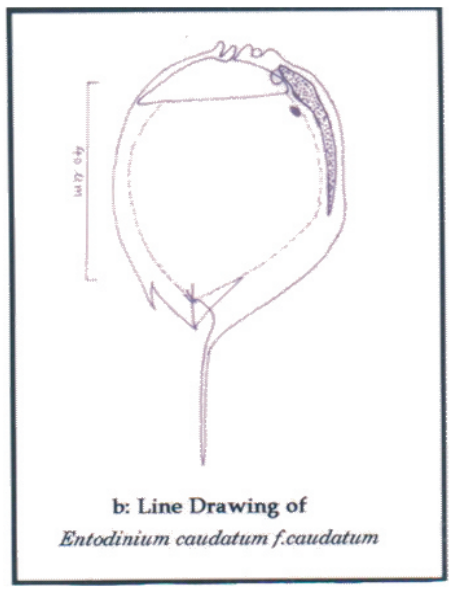
Sr.No.	Parameters	Minimum	Maximum	Average
1	**Body**			
	Length	25.68	55.64	38.18
	Width	23.54	44.94	32.90
	Length Width Ratio	1.09	1.24	1.16
2	**Macronucleus**			
	Length	12.84	32.10	20.67
	Percent length of body	50.00	57.69	54.14
	Dia. Ant end.	3.00	8.56	4.62
	Dia. post end.	2.14	6.42	2.93
3	Mouth	4.28	12.84	8.69
4	**Lobe**			
	Dorsal Spine	12.84	29.96	20.67
	Rt. Ventral lobe	4.28	8.56	5.95
	Lt. Ventral Lobe	2.14	6.42	3.21

TABLE – 2.0
Comparative Body dimensions of E.cautatum f.caudatum given by earlier worker and the present dimensions
(In microns)

Parameters	Authors		
	Lubinsky (1957)	**Dehority (1993)**	**Present Author (2014)**
Length	38-65	28-70 (35)	25.68-55.64 (38.18)
Width	--	25.50 (28)	23.54-44.94 (1.09-1.24)
L/W ratio	1.1 – 1.7 (1.37)	1.1-1.7 (1.25)	1.09-1.24 (1.16)



(Fig. 1a)
PHOTOGRAPH OF Entodinium caudatum f.caudatum



(Fig. 1b)
Entodinium caudatum f.caudatum

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