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***Research Article***

# STUDY ON THE OCCURRENCE OF *DIPLODINIUM POLYGONALE* (DOGIEL, 1925) FIRST RECORD FROM THE RUMEN OF CATTLE (*BOS INDICUS*) IN INDIA

***Sanghai P. K.[1] and Kshirsagar H. S.[2]**
*[1]Department of Zoology, Shivaji A.C. & Science College, Kannad -431103, District Aurangabad (M.S.) India*
*[2]Department of Zoology, Shivaji College, Parbhani-431401, (M.S.) India*
**Author for Correspondence*

## ABSTRACT
A survey has been made to study the protozoan ciliates of subfamily Diplodiniinae (Order: Entodiniomorphida) from the rumen of cattle (*Bos indicus*). The present paper reveals the occurrence of *Diplodinium polygonale* (Dogiel, 1925) recorded first time from the rumen of cattle (*B. indicus*) in India. The size and morphology of this species is compared to those previously reported in different geographical areas.

***Keywords****: Rumen, Cattle, Ciliates, Diplodinium*

## INTRODUCTION
Rumen is the largest compartment of the stomach that occupies 80 per cent of the abdomen in the ruminant animals. The rumen does not secrete any enzyme but constantly receives the saliva. The pH of the rumen is in between 5-7.5.
The condition is strictly anaerobic and temperature ranges from 38-41$^{o}$C. In this way the rumen favors for microbial fermentation. Rumen microorganism includes viruses, bacteria, fungi and protozoa. Of them protozoa have large bodies and characteristic shape.
Gruby and Delafond (1843) first reported the protozoa from ruminants since then a number of protozoan species have been reported from different parts of the world Dogiel (1927) Becker & Talbott (1927), Hsiung (1932) Clarke (1964), Ogifmoto & Imai (1981) and Dehority (1993, 2005) Gocman (1999a,1999b, 2000) Gocman *et al.,* (2005) Martenele *et al.*, (2008), Gocman and Gurelli (2009), Dirk *et al.,* (2010), Dirk and Dehority (2011) and Gurelli (2014), but very few studies have been made in India. Kofoid and Maclennan (1930, 1932, 1933), Dasgupta (1935), Banerjee (1955), Mathur (1963), Misra (1972), Mukherjee & Sinha (1989, 1990) Sanghai and Kshirsagar (2015) studied rumen ciliates from different hosts. Kulkarni & Kshirsagar (2001) studied the genus *Entodinium* and reported 13 new species. The present paper deals with the occurrence of *Diplodinium polygonale* (Dogiel, 1925) recorded first time from the rumen of cattle (*B. indicus*) in India. The size and morphology of this species is compared to those previously reported in different geographical areas.

## MATERIAL AND METHODS
During the present study rumen fluid samples were collected from 814 adult Indian cattle slaughtered at abattoirs of Kannad, Dist. Aurangabad of Maharashtra State (India). After the removal of the stomach the rumen was slit open and 10-15ml of rumen fluid was collected in a glass vial then immediately the glass vial was closed airtight and brought to the laboratory. It was centrifuged and preserved by adding 1:1 glycerine alcohol solution. To determine the intensity of the ciliates live specimen were examined under the microscope by taking drop of fluid on a clean glass slide.
The permanent slides of the sample were made in duplicate stained by wet Tungstophosphoric Haematoxylin stain. Identification of genera and species of rumen ciliates were based on description published by earlier workers (Dehority 1993). All the measures of the ciliates were based on a study of 50 specimens (n=50) with an ocular micrometer, line drawings were made with a camera lucida at magnification 10x X 40x.

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***Diplodinium polygonale*, Dogiel 1925**
**Description of the Species: - (Figure 1, 2)**

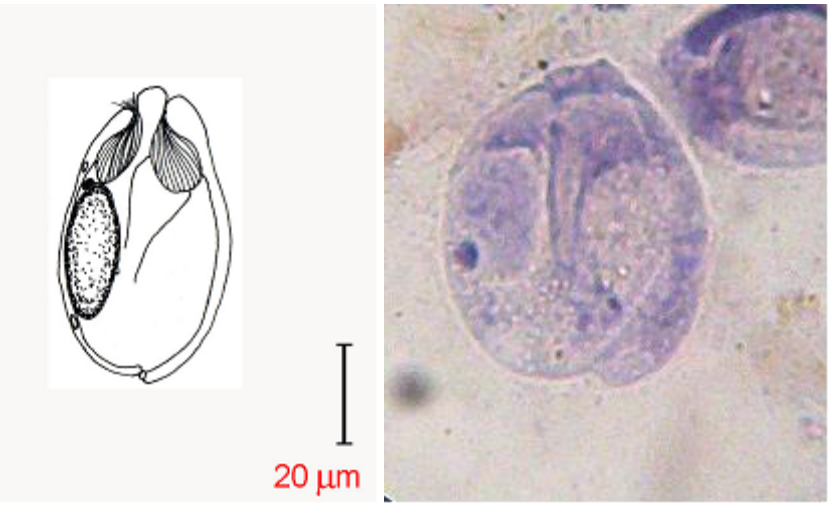


**Figure: 1) Line Drawing and 2) Photomicrograph of *Diplodinium polygonale* (Dogiel, 1925)**

The body is small, short and roughly hexagonal in shape. The adoral ciliary zone is relatively small encloses mouth and the left ciliary zone small, inconspicuous. The operculum is small but distinct and slightly extended anterior to the oral zone. The dorsal surface of the body is flat straight, while the ventral surface is convex giving a hexagonal shape to the body. The anterior end of the body is convex while posterior end is flat without any caudal projection.
The oesophagus is slightly conical funnel shaped structure arises from the base of the mouth. It ends nearly anterior third of the macronucleus. The endoplasmic sack originates at the level of anterior end of macronucleus. It occupies almost entire portion of the body. It is surrounded by a thin boundary layer. The ectoplasm is weakly developed.
The rectum is short tubular arises from the posterior end of endoplasmic sack. It opens through an elliptical anus, which lies in the middle of the posterior end.
The macronucleus is short, heavy thick structure lies in the dorsal surface to the right mid line. The anterior end of the nucleus is much broad smoothly rounded, while the posterior end is narrow blunt. The micronucleus is small spherical slightly ellipsoidal thick structure. It is located in the left of the middle part of the macronucleus. The position of the micronucleus varies from anterior to the posterior end at the left side of the macronucleus. There is only one contractile vacuole. It is large found anteriorly just behind the left ciliary zone.
The body dimensions and other measurements of *Diplodinium polygonale* are given in Table 1

***Comments***

*Diplodinium polygonale* was first described by Dogiel (1925) as *Diplodinium polygonale* and redescribed in 1927 as *Anoplodinium polygonale* from *Rhaphiceros* sp. from British East Africa. A comparison of the dimensions of the species described here and those given by earlier workers are given in table 2.
The table indicates that the body size of the species described here is larger than the size reported by Dogiel (1927), Ogimoto & Imai (1981) and Dehority (1993). The width of the body recorded during the present study is larger than the width reported by Dogiel (1927), Ogimoto & Imai (1981) and Dehority (1993). The L/W ratio recorded here is less as compared to the L/W ratio given by earlier workers. The macronucleus observed here shows variations from short, heavy body to straight rod like with small depression. The micronucleus present here shows variable positions from anterior to middle and posterior dorsal region of the macronucleus.
In the present studies, this species is identified for the first time from the rumen of the cattle in India.

**Table 1: The Body Dimensions and Other Measurements of *Diplodinium polygonale* are as below, all Measurements are in Microns (n=50)**

| Sr. No. | Parameters | Minimum | Maximum | Average |
|---|---|---|---|---|
| **1** | **Body** | | | |
| | Length | 36.8 | 54.4 | 45.25 |
| | Width | 28.8 | 51.2 | 39.01 |
| | L/W Ratio | 1.00 | 1.40 | 1.16 |
| **2** | **Macronucleus** | | | |
| | Length | 9.6 | 30.4 | 20.77 |
| | %Length to the Body | 23.08 | 61.54 | 45.98 |
| | Diam. Ant. End. | 3.2 | 14.4 | 8.41 |
| | Diam. Post. End | 3.2 | 12.8 | 7.30 |
| **3** | **Micronucleus** | 1.6 | 6.4 | 4.03 |
| **4** | **Adoral Ciliary Zone(Mouth)** | 6.4 | 16 | 10.18 |
| **5** | **Left Ciliary Zone** | 4.8 | 9.6 | 6.30 |
| **6** | **Rectum** | 3.2 | 8 | 5.02 |

**Table 2: Comparative Body Dimensions of *Diplodinium polygonale***

| Parameters | Authors | | | |
|---|---|---|---|---|
| | **Dogiel (1927)** | **Ogimoto & Imai (1981)** | **Dehority (1993)** | **Present Study** |
| Length | 32-38 (35) | 30-40 | 30-40 (35) | 36.8-54.4 (45.25) |
| Width | 20-24 (22) | 20-25 | 20-24 (22) | 28.8-51.2 (39.01) |
| L/W Ratio | 1.6 | | 1.6 | 1.00-1.40 (1.16) |
| Ma. Nu. L | -- | | -- | 9.6-30.4 (20.77) |
| Mi Nu. Dia. | -- | | -- | 1.6-6.4 (4.03) |

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