

Description of a new species cephaline gregarine *Stenophora bristili* (Apicomplexa, Sporozoea) from Millipede (*Chondromorpha severini*) in Aurangabad district (M.S), India

J. C. Bhandari* and S. V. Nikam

Department of Zoology Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. (M.S.), INDIA

*Corresponding author. E-mail: joproto@gmail.com

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Abstract: The study of the endoparasitic cephaline gregarine in the gut content of millipede (*Chondromorpha severini*) was found to be infested with a new species (*Stenophora bristili*) of genus *Stenophora* (Labee, 1899). It differs from all the earlier reported species. The shape of the body of cephalont small elongated, slightly curved and rounded posterior end. Potomerite consists of fine bundle of bristles. The Sporont is elongated curved, slightly tapering and rounded posterior end, having brush like broader in between protomerite and deutomerite, Nucleus is spherical with ecentric karyosome. The different developmental stages including cephalont, sporont, gametocyst and sporocyst have been observed.

Keywords: Cephaline gregarine, *Chondromorpha severini*, *Stenophora*

INTRODUCTION

Millipedes are a major group of detritivores in tropical and temperate broadleaf forests. They are important in nature as they play the ecological role of deposit feeders that enhance the rate of decomposition for other smaller deposit feeders as well as decomposers (Hopkin *et al.*, 1985; Price, 1988). Infection by cephaline gregarines is common and widespread in millipedes (Crawford *et al.*, 1987). They belong to the family Gregarinidae, suborder Cephalina, order Eugregarinida, class Sporozoea, and phylum Apicomplexa (Margulis *et al.*, 1993). They live in digestive tracts, malpighian tubules, fat tissue, hemolymph, or reproductive organs of marine and terrestrial invertebrates (Chen *et al.*, 1997, Field and Michiels 2006, Valigurová and Koudela 2006). Levine (1970) depicted the life cycle of gregarines and described as many as 120 species of gregarines from the eight genera that can infect millipedes, *Amphoroides*, *Cnemidospora*, *Fonsecaia*, *Hyalosporina*, *Monoductus*, *Phleobum*, *Spirosoma*, and *Stenoductus*. The Eugregarinida are all parasitic and are restricted to invertebrates (Clopton, 2002). Mostly harbor are the Arthropoda host Genus *Stenophora* first established by Labbe (1899). It commonly occurs in the different host of millipede. The paper deals with morphological characteristic, similarities and its differences have been found out in comparison with other species of genus *Stenophora*.

MATERIALS AND METHODS

Chondromorpha severini (Silv) millipede was collected from the university campus of Aurangabad district and

were brought to the laboratory in plastic boxes filled with soil and dead leaves collected from their habitats. Millipedes used in this study were distinguished by their sex and anesthetized by low-temperature knock-down at 0°C. After careful dissection, the intestines were taken out from millipedes and divided into three parts, the anterior, middle, and posterior, residue of intestine taken out separately in to watch glasses containing 0.6% NaCl. All different stages of gregarines in the gut were examined under the phase contrast microscope. The smeared are air-dried and fixation was done by schaudinn's fixative and the smears were stained with haematoxylin. Gregarines were identified according to their characteristic features as described by Clopton (2002).

RESULTS AND DISCUSSION

Description of the species *Stenophora bristili* (n.sp)

Cephalont: The small cephalont was observed in the anterior part of intestine. The cephalont is elongated, small, slightly curved and rounded at the posterior end (Fig 1). It measures 37.29 to 46.6 µm in length and 16.31 to 27.96µm in width. The protomerite consists of fine bundle of bristles. The deutomerite is elongated slightly curved at the posterior end. The nucleus is ovoidal in shape with small karyosome placed at the middle of the deutomerite.

Sporont: The fully mature sporont was present in the middle part of intestine. It is extensively elongated curved, slightly tapering and rounded at posterior end. It measures about 228.34 to 314.55 µm in length and 30.29 to 48.93µm in width.

The body of the sporont divided in to three parts, epimerite, protomerite and deutomerite. These parts are separated by an endoplasmic indentation. There is clearly distinction between ectoplasm and endoplasm. The ectoplasm forms outer covering of the body it is thin and dark and the endoplasm is dence and yellowish brown in colour.

The septum in between protomerite and deutomerite forms brushlike border. At the tip of the protomerite, epimerite modifies in to fine bristles, it measures about 9.32 to 11.65 μm in length. The deutomerite is extremely elongated slightly curved and rounded at the posterior end. It measures 167.76 to 244.71 μm in length and 23.3 to 48.93 μm in width. The nucleus is dark granular, spherical in shape and it is generally located in the middle of the deutomerite but in some cases it is slightly at the posterior end. Karyosome is seen which is slightly eccentric.

Gametocyst: The gametocyst is somewhat oval in shape during the course of development it become spherical. It measures 20 to 30 μm in diameter.

Sporocyst: No sporocyst was found.

After comparison with *Stenophora* species described from millipede, the present species was found to be closest to *S. ellipsoidi* (Chakrawarty, 1934), *S. mahabaleshwari* (Amoji and Rodgi, 1972), *S. cassidiformis* (Rodgi and Bhall, 1961), *S. ozakii*, (Hukui, 1952 and Gulbhile, 2005), *S. papillata* (Karandikar and Rodgi, 1955), *S. conjugate* (Rodgi and Ball, 1961) and *S. akiyoshinsis* (Hyoma and Hoshide, 1969) but it shows some distinguishing characters which makes it different from all of them.

The shape of the body is ellipsoidal in the *S. ellipsoidi* and *S. cassidiformis*, in the *S. mahabaleshwari* it is leaf like. Elongated cylindrical shape is present in *S. ozakii*, *S. conjugata* and *S. akiyoshinsis* it is cylindrical to elongate ovoid. In the present species it is also elongated but swollen in the middle and slightly curved at the posterior end (Fig. 2).

Rounded shape of epimerite present in *S. ellipsoidi* and dome shaped epimerite in the *S. mahabaleshwari*, ball like and hyline in the *S. papillata* and *S. conjugate*. In the present species it is different than that of previous species. The epimerite modifies in to fine bristles. The septum between protomerite and deutomerite forms brush like border. This type of structure is not seen in the previous species. The shape of the protomerite is different in all above species. Bottle shaped protomerite is present in *S. ellipsoidi*, pot shaped in *S. mahabaleshwari*, dome shape in *S. cassidiformis*, ball and knob like in *S. ozakii*, shirt buttonlike and dome like with drown out papilla present in *S. papillata* and *S. conjugate* and dome shape, subglobular in *S. askiyoshinesis*. In the present species it is somewhat semi oval or bulbous with brush like broader with slightly concave septum in between protomerite and deutomerite (Fig. 3).

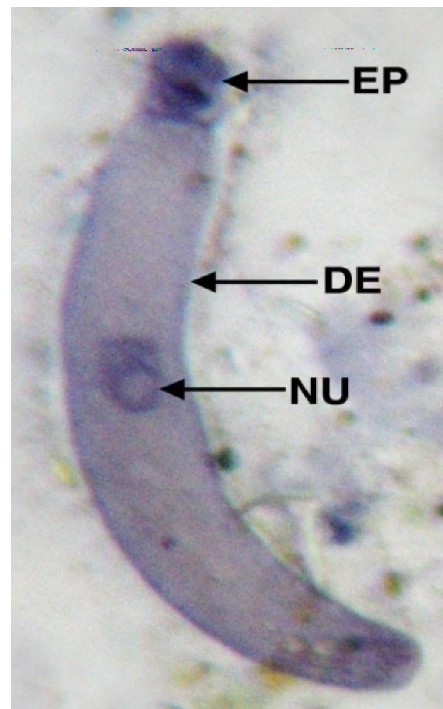


Fig.1. Cephalont (EP-Epimerite, DE-Deutomerite, NU-Nucleus).

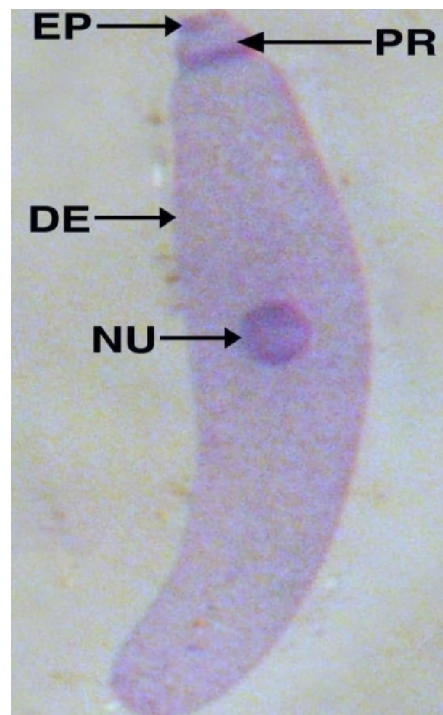


Fig.2. Sporont (EP-Epimerite, PR-Protomerite, DE-Deutomerite, NU-Nucleus).

The shape of the nucleus in previous species is elliptical, ovoidal, spherical, spindle shaped, boat shaped and ellipsoidal where as in the present species it is spherical with eccentric karyosome. The comparative characters and body dimensions are shown in table1. The hosts of all the previous species are different. The present author considered the species described by her as a new species

Table 1. Showing a comparison of the species of the genus *Stenophora*.

S. No	1	2	3	4	5	6	7	8
Particulars	<i>S. ellipsoidi</i> Chakravarty (1934)	<i>S. papillata</i> Karandikar and Rodgi (1955)	<i>S. conjugate</i> Rodgi and Ball (1961)	<i>S. cassidiiformis</i> Rodgi and Ball (1961)	<i>S. akiyoshiensis</i> Hyoma and Hoshide (1969)	<i>S. mahabaleshwari</i> Amoji and Rodgi (1972)	<i>S. ozaki</i> Hukui (1952), Gulbhile (2005)	<i>S. bristili</i> (n.sp.)
Body shape and dimensions (Spotont)	Ellipsoidal L - 250 - 372µm W - 50 - 95µm	Elongated. L - 724X95µm	Elongated. L - 360X80 µm	Ellipsoidal, L - 120-180 X 45-70µm	Cylindrical, elongated ovoidal L-200-250µm / W-50- 60µm	Leaf like L - 80 -280µm W- 20 - 135 µm	Elongated L - 4.66 to 9.32µm W - 6.99 - 11.65µm	Elongated curved L- 314.55 - 8.34µm W- 302 - 48.93µm
Epimerite	Rounded	Ball like and hyaline	Ball like hyaline	-----	-----	Dome shaped	-----	Fine bristles
Protomerite	Bottle shaped	Shirt button like, with out its upper knob, with apparent pore	Dome like with drownout papilla with apparent pore	Dome shaped	Dome shaped like sub globular	Pot shaped	Ball and knob shaped	Semi oval or bulbous
Nucleus	Elliptical	Spindle shaped	Boat shaped	Spherical	Ellipsoidal	Ovoidal	Spherical	Spherical dark granular
Gametocyst	Spherical	Oval	Spherical	Somewhat Spherical	-----	Spherical	Oval	Somewhat oval
Sporocyst Host	Spindle shaped <i>Diplopoda</i>	Oval <i>Thyropygus</i> <i>nigrolabiatus</i>	Tears drops like <i>Thyropygus</i> <i>nigrolabiatus</i>	Spherical <i>Strongylosoma</i>	----- <i>Skleropratoropus</i>	Spherical <i>Strongylosoma</i>	Spherical <i>C. kelaarti</i>	----- <i>C. severini</i>
Locality	Calcutta	Mysore State India	Mysore State India	Mysore State India	Akiyoshi (Japan)	Dhawar Karnataka	Parali (V) dist. Beed	Aurangabad district



Fig. 3. Fine bristles and septum.

of genus *Stenophora* because of its distinctness i.e. brush like broader in between protomerite and deutomerite and epimerite modifies in fine bristles (Fig. 3).

All of these differences suggest that the present species is a new one and hence named *Stenophora brisitili* (n.sp).

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