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

Received: October 26, 2012; Revised received: February 27, 2013; Accepted: March 25, 2013

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 cephalon 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 Sporozoaa, 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, Amphiroides, Cenmidospora, Fonsecia, Hyalosporina, Monoductus, Phleobum, Spirocoma, and Stenoductus. The Eugregarinida are all parasitic and are restricted to invertebrates (Clopotoon, 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 into three parts, epimerite, protomerite and deutomerite. These parts are separated by an endoplasmic indentation. There is clearly a distinction between ectoplasm and endoplasm. The ectoplasm forms outer covering of the body it is thin and dark and the endoplasm is dense and yellowish brown in colour.

The septum in between protomerite and deutomerite forms brushlike border. At the tip of the protomerite, epimerite modifies into fine bristles, it measures about 9.32 to 11.65µm in length. The deutomerite is extremely elongated slightly curved and rounded at the posterior end. It measures 167.76 to 244.71µm in length and 23.3 to 48.93µm 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 becomes spherical. It measures 20 to 30µm 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* (Karanidkar and Rodgi, 1955), *S. conjugate* (Rodgi and Ball, 1961) and *S. akiyoshinesis* (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. akiyoshinesis* 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 drawn out papilla present in *S. papillata* and *S. conjugate* and dome shape, subglobular in *S. akiyoshinesis*. 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).
Table 1. Showing a comparison of the species of the genus Stenophora.

| S. No | Particulars | S. ellipsoidi Chakravarty (1934) | S. papillata Karundikar and Rodgi (1955) | S. conjugate Rodgi and Hall (1961) | S. cassidiformis Rodgi and Ball (1961) | S. akiyoshiensis Iyuma and Hoshide (1969) | S. mahabaleshwarl Amoju and Rodgi (1972) | S. ozaki (1952), Hukui, Gulbule (2005) | S. britisli (n.sp.) |
|-------|-------------|---------------------------------|----------------------------------------|---------------------------------|-------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| 1     | Body shape and dimensions (Sporont) | Ellipsoidal, L - 250 - 372μm | Elongated, L - 724X95μm | Elongated, L - 360X80μm | Ellipsoidal, L - 120-180 X 45-70μm | Cylindrical, elongated ovoidal | Leaf like | Elongated | Elongated curved L- |
|       |             |                                |                                        |                                |                                     | L-200-250μm | W-20 - 135 μm | 9.32μm | 314.55 |
| 2     | Epimerite   | Rounded | Ball like hyaline | Ball like hyaline | --- | --- | Dome shaped | --- | --- | Fine bristles |
| 3     | 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 |
| 4     | Nucleus     | Elliptical | Boat shaped | Spherical | Ellipsoidal | Ovoidal | Spherical | Spherical dark granular | Spherical |
| 5     | Gametocyst  | Spherical | Oval | Spherical | Somewhat | Spherical | Oval | Somewhat oval | |
| 6     | Sporocyst Host | Spindle shaped Diplodora Thryopyrgus nigrolabialis | Oval | Tear drops like Thryopyrgus nigrolabialis | Spherical | Stronglysoma | Spherical | C. kelaartii | |
| 7     | Locality    | Calcutta | Mysore State India | Mysore State India | Mysore State | Akiyoshi (Japan) | Dhawar Karnataka | Parali (V) dist. | Aurangbad district | India |


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).

**ACKNOWLEDGEMENT**

Authors are thankful to the Head of Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S) India for their kind cooperation, encouragement and facilities extended to us.

**REFERENCES**

Amoji, S. D. and Rodgi, S. S. (1972): New species of gregarine, *Stenophora mahabaleshweri*, sp. nov., from millipede, Strongylosome sp. *Karnatak Univ. J. Sci.*, 17: 96-99.

Chakravarty, M. M. (1934): Studies on Sporozoa from Indian millipedes. *III. Life history of a Stenophora ellipsoidi* n.sp. *Arch. Paroïtistenk.*, 82: 164-168.

Chen, W. J., Chow, C. Y and Wu, S. T. (1997): Ultrastructure of infection, development and gametocyst formation of *Ascorgregarina taiwanensis* (Apicomplexa: Lecudinidae) in its mosquito host, *Aedes albopictus* (Diptera: Culicidae). *J. Eukary. Microbiol.*, 44:101-108.

Clopton, R.E (2002): Phylum Apicomplexa Levine 1970: Order Eugregarinorida Leger, 1900. In: Lee J, Leedale G and Patterson D, Bradbury PC (eds) Illustrated guide to the protozoa, 2nd edn. Society of Protozoologists, Lawrence, KS, 205-288.

Crawford, C. S., Bercovitz and Warburg, M. R. (1987): Regional environments, life history patterns and habitat use of sprostrepid millipedes in arid regions. *Zool. J. Linn. Soc.*, 89:63-88.

Field, S. G and Michiels, N. K. (2006): Aechaline gregarine parasites (*Monocystis* sp.) are not transmitted sexually among their lumbricid earthworm hosts. *J. Parasitol.*, 92: 292-297.

Gulbile, V. D. (2005): Study on protozoan parasites of some invertebrate. Ph.D. Thesis *Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S) India*.

Hopkin, S. P., Watson, K., Martin, M. H and Mould, M. L. (1985): The assimilation of heavy metals by *Lithobius variogrites* and *Glomeris marginata* (Chilopoda: Diplopoda). *Bijd. Dierkund.*, 55: 88-94.

Hukui, T. 1952: On two types of *Stenophora nematoides* Leger and Duboscq, 1903. J. of Science of the Hiroshima University (Zool.), 13, 91-95.

Hyoma Hoshide (1969): Note on the gregarines in Japan 3. A new Gregarine, *Stenophora akiyoshiensis* n.sp from a cave living Millipede, *Skleroprotopus ikeadi* Takauwa. *Bulletin of the faculty of Education, Yamaguchi University*, Vol. 19, pt.2.

Karandikar and Rodgi (1930): Some New species of gregarine from millipedes of Mysore State, India. *J. Protozool.* vol. 7, 7-8, 162-179.

Labbe, (1899): Sporozoa. *Das Tierreich*. 5: 1-180.

Levine, N.D. (1970): Phylum Apicomplexa In: J.J. Lee, S.H. Hutner and E.C. Bovee, eds. *1985. An Illustrated Guide to the Protozoa*, Society of Protozoologists, Lawrence, KS, pp. 322-374.

Margulis, L., Mckhann, H.I. and Olendzenski, L (1993): *Illustrated Glossary of Protista*. Jones and Barlett Publishers, London, UK p 276.

Price, P.W. (1988): An overview of organismal interaction in ecosystems in evolutionary and ecological time. *Agric. Ecosys. Environ.*, 24: 369-377.

Rodgi, S. S. and Ball, G. H. (1961): New species of gregarine from millipedes of Mysore State, India. *J. Protozool.*, 8 (2): 162-179.

Valiguurová, A and Koudela, B. (2006): Ultra structural study of developmental stages of *Mattesia dispara* (Neogregarinorida: Lipotrophidae), a parasite of the flour moth *Ephestia kuehniella* (Lepidoptera). *Eur. J. Protistol.*, 42: 313-323.

---

**Fig. 3.** Fine bristles and septum.