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Prevalence and Morphological details of Intestine Dwelling Ciliate *Nyctotherus spirostreptae* from Millipede, *Chondromorpha kelaarti*

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Abstract

Nyctotherus spirostreptae, shows its diversity in various hosts. A new species which has been first time reported by Lalpotu, from intestine of *Periplaneta americana* (1976). Later the same species is described by Bhandari (2010) from millipede *Trigoniulus corallines*. The present species is again re-described in the intestine of Millipede, *Chondromorpha kelaarti* by present author. It shows similarity to both the previous individuals of the species, only it is slightly larger than Bhandari's species and smaller than that of Lalpotu (n. sp. 1976). Percentage of prevalence was observed for a period of two years, January 2007 to December 2008, it was 47.24% and 55.16% respectively.

Key words- Prevalence, Intestine, *Nyctotherus spirostreptae*, *Chondromorpha kelaarti*

Introduction

Genus- *Nyctotherus* Leidy, (1849)

The genus *Nyctotherus* is belongs to Class Spirotrichea, Subclass Polymenophora, Order Clevelandellida (de Puytorac and Gain, 1976) and Family Nyctotheridae (Amero, 1972). It is first time reported by Leidy, (1849), in the millipede host. Later several forms were described by various authors in various hosts. Grasse (1928) suggested the splitting up of this genus *Nyctotherus* and *Nyctotheroides* to accommodate forms with and without a karyophore respectively. Corliss (1961) elevated these subgenera to a generic level, Amero and Sena (1967), they also suggested the splitting up of this genus into three subgenera as *Recurviperistomatus*, *Curviperistomatus* and *Nyctotherus* on the nature of cytopharynx. They listed 33 species of this genus *Nyctotherus*. Early workers like Puytorac *et al.* (1967, 1968) Albaret (1968,1970) and Earl (1970) also reported different *Nyctotherus* species and related new genus like *Metanyctotherans*, *parasicuohora* and *Sicuophore* Earl (1972) also established a new superfamily Plagiotomoidae to place different genus (above described genera) and also named two families, Plagiotomidae (Butschli, 1887) and Clevelandellidae (Kidder 1938)

Corliss (1979) described *Nyctotherus* in class Polyhymenophora (Jankowski 1967), Subclass Spirotrichea Butschli, (1889), Order Heterotrichida Stein (1859), and Suborder – Clevelandellina (de Puytorac and Grain (1976) with family Nyctotheridae Amero (1972).

According to recent literature, Bhatia *et al.*, (1936) has given a key for the identification of the species of the genus *Nyctotherus*.

- Cytopharynx not reaching beyond the middle of the body.
- Cytopharynx directed obliquely backwards and not reaching the middle.
- Cytopharynx shorter than the pristome.

- (i) Body bean shaped with concave right margin. Length 26 to 28 μ Macronucleus globular and contains 4-5 chromatin masses.

N. faba (*Schaudinn*)

- (ii) Body peculiar shaped. Length 40-50 μ ; macronucleus globular with 4 chromatin masses.

N. africanus (*Castellani*)

- (iii) Body ovoid, narrower and rounded anteriorly and broader and stunted posteriorly. Length 90 - 400 μ , macronucleus bean shaped.

N. giganteus (*Kranse*)

- (iv) Body egg shaped, Length 100 - 140 μ . Macronucleus egg shaped.

N. velox (*Leidy*)

- (v) Body ovoid. Cytopharynx slightly curved length 60 - 70 μ . Macronucleus ovoid or slightly horse – shoe shaped.

N. termitis (*Dobell*)

- (vi) Body reniform. Cytopharynx slightly curved like a semicircle, with a diverticulum at its junction with the cytostome. Length 120 - 170 μ Macronucleus reniform of horse shoe shaped.

N. pappillatus (*Dobell*)

- (vii) Cytopharynx reaching beyond the middle of the body, cytopharynx shorter than the transverse diameter of the body. Cytopharynx slightly curved with the concavity directed forwards. Body elongated length 170 μ . Macronucleus elongated oval.

N. kempi (*Ghosh*)

- (viii) Cytopharynx broadly curved posteriorly. Body is oviform, Length is 30 - 120 μ m. Macronucleus is discoidal.

N. haematobius ENTZ

- (ix) Body ovoid. Anterior end narrow, posterior end wide but tapering to a point length 112 to 152 μ for small forms and 200 - 268 μ for large ones macronucleus tetrahedral.

N. piscicola (*Daday*)

- (x) Body egg shaped length 100 μ . Macronucleus egg shaped.

N. duboisii (*Kunstler*)

- (xi) Body kidney shaped, length 160 μ - 180 μ (*Bezz*) or 77 to 11 μ (*Stein*) breadth $\frac{2}{3}$ - $\frac{3}{4}$ of the body length. Macronucleus kidney shaped.

N. cordiformis (*Stein*).

The systematic position of ciliates in millipede

Phylum:- Ciliophora.

Class:- Spirotrichea.

Subclass:- Polymentophora

Order:- Clevelandellida – de Puytorac and Gain, (1976)

Family:- Nyctotheridae – Amero, (1972)

Genus:- *Nyctotherus* – Leidy, (1849)

Species:- *N. Spirostreptae*, Lalpotu, (1976), Bhandari (2010)

Material and Methods

The hosts were collected from different parts of hilly regions of Nashik dist (Deola, Nandgaon; Surgana, Kalwan Satana) of Maharashtra state. Due care was taken and the hosts were collected in moist soil with decaying leaves were present and the temperature was maintained by using ice bags around them. Mostly the hosts were collected during morning and evening. Due to the great variability in temperature and humidity the millipedes were only available in the period of June to November. Especially they were found abundant in rainy season.

The faecal samples were obtained from different parts of host intestine like fore gut mid gut and hind gut. The drops of faecal samples were observed under 45X and then 100X under microscope. Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements, methyl cellulose solution was used. Methyl cellulose has been found to have many advantages, as it arrests the movement, ciliates can be identified by their appearance. For the preparation of permanent slides, the positive samples were stained by tungstic-phosphoric acid haematoxylin.

The Dry silver impregnation was also used to study infraciliature of the ciliates. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro, micronucleus cyto-pharynx and cytophyge.

Prevalence of Ciliate *Nyctotherus* in Millipedes, *Chondromorpha kelaarti*

During the period of two years (Jan.2007 to Dec.2008) a total 798 animals (*Chondromorpha kelaarti*) were examined, 310 of these were positive for ciliates infection.

In the **first year** (Jan.2007 to Dec.2007) total 381 animals were examined 180 of these were positive. The percentage of prevalence was being 47.24%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during October (70.29%), minimum in November (31.94%) and moderate in remaining months.

In **second year** (Jan.2008 to Dec.2008) maximum percentage of prevalence was recorded during September (74.36%), minimum in June (45%) and moderate in remaining months.

The pattern in both the year suggests that the peak is after the monsoon rain. The percentage then gradually reduces in starting of the winter months and reaches a low with the onset of summer. The details of the number of animals examined and the month wise prevalence are shown in **Table No. 1 and 2**.

Description of the species

The ciliates were collected from the intestine of millipede *Chondromorpha kelaarti*. The hosts were collected from the Nashik district. During the study a number of hosts of above species were examined under the laboratory conditions. While examining, most of the infection was found in the middle part of intestine.

Fully mature ciliates are ovoidal in shape, both the ends are rounded. The total length of the body is 75 to 89.5 μ and width is 42 to 61.5 μ . The peristomal groove starts from just near the anterior end of the body and runs along the ventral surface for some distance which measures about 39 μ in length, leads into cytopharynx. The peristomal groove is larger than the cytopharynx. The cytopharynx is short measures about 34.5 μ in length. It is straight, tubular or slightly curved in the middle region. The macronucleus is somewhat ovoidal in shape, it is broader than the length, and situated at the anterior surface of the body it measures 13 to 19.5 μ in length and 17.5 to 22 μ in width. The micronucleus is not seen. The endoplasm is granular and ectoplasm is thin and dark. A fairly big contractile vacuole which measures about 17 μ in diameter is located posterior to the cytophyge. The cytophyge is a slit like opening present at the posterior end of the body as shown in **Plate No. 2**.

Comments:- The genus *Nyctotherus* was first introduced by Leidy (1849) when he investigated *N. velvox* from the intestine of the millipede *Spirobolous (Jolus marginatus)*.

It is seen from available literature that at least 20 species of *Nyctotherus* are described by different workers from millipedes of different genera all over the world. In India six species are so far described from millipedes belonging to the genera *Thropygus* and *Gongylorrhhus*. These are *N. diplopoda*, *N. thropygus*, *N. gangylorrhhus* Karandikar and Rodgi (1956), *N. nigrolobiatus*, *N. georgi* Amoji and Rodgi (1970) and, the *N. spirostreptae* (n. sp.) is described by Lalpotu (1976) in *Spirostreptus* millipede. Again the same species is described by Bhandari (2010) from millipede *Trigoniulus corallinus* and in *Chondromorpha kelaarti* by present author. The present species is similar to both the previous species, only it is slightly larger than Bhandari's species and smaller than that of Lalpotu (n. sp. 1976).

The single contractile vacuole is present in all of three, but it is slightly larger in size than that of the Bhandari's species. The slit like cytophyge is again matches with both of the previous species. Even though the localities and the host species are different the above individuals shows close morphological similarities to each other. Except some minor differences like their hosts are different Lalpotu first time described it from *Spirostreptus*, Bhandari has investigated from *Trigoniulus corallinus* while present author described it from the host *Chondromorpha kelaarti*. Almost all the characters of present species are matched to the *N. spirostreptae* (n. sp. Lalpotu, 1976 and Bhandari, 2010), hence it is re-described here as *N. spirostreptae* as shown in **Table No. 3**

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TABLE 1

Showing the monthwise prevalence of ciliates in Millipedes (*Chondromorpha kelaarti*) during the period from Jan.2007 to Dec.2007

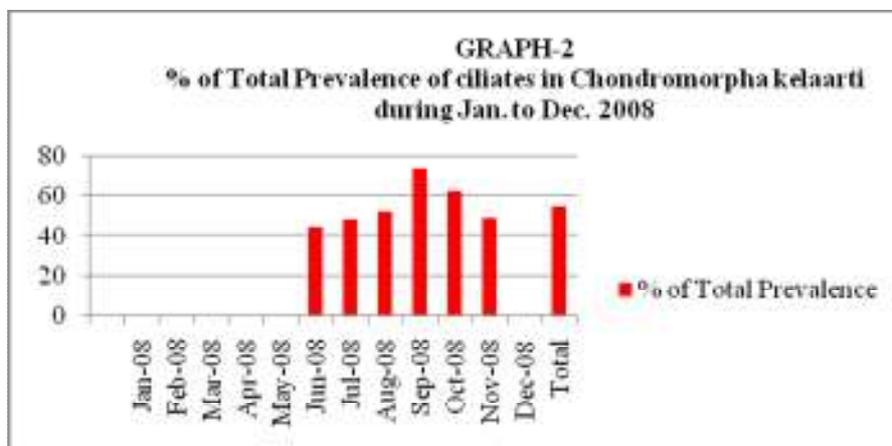
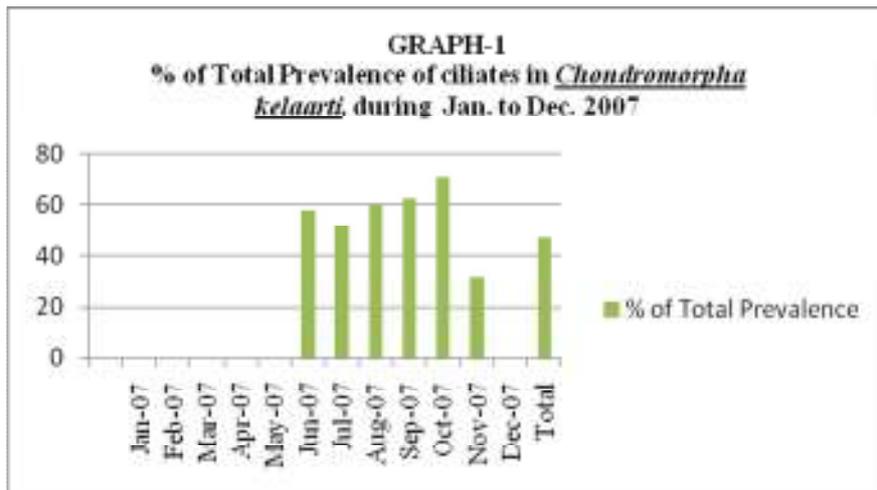
Sr No	Months	Total No.of Host Examined	No.of +ve Hosts	% of Total Prevalence
1	Jan-07	-----	-----	-----
2	Feb-07	-----	-----	-----
3	Mar-07	-----	-----	-----
4	Apr-07	-----	-----	-----
5	May-07	-----	-----	-----
6	Jun-07	19	11	57.89
7	Jul-07	71	37	52.11
8	Aug-07	65	39	60.00
9	Sep-07	67	42	62.69
10	Oct-07	87	28	70.29
11	Nov-07	72	23	31.94
12	Dec-07	-----	-----	-----
	Total	381	180	47.24

TABLE 2

Showing the month wise prevalence of ciliates in Millipedes (*Chondromorpha kelaarti*) during the period from Jan.2008 to Dec.2008

Sr.No	Months	Total No. of Host Examined	No. Of +ve Hosts	% of Total Prevalence
1	Jan-08	-----	-----	-----
2	Feb-08	-----	-----	-----
3	Mar-08	-----	-----	-----
4	Apr-08	-----	-----	-----
5	May-08	-----	-----	-----
6	Jun-08	60	27	45.00
7	Jul-08	47	23	48.94
8	Aug-08	74	39	52.70
9	Sep-08	39	29	74.36
10	Oct-08	110	69	62.73
11	Nov-08	87	43	49.43
12	Dec-08	-----	-----	-----

	Total	417	230	55.16
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Sr.	No. Species	1	2	3
No.	Comparative characters	<i>N. spirostreptae</i> Lalpotu (1976)	<i>N. spirostreptae</i> Bhandari (2010)	<i>N. spirostreptae</i> Present author
1	Body shape and dimensions	Ovoidal, ant. end slightly narrow, post. end is broad L- 75.6 to 126µ W- 47.3 to 81.9µ	Ovoidal, L- 69.9 to 76.89µ W- 49 to 53.59µ	Ovoidal, L- 75 to 89.5µ W- 42 to 61.5µ
2	Peristomal groove	Anterior end run ventrally, leads to cytopharynx	Anterior end run ventrally, leads to cytopharynx	Anterior end run ventrally, leads to cytopharynx
3	Cytopharynx	Straight slightly curved at the middle of the body	Straight slightly curved at the middle of the body	Tubular, slightly curved
4	Macronucleus	Somewhat oval	Somewhat oval L- 11.65 to 16.31µ W- 16.31 to 20.62µ	Oval, length is less than width L- 13 to 19.5µ W- 17.5 to 22µ
5	Micronucleus
6	Contractile vacuoles	Single	Single, 10µ diameter	Single large 17.5µ in diameter
7	Cytopyge	Slit like	Slit like	Slit like
8	Host	<i>Sprostreptus</i>	<i>Trigoniulus coralinus</i>	<i>Chondromorpha kelaarti</i>
9	Locality	Parbhani dist.	Aurangabad dist.	Nashik dist.

Topography-

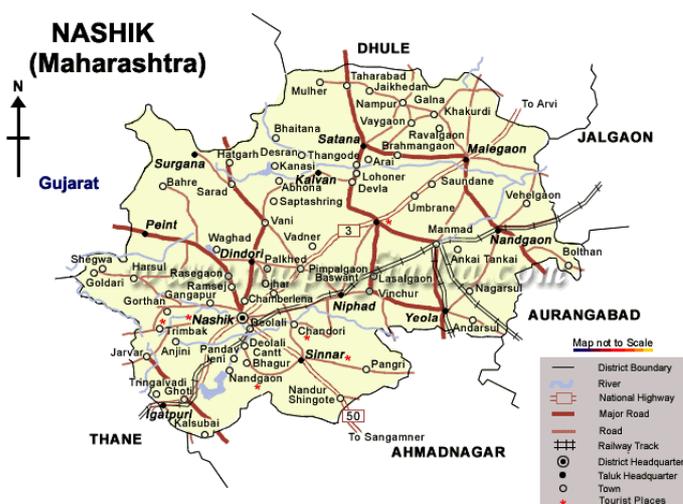


Plate- 1 showing Map of Nashik District of Maharashtra, India

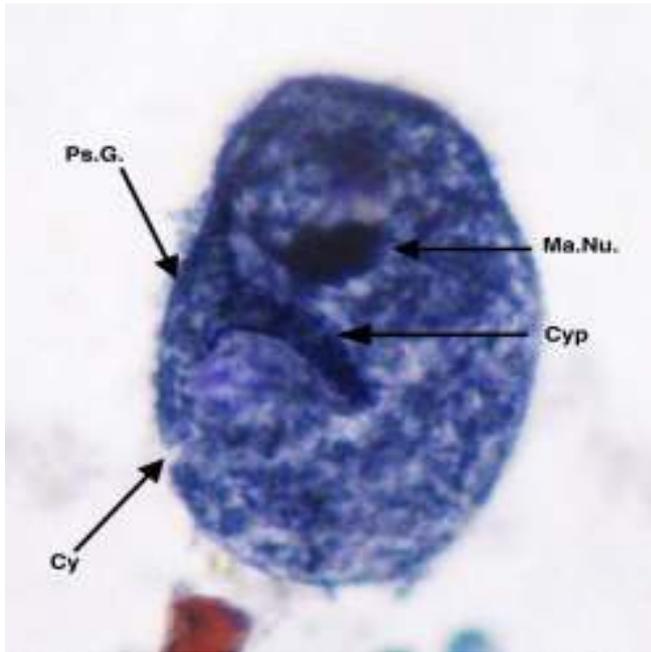


Plate 2. Nyctotherus spirostreptae W.M.