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FREE-LIVING MARINE NEMATODES FROM CHINNA CREEK, KARACHI, SINDH, PAKISTAN

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ABSTRACT

Biodiversity and biosystematics of free-living marine nematodes were investigated in water and sediment samples collected from five stations at Chinna Creek. Chinna Creek which is also known as Eastern Break water is about 5.0 km long , 300 to 500 m wide with a depth ranges from 1 to 3 meters and is situated at the South East of Karachi at Manora Channel. Faunastic survey of the benthic communities revealed a total of fifteen genera belonging to ten families in three orders from Chinna Creek. Epistrate feeders were the major trophic group at Chinna Creek, they comprised 46 % of the total nematode fauna followed by predators 38 % and deposit feeders 16 % only.

Key-words: Marine nematodes, Chinna Creek, Karachi, Pakistan

INTRODUCTION

Karachi, a large industrial and densely populated coastal city, is expanding at an extraordinary rate. Due to rapid industrial expansion and population increase, large amount of untreated industrial and domestic wastes are being discharged through the Lyari River in the western backwaters of Manora Channel into Karachi harbor and subsequently, into the sea, polluting the coastal environment. Within marine environment free-living marine nematodes in term of abundance form a major component of the meiobenthic fauna of the soft bottom (Almanza, 2010). Nematodes comprise the largest animal Phylum in terms of density and number of species (Blaxter *et al.*, 1998). Among them free-living marine nematodes are found in greatest abundance in a variety of sediments and surfaces of intertidal and benthic zones. They are present in sediments that extend from the tidal reaches of marshes and mud flats and the spray zone of open beaches to the abyssal plains (Hope and Murphy, 1972). They play an important role in marine ecosystem. A very significant portion of energy flow of benthic system passes through the nematodes (Heip *et al*., 1985).

Nematodes are considered as bioindicator (Vincx and Heip, 1991). Meiobenthic fauna in biomonitoring studies for the assessment of marine water quality has been used since more than 100 years (Davis, 1995). Among the benthic communities Nematoda is the group which vary in sensitivity to pollutants and environmental perturbation (Bongers and Ferris, 1999), therefore presence of a specific nematode species in high population indicates specific type of pollution (Amjad and Grey, 1983; Raffaelli and Mason, 1981).

The history of free-living marine nematodes investigation in Pakistan was started in 1962-1963 by Timm, he worked on two locations of Karachi viz., Manora and Netive Jetty. Later on such studies were performed by Maqbool and Nasira (1998). In 2007 free-living marine nematodes of Arabian Sea, a review was given by Nasira and Shahina and reported a total of 123 species, 104 genera belong to 34 families, 6 suborders, 4 orders, 2 subclasses and 1 class from a taxonomic point of view. Among them one genus and 33 species are new to science while 70 species were found as new records from Pakistan. Biodiversity, systematic and ecology with taxonomy of free-living marine nematodes of Arabian Sea in the coastal areas of Pakistan was studied by Kamran (2011).

MATERIALS AND METHODS

Study area: The present study were conducted at five sites of Chinna Creek along the coast of Karachi, Sind. A total of 35 marine samples were collected. Samples were brought to the laboratory processed and analyzed.

Sampling: Water and sediment samples were collected during 2008. One liter of each sample was mixed to make one composite sample of three liters. Samples were collected in sterile plastic bags. For meiofauna analysis samples were taken by pushing a cylindrical corer into the sediment to a depth of 5-8 cm. Samples were fixed with 4% formalin in filtered sea water. The abundance of nematodes was determined from sediments and water samples, following the methodology of Somerfield *et al*., (1994).

Meiofauna analysis: Samples collected from each sites were brought to laboratory fixed in 4% formaline and stained with 0.1 % Rose Bangle. Each sediment sample was washed in tap water through a 45 µm sieve and meiofauna extracted by Cobb's sieving and decanting method (Cobb, 1918). The suspended material, from four washings was allowed to settled for 15 to 20 minutes and the supernant water was decanted. Nematodes were transferred to 1.5 % glycerine solution and allowed to dehydrate slowly for 4-5 days at 40-60°C (Seinhorst,1959). Processed specimens were placed in a tiny drop of pure glycerine and covered with a 19 mm cover slip supported by paraffin wax and glass fibers. Morphological identification of marine nematodes was made under compound microscope.

RESULTS AND DISCUSSION

Analysis of marine samples revealed the presence of fifteen nematode genera belonging to ten families in three orders. They were identified according to the systematics provided by Lorenzen (1981), Tarjan (1980), Keppner and Tarjan (1991, 1994) and Warwick *et al*., (1998) and were classified according to their feeding groups.

Results of the surveys of Chinna Creek indicated that despite pollution in Karachi harbor, which receives a considerable amount of industrial and domestic wastes from Karachi through the Lyari River, large number of marine nematodes were present. Marine nematodes have the ability to develop different tolerance mechanisms for survival in high levels of pollution. At Chinna Creek epistrate feeders were dominant feeding types. They comprised 46 % of the total trophic groups followed by predators 38 % and deposit feeders 16 % only.

Systematic Account

Class Adenophorea von Linstow, 1905

Key to Orders

1. Amphids inconspicuous, consisting of slit like openings and subcuticular pouch. Cuticle smooth or annulated, rarely ornamented……**Enoplida**

   Amphids circular, spiral or vesicular. Cuticle smooth or annulated with or without punctation…….2

2. Buccal cavity armed with one dorsal tooth and usually with two smaller subventeral teeth. Amphids uni or multispiral, oval or rounded in outline. Cuticle often with punctation…….**Chromadorida**

   Buccal cavity distinct, rarely absent, usually without teeth. Amphids circular or loop shaped. Cuticle without punctation. Female gonad outstretched, paired or unpaired. Male generally without supplements…….. ……..…….**Monhysterida**

Order Enoplida Filipjev, 1929

Key to Families

Stoma spacious, barrel shaped with well sclerotized walls with large three teeth. Oesophagus cylindrical begining at posterior end of stoma, not enlarged posteriorly, supplement papilloid not sclerotized. Demanian system often present…….**Oncholaimidae**

Stoma with three claw like teeth at anterior end of stoma. Oesophagus extending to lip region but not attached to cuticle, supplements setose. Four cephalic and six labial setae present. Demanian system absent…….. ……**Ironidae**

Family Oncholaimidae Filipjev, 1921

This family was found to be represented by two genera viz., *Metoncholaimus* Filipjev, 1918 and *Oncholaimus* Dujardin, 1845

Key to genera

Spicules long, gubernaculum present or absent……..……..……..……..***Metoncholaimus***

Spicules short, gubernaculum absent……..…..……***Oncholaimus***

***Metoncholaimus* Filipjev, 1918**

Body 3-8 mm long with large left subventral tooth. Spicules moderately to greatly elongate, setaceous, gubernaculum present usually. Demanian system with exit pore.

***Oncholaimus* Dujardin, 1845**

Body 3-6 mm long with large left ventrolateral tooth. Short spicules with no gubernaculum. Male without well developed pre-cloacal organs. Demanian system without exit pores.

Family Ironidae de Man, 1876

This family was found to be represented by only one genus *Trissonchulus* Cobb, 1920.

***Trissonchulus* Cobb, 1920**

Body 2-6 mm long. Cephalic sensillae papilliform. Stoma elongate tubular with parallel walls, oesophagus without posterior bulb, female gonad monodelphic, opisthodelphic. Three teeth in the buccal cavity with dorsal pair fused together to varying degree and relatively short blunt tail.

Order Monhysterida Filipjev, 1929

Key to Families

One ovary, oesophagus cylindrical, only rarely with terminal bulb, gubernaculum simple, stoma short, narrow, funnel shaped……..……..…….....**Monhysteridae**

Two ovaries, oesophagus usually with a terminal bulb, gubernaculum with elongate caudal apophysis. Head with six minute labial papillae and 8, 10 or 16 cephalic setae…… ……**Linhomoeidae**

Family Monhysteridae de Man, 1876

This family was represented by a single genus *Diplolaimella* Allgen, 1929

***Diplolaimella* Allgen, 1929**

Body 0.5-1.0 mm long. This genus has double buccal cavity, tail long, conico-cylindrical, pre-cloacal and post-cloacal papillae present or absent.

Family Linhomoeidae Filipjev, 1922

This family was also represented by a single genus *Eleutherolaimus* Filipjev, 1922

***Eleutherolaimus* Filipjev, 1922**

Body 1.5-3.3 mm long. Buccal cavity with cylindrical walls and 4+4 cephalic setae.

Order Chromadorida Filipjev, 1929

Key to Families

1. Amphid a broken circle. Stoma short, narrow, cylindrical……..**Leptolaimidae**
Amphid spiral or multispiral, stoma wide.....2

2. Buccal cavity wide with complicated mandibles. Stoma divided into two distinct chambers with a series of denticles between them.....**Selachinematidae**

3.Buccal cavity with dorsal tooth larger than subventral teeth. Integument punctuate…….… **Cyatholaimidae**

3. Cuticle punctate, stoma usually with 3 symmetrical teeth…….....**Chromadoridae**

Cuticular punctations readily apparent, stoma consisting only a small vestibuly teeth, barely recognizable. Amphid narrowely coiled .....**Comesomatidae**

Family Chromadoridae Filipjev, 1922

This family was found to be most abundant and diversified in Chinna Creek. It is represented by five genera viz., *Chromadora* Bastian 1865; *Endeolophos* Boucher, 1976; *Hypodontolaimus* de Man 1886; *Ptycholaimellus* Cobb,1920 and *Spilophorella* Filipjev, 1917.

Key to genera

1. Pre-cloacal supplement present…….2
Pre-cloacal supplement absent……..4

2. Oesophagus with an elongate double posterior bulb…...…….……....***Ptycholaimellus***
Oesophagus with pronounce posterior bulb……..…….....3

3. Buccal cavity conical with one dorsal and two subventral solid teeth……..***Chromadora***
Buccal cavity with large S-shaped hollow dorsal tooth……..……..*****Hypodontolaimus***

4. Cuticle homogeneous, oesophagus cylindrical……..……..***Endeolophos***
Cuticle heterogeneous, oesophagus bulb double……..…….***Spilophorella***

***Ptycholaimellus* Cobb, 1920**

Body 0.5-1.5 mm long. Buccal cavity with large S-shaped dorsal tooth and a dorsal apophysis. It has an elongated double posterior oesophageal bulb, homogenous cuticular ornamentation with lateral differentiation of two longitudinal lines of dots.

***Chromadora* Bastian, 1865**

Body 0.5-1.5 mm long . Amphid transverse slit like. Buccal cavity conical with one dorsal and two subventral solid teeth, four cephalic setae, cuticle with four longitudinal rows of dots, quite separate linked by transverse bars, precloacal supplement present.

***Hypodontolaimus* de Man, 1886**

Body 0.5-1.5 mm long. Hollow dorsal tooth in large S-shape and has a dorsal apophysis. Homogeneous cuticular ornamentation with lateral differentiation of two longitudinal files of dots.

***Spilophorella* Filipjev, 1917**

Body 0.5-1.5 mm long. It has complex heterogeneous cuticle with lateral differentiation, hollow dorsal tooth in deep buccal cavity, elongated double posterior oesophageal bulb, a long pointed unstriated spinneret. Tail tip elongate.

***Endeolophos* Boucher, 1976**

Body 0.5-1.5 mm long. Cuticle homogeneous behind head sclerotized buccal cavity, 6+4 cephalic setae, precloacal supplements absent. Dorsal tooth is more pointed than sub-ventral teeth, proximal end of gubernaculum with slightly posteriorly pointed.

Family Cyatholaimidae Filipjev, 1918

Two genera were identified in this family viz., *Marylynnia* Hopper, 1977 and *Paracanthonchus* Micoletzky, 1924.

Key to genera

1. Gubernaculum distally expanded and dentate, cuticle with transverse rows of fine dots which may be slightly larger in the lateral fields, tubular pre-cloacal supplements…….. ……..……***Paracanthonchus***

2. Gubernaculum expanded slightly distally, cuticle pore of two types, rounded and longitudinally oval which referred to as lateral modified punctation, pre-cloacal supplements cup shaped ..……***Marylynnia***

***Paracanthonchus* Micoletzky, 1924**

Body 1-4 mm long. Buccal cavity with one dorsal and two smaller subventral teeth. Amphid multispiral, cuticle with transverse rows of fine dots, larger in the lateral fields or may be irregularly arranged, oesophageal bulb absent, gubernaculum distally expanded and dentate, proximally paired, supplements tubular.

***Marylynnia* Hopper, 1977**

Body 1.5-3.5 mm long. Buccal cavity with one dorsal, two pairs of subventral teeth. Cuticle with transverse rows of dots, lateral differentiation of larger, more widely spaced dots; cuticle pores of two types, simple rounded and longitudinal oval, called lateral modified punctuation (LMPs). Gubernaculum expanded slightly distally with several small teeth, paired; pre-cloacal supplements cup shaped. Tail elongate conico-cylindrical.

Family Comesomatidae Filipjev, 1918

This family is represented by a single genus *Sabatieria* Rouville, 1903

***Sabatieria* Rouville, 1903**

Body 1-3 mm long. Cuticle annulated with transverse rows of punctuations. Amphid multispiral, immediately posterior to the cephalic setae. Buccal cavity cup shaped without teeth. Four cephalic setae. Spicules short, gubernaculum with dorsal apophysis. Pre-cloacal supplements present.

Family Selachinematidae Cobb, 1915

This family is found to be represented by one genus *Halichoanolaimus* de Man, 1886

***Halichoanolaimus* de Man, 1886**

Body 0.5-2.5 mm long. Buccal cavity in two parts, separated by rows of squarish blocks. Cuticle annulated with transverse rows of punctations. Setose pre-cloacal supplements. Tail elongated.

Family Leptolaimidae Orley, 1880

This family is represented by only a single genus *Halaphanolaimus* Southern, 1914

***Halaphanolaimus* Southern, 1914**

Body 1-2 mm long. Buccal cavity elongated, tubular. Four cephalic setae. Cuticle conspicuously annulated. Tubular supplements extend into the oesophageal region. Males with pre-cloacal cuticularised pre-cloacal supplements.

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