Nematodes as Bio-indicator in Wetland Ecosystem

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ABSTRACT

The prevalence of organisms reflect the nature and quality of the environment, thus existing nematode species and the resultant community structure differs in marine, brakish as well as freshwater habitats. Survey were carried out in Indra Gandhi canal area, small ponds of district Jaisalmer, Barmer, Bikaner, Shri Ganganagar, Hanumangarh and also on polluted or sewage drain of district Jodhpur and surrounding areas. Nematodes extracted from the sediment samples and the water samples and studies were made using parameters; nematode density, trophic diversity and species diversity. 65 species and five nematode trophic group were identified according to their morphological structure and mode of feeding: herbivores, bacterivores, fungivores, omnivores and predators. Numerically, bacterivores exceeds all other trophic group in canal water and predator in sewage drain. Indra Gandhi Canal water show greater generic and species diversity of nematodes, which belong to each order of phylum Nematoda as compare to sewage drain. Relatively greater numbers of bacterivores espacially cepholobids in canal water indicate bacterial decomposition. The high density and low species diversity in polluted or sewage water may be due to selected increase in indicator species population that shows particular contamination.

Keywords: Fresh water nematodes, sewage nematodes, taxonomic diversity, India, fauna of IGNP command area.

INTRODUCTION

Rajasthan being the largest state of India constitute 10.4 % of land area of India. Aravalli ranges of hill, divides the state into two major parts, south-east and north-west. The Great Indian Desert or the Thar Desert spreads in north-west part of Rajasthan, is one of the smallest deserts in the world but most thickly populated. There are 24 protected areas in state. Various ecological process takes place within the wetlands and thus freshwater ecosystem contain a high variety of fauna and flora eg. Insects, nematodes, arachnids, crustaceans, mollusks, plants, algae, protozoans, fungi, bacteria and viruses. Nematodes are found in almost every kind of habitat i.e. terrestrial, rivers, lakes, marine, freshwater, ice land etc. as parasites in vertebrate and invertebrate animals and vary in sensitivity to pollutants and environmental disturbance (Bongers and Ferris, 1999), constitute nearly 90% of all Metazoa in number and have 26,642 recorded species (Hugot et al, 2001). Leidy (1851) reported first aquatic nematode species *Tobrilus longus*. Beier and Traunspurger (2001) studied nematode community structure in polluted waters and revealed important results on bio-indicator species. Keeping in view the meager information on aquatic nematodes of Rajasthan, this paper presents a list of nematodes associated with fresh and sewage water.

STUDY AREA

Survey were carried out in Indra Gandhi canal area, small ponds of district Jaisalmer, Barmer, Bikaner, Shri Ganganagar, Hanumangarh and also on polluted or sewage drain of district Jodhpur and surrounding areas. Wet soil samples were collected from the nearby canal as well as from the shore or the bottom of water bodies and sewage drain using shovel.

MATERIAL AND METHODS

Nematodes extracted from the samples by modified Cobb’s sieving and decantation technique. Isolated nematodes were identified up to generic level and population counts were made by using counting dish to get trophic diversity and species diversity. Later nematodes were kept for dehydration to do taxonomic study up to species level.

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\text{Mean Trophic diversity} = \frac{\text{Total number of nematodes of a trophic group in samples}}{\text{Total number of samples collected}}
\]

\[
\text{Mean Specific Diversity} = \frac{\text{Total number of species in all samples}}{\text{Total number of samples collected}}
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\[
\text{Mean Density} = \frac{\text{Total number of nematodes in all samples}}{\text{Total number of samples collected}}
\]
### Table 1. A list of nematodes species recorded from IGNP command area and Sewage drain.

**Order TYLENCHIDA Thorne, 1949**

**Family HOPLOLAIMIDAE, Filipjev, 1934 (Wieser, 1953)**
- *Hoplolaimus indicus* Sher, 1963 [Herbivores]
- *Helicotylenchus dhysteroides* Siddiqi, 1972 [Herbivores]

**Family TELOTYLENCHIDAE Siddiqi, 1960**
- *Tylenchorhynchus mashoodi* Siddiqi & Basir, 1959 [Herbivores]

**Order RHABDITIDA Chitwood, 1933**

**Family CEPHALOBIDAE Filipjev, 1934**
- *Cephalobus parvus* Thorne, 1937 [Bacterivores]
- *Eucephalobus* sp. [Bacterivores]
- *Acrobeles* sp. [Bacterivores]
- *Acrobeles dimorphus* Heyns & Hogewind, 1969 [Bacterivores]
- *Cheiloplacus sclerovaginatus* Sumenkova & Razzhivln, 1968 [Bacterivores]
- *Acrobelloides enoplus* Steiner, 1938 [Bacterivores]
- *Chiloplacus nodihruresis* Rathore & Nama, 1992 [Bacterivores]
- *Cervidellus serratus* (Thorne, 1925) Thorne, 1937 [Bacterivores]
- *Zeldia punctata* (Thorne, 1925) Thorne, 1937 [Bacterivores]
- *Zeldia* sp. [Bacterivores]
- *Zeldia acuta* Allen & Noffsinger, 1972 [Bacterivores]
- *Zeldia minor* Allen & Noffsinger, 1972 [Bacterivores]
- *Stiegellela* sp. [Bacterivores]

**Family PANAGROLAIMIDAE Thorne, 1937**
- *Panagrolaimus chaleographi* Fuchs, 1930 [Bacterivores]
- *Panagrolaimus dendroctoni* (Fuchs, 1932) Rühm, 1956 [Bacterivores]
- *Tricephalobus* sp. [Bacterivores]

**Family RHABDITIDAE Örley, 1880**
- *Protorhabdites* sp. [Bacterivores]
- *Distolabrellus veechi* Anderson, 1983 [Bacterivores]
- *Distolabrellus* sp. [Bacterivores]
- *Cruznema* sp. [Bacterivores]
- *Teratorhabdites* sp. [Bacterivores]
- *Cuticularia* sp. [Bacterivores]

**Family DIPLOGASTRIDA Micoletzky, 1922**
- *Butlerius okai* Rahm, 1938 [Predator]

**Family Neodiplogastridae Paramonov, 1952**

**Order MONHYSTERIDA De Coninck & Schuurmans Stekhoven, 1933**

**Family MONHYSTERIDAE De Man, 1876**

**Order ARAEOLAIMIDA De Coninck & Schuurmans Stekhoven, 1933**
Family LEPTOLAIMIDAE Örley, 1880
Chronogaster daoi Loof, 1964 Bacterivores

Family CYLINDROLAIMIDAE Micoletzky, 1922
Cylindrolaimus obtusus Cobb, 1916

Family RHABDOLAIMIDAE Chitwood, 1951
Rhabdolaimus brachyurus Meyl, 1954 Bacterivores

Family PLECTIDAE Örley, 1880
Wilsonema sp.

Order CHROMADORIDA Chitwood, 1933

Family MICROLAIMIDAE Micoletzky, 1922
Prodesmodora sp.

Order ENOPLIDA (Baird, 1853) Chitwood, 1933

Family PRISMATOLAIMIDAE Micoletzky, 1922
Prismatolaimus parvus Milne, 1963 Bacterivores
Prismatolaimus leptolaimus Andrassy, 1969 Bacterivores

Family TRIPYLAIDAE Örley, 1880
Trichistoma sp. Predator

Order DORYLAIMIDA Pearse, 1942

Family DORYLAIMIDAE De Man, 1876
Dorylaimus sp. Omnivores
Thornenema mauritianum (Williams, 1959) Baqri & Jairajpuri, 1969 Omnivores

Family APORCELAIMIDAE Heyns, 1965
Torumanawa sp.

Family QUDSIANEMATIDAE Jairajpuri, 1965
Ecumenicus monhysterum De Man, 1880 Omnivores
Eudorylaimus chauhani (Baqri & Khera, 1975) Andrassy, 1986 Omnivores
Discolaimus major Thorne, 1939 Predator

Family NORDIIDAE Jairajpuri & Siddiqi, 1964
Kochinema conicaudatum Baqri & Bohra, 2003

Family CARCHAROLAIMIDAE Thorne, 1967
Carcharolaimus masoodi Jairajpuri, 1968

Family LONGIDORIDAE Thorne, 1935
Longidorus sp. Herbivores
Paralongidorus citri (Siddiqi, 1959) Siddiqi, Hooper & Khan, 1963 Herbivores

Family XIPHINEMATIDAE Dalmasso, 1969
Xiphinema basiri Siddiqi, 1959 Herbivores
Xiphinema insigne Loos, 1949 Herbivores

Family BELONDIRIDAE Thorne, 1939
Dorylaimellus (B.) discocephalus Siddiqi, 1964 Fungivores

Family TYLENCHOLAIMIDAE Filipjev, 1934
Tylencholaimus sp. Fungivores
Family LEPTONCHIDAE Thorne, 1935
Leptonchus granulosus Cobb, 1920
Gymnotyleptus sp. Fungivores

Family NYGOLEAIMIDAE Thorne, 1935
Nygolaimus harishi Ahmad & Jairajpuri, 1980
Nygolaimus anneckei Heyns, 1968 Predator

Family MYLONCHULIDAE Jairajpuri, 1969
Mylonchulus minor (Cobb, 1893) Andrássy, 1958 Predator

Family BATHYODONTIDAE Clark, 1961
Bathyodontus cylindricus Fielding, 1950 Predator

Family MONONCHULIDAE De Coninck, 1965
Oionchus obtusus Cobb, 1913 Predator

Order MONONCHIDA Jairajpuri, 1969

RESULTS

Sixty five species and five nematode trophic group were identified according to their morphological structure and mode of feeding; herbivores, bacterivores, fungivores, omnivores and predators. Numerically, bacterivores exceeds all other trophic group in canal water and predator in sewage water. Indra Gandhi Canal water show greater generic and species diversity of nematodes, which belong to each order of phylum Nematoda as compared to sewage drain. Relatively greater number of bacterivores espacially cephalodids in canal water indicate bacterial decomposition. However, high density of a particular one or two species in sewage water indicates particular contamination. Most of the species found in sewage were predators followed by bacterivores.

DISCUSSION

A total of sixty five species were identified from IGPN command area and sewage drain. (Yeates et al., (1993) and Tahsseen, (2006) listed fifty species of nematodes under five trophic groups in the sewage water. As nematodes co-exist together in different ecosystem (Boag & Yeates, 1998), their frequency, density, and diversity varies depending upon ecological and edaphic factors (Sohlenius 1979). In terms of generic diversity, the bacterial feeders were dominant over other groups in canal water and predator in sewage water. However individuals of herbivores were found a few in both ecosystems and most of the nematode species were microbe grazing which have been reported to regulate the rates of decomposition (Seastedt, 1984; Trofymow and Coleman, 1982; Yeates and Coleman, 1982) and nutrient mineralization (Seastedt et al., 1988; Sohlenius et al., 1988).

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