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Population dynamics of Rotifers in Jannapura tank, Karnataka

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Abstract

In this study water quality status of Jannapura tank near Bhadravathi town of Shimoga district was assessed by rotifers analysis during January to December 2008. A total of 05 genera and 08 species of Rotifera belonging to 4 families were recorded. The family Brachionidae consists of 5 species and rest of the families consists of single species of rotifers respectively. The density of rotifers varied from 12 to 145 organisms/litre. The zooplankton analysis showed an average and lower abundance of species in rainy months and maximum occurrence in summer months due to the different environmental and inflow characteristics of the water body. Occurrence of rotiferan species indicates the water quality deterioration and onset of eutrophication in Jannapura tank. In the present study, as per water quality recommended by CPCB, Rawals data and BIS standards, the tank water is not suitable for human consumption and hence, the water body is eutrophic and productive.

Keywords: Rotifera, Jannapura tank, Monthly variation, water quality parameters,

1. Introduction

The knowledge of abundance, species diversity and special distribution of zooplankton is important in understanding trophodynamic and trophic progression of water bodies. Phytoplankton and zooplankton undertake a journey from bottom to surface at the approach of darkness. Light intensity is considered the main factor, in addition to other factors like temperature, pressure, gravity and predators to influence this phenomenon (Sreelatha and Rajalakshmi, 2005; Pawar. 2015) ^[25, 19]. They serve as a link between primary & tertiary production (forming major food source). Density of zooplankton is directly correlated with fishery potential (Pawar. 2015) ^[19].

Rotifera are called Rotatoria or wheel animalcules is group of small, usually microscopic, pseudocoelomate animals which have been variously regarded either as a class of phylum Aschelminthes, or as a separate minor phylum. They are ubiquitous, occurring in almost all types of fresh water habitats, from large permanent lakes to small temporary puddles and feed on algae and bacteria. Being prey for plankton feeders, Rotifers play a crucial role in many freshwater ecosystems. They are permanently and obligatorily connected to aquatic habitats in all active stages, only their resting stages are draught resistant (Hendrik, 2007) ^[11]. Rotifer distribution and diversity is influenced primarily by deteriorating quality of water in freshwater ecosystems and secondarily by eutrophication and salinization. The nutrients, primary production, temperature, abundance of predators and competitors, and potential food resources are important factors influencing the structure of rotifer community (Devetter, M. and Sed'a, 2003; Ekhande *et al.*, 2013) ^[7, 10].

There has been lack of studies regarding the population of rotifers from Jannapura tank, Karnataka. Keeping this in view, the aim of the present study was to collect, identify and to determine monthly variations of density of rotifers.

2. Materials and Methods

Study area

Jannapura tank is located near Bhadravathi town in Shimoga district of Karnataka (13o48'37"-13o52'30"N & 75o40'42"-75o43'33"E) and it is perennial one and receives the water from Bhadra left bank channel as well as rain water. The area of the tank is about 20 ha and depth around 5-10mt. This water body is utilised for irrigation and fish culture.

Water samples were collected by using good quality polythene bottles on monthly basis,

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between 8 to 10 AM from January to December 2008. Water temperature and pH were recorded at the sampling site itself. Dissolved oxygen was fixed on the spot itself in BOD bottles. Other water quality parameters were estimated as per the standard methods of APHA (1998) [1].

Zooplankton Analysis

Zooplankton were collected at monthly intervals. The plankton net made of bolting nylon silk of mesh size 50 µm is used for collection of zooplankton and which is conical shape and reducing cone with the bottle at its end. For a precise collection, the plankton net is towed horizontally and obliquely (for Qualitative) in surface water of the study area. About 100 liters of water is filtered by passing water through plankton net. Samples were then washed into wide mouth bottles and were preserved by adding 5% formaldehyde solution. Further analysis was done by putting 1 ml of the preserved sample on a Sedgwick-Rafter counter cell and studying it under an

inverted microscope. For qualitative analysis, the keys given in Edmondson (1959) [9], Needham and Needham (1962) [17], Pennak (1978) [20], Tonapi (1980) [27] and APHA (1998) [1] were utilized and results were expressed as Organisms per liter (O/L).

3. Results

Zooplankton Analysis

Table 1 depicted diversity of rotifers in Jannapura tank. During the present study, 5 genera and 8 species of rotifers were recorded and the species spectrum include *Keratella tropica*, *Brachionus calyciflorus*, *Brachionus caudatus*, *Brachionus quadridentatus*, *Brachionus falcatus*, *Hexartha*, *Rotaria sp.*, *Filina longiseta*. Figure 1 shows percentage composition of Rotifer families in Jannapura tank the density of rotifera varied from 12 to 145 O/L. The maximum number of rotifers (145 O/L.) were recorded during February 2008 and the number was minimum with 12 o/L during August 2008 (Figure 2).

Table 1: Diversity and Classification of rotifers in Jannapura tank during 2008.

Class - Monogonota Order - Ploimida Family - Brachionidae <i>Brachionus calyciflorus</i> <i>Brachionus caudatus</i> <i>Brachionus quadridentatus</i> <i>Brachionus falcatus</i> <i>Keratella tropica</i>	Class - Bdelloidea Order - Bdelloida Family - Philodinidae Genus - Rotaria <i>Rotaria sp.</i>	Order- Flosculariacea Family - Filinidae Genus - Filina <i>Filina logesita</i>	Class-Eurotatoria Order- Flosculariaceae Family-Hexarthridae <i>Hexartha sp.</i>
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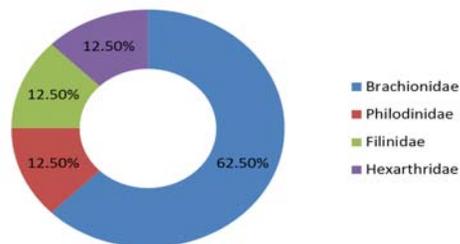


Fig 1: Percentage composition of Rotifer families in Jannapura tank

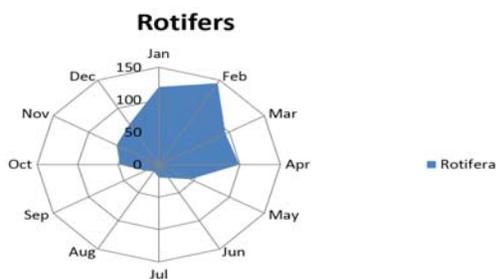


Fig 2: Radar diagram showing monthly abundance of rotifers (O/L) in Jannapura tank during 2008

Water Analysis

Water quality data of Jannapura tank is compared with CPCB, WHO and Rawal’s standards and the results are tabulated in Table 2. The water temperature deviated from 22.5°C to 32°C and pH of the water was alkaline in nature. Sulphate level fluctuated from 48.6 to 70.8 mg/L respectively. Maximum Dissolved oxygen level of 4.8 mg/L and minimum of 2.4 mg/L was recorded. BOD level varied from 6.8 to 16.8 mg/L. Calcium content ranged 18 to 50 mg/L but magnesium content was slightly lower than calcium and ranged between 16 and 40 mg/L. However, the nitrate and phosphate contents were deviated from 14.6-54.4 mg/L and 0.28-2.08 mg/L respectively. The water body receives sewage water from surrounding areas and the depth of the tank is slowly reduced due to deposition of silt from surface runoff. As per CPCB (1995), WHO (1971, 2004) and Rawals (1978) standards and it is found that, tank water is included under eutrophic category having low DO and high BOD, phosphate and nitrate.

Table 2: Water quality parameters of Jannapura tank compared with CPCB, WHO and Rawal’s standards.

Parameter	Jannapura tank	Maximum permissible limit, CPCB (1995)	WHO (1971,2004)	Permissible limit, Rawals data(1978)
pH	7.6-8.1	6.5-8.5	7.0-8.5	6.5-8.5
BOD (mg/L)	6.8-16.8	30	6.0	-
Calcium (mg/L)	18-50	75	200	75
Magnesium (mg/L)	16-40	-	150	50
NO ₃ (mg/L)	14.6-54.4	45	10	-
Chloride (mg/L)	161.5-188.4	200	250	-
Sulphate (mg/L)	48.6-70.8	200	400	-
Total hardness (mg/L)	244-360	-	500	150
Phosphate mg/L	0.28-2.08	-	-	2

4. Discussion

In the aquatic habitat plankton play a critical role not only in converting plant food to animal food but also serves as source of food for their organisms (Rajashekhar *et al.*, 2010; Madhusudhana Rao *et al.*, 2014)^[21, 15]. Bharati *et al.*, (2014)^[4] reported that the abundance of Rotifer species such as *Brachionus* indicates nutrient rich water body which may undergo the state of eutrophication. From the different parts of the world about 1700 species of rotifers have been described and 500 species (only 330 species belonging to 63 genera and 25 families have so far been authenticated) were described from Indian water bodies (Arora and Mehra, 2003; Kiran *et al.*, 2007; Tanmay Datta, 2011)^[2, 13, 26]. In this study, *Brachionus* species (04 species) was found to attain numerical superiority in rotifer population. *Brachionus* species are considered typical for and most frequent in tropical environment (Nogueira, 2001; Mulani *et al.*, 2009; Tanmay Datta, 2011)^[18, 16, 26].

Brachionus species are very common in temperate and tropical waters (Hutchinson 1967)^[12], indicates alkaline nature of water. According to Dirican *et al.*, (2009)^[8] permanent dominancy of rotifer species such as *Brachionus* and *Keratella* are indicative of eutrophic condition and their abundance was due to the presence of high levels of organic matter in the tank. Abundance of rotifer species in the present water body which is due to the discharge of different wastes into the tank such as agriculture runoff, sewage etc. (Kolhe *et al.*, 2013; Bharati G. Kolhe *et al.*, 2014)^[14, 4].

Rotifers are considered as indicators of water quality assessment (Berzens and Pejler, 1989)^[3]. More work is still required to designate regional indicator species from different parts of India. It is presumed that rotifers utilize the nutrients as well as phytoplankton more rapidly to build up their population. This may be the reason for the worldwide distribution of rotifers (Pennak, 1978)^[20].

Sakhre and Joshi (2006) reported 8 species of rotifers in Yeldari reservoir, India. Madhusudhana Rao *et al.* (2014)^[15] recorded 9 species of Rotifers from perennial pond at Lake Kolleru Region of Andhra Pradesh. In their study the genus *Brachionus* was the dominant group. Hence, our findings were similar to the study of Sakhare and Joshi (2006)^[22]. The present investigation also supports the findings of Sharma and Capoor (2010)^[23]. Presence of rotifera in the water body indicates the water quality deterioration and onset of eutrophication at alarming rate (Sharma *et al.*, 2010)^[24]. From the present study it is suggested that rotifer fauna of Jannapura tank of Bhadravathi taluk can be linked with favorable conditions and availability of abundant food. Detailed study in the future will ensure to yield new insight into the actual status of rotifer fauna.

5. Conclusion

Based on physico-chemical relationship with zooplankton of Jannapura tank the water is not suitable for human consumption as it possess higher values of phosphate and nitrate due to incoming sewage. The species such as *Brachionus*, *Keratella*, *Filina*, indicate organic pollution as an account of disposal of sewage and human anthropogenic activities. The tank can be conserve and manage by the concerned authorities. Hence, there is an urgent need to control the discharge of sewage from residential areas.

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