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Determination of Rotifer Distribution to TROPHIC NATURE OF PONDS

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ABSTRACT *Many scientific investigations reveal that the rotifers are good biological indicators of a particular ecological condition. Some studies have been carried out in establishing species which may serve as indicators of particular types of water quality. With the upcoming of synthetic society the problem of getting good quality of water and related things become obscure. Some of the planktons living in specific environment necessarily not found elsewhere. Rotifers, Copepoda and Cladocerans are common components of freshwater zooplankton communities. Among the zooplanktons especially the species belonging to Rotifera are best indicators of water quality, aquatic pollution and tropic nature of a given environment. Rotifers are most common components of freshwater zooplankton community. Species of the genus Brachionus are sensitive to changes in the water quality. Consequently their use as standard bioassay organisms has been universally recognized (APHA, 1998). Information on the acute toxicity tests of lead (Pb) on Brachionus is available in literature (Snell & Janssen, 1995, Legaspi & Rico 2001). The role of some of the Rotifers in the determination of trophic nature of ponds is discussed in the present investigation.*

Introduction

Ruth Patrick (1950) summarizing the results of biological measure of stream conditions, laid stress on the biodynamic cycle. The measure of water quality is the basis for his concept. Physical and chemical analysis involve long drawn out processes, a concept also supported by De Meester et al., (2005). Devetter (1998, 2003) had the opinion that 'the physical and chemical natures of clean water vary a great deal and hence it becomes difficult to declare water healthy merely on the basis of chemical analysis. A simple chemical constituent never acts independently as a limiting factor but it is the interaction of many factors that constitutes an environment. The studies on the biological indicators are therefore more dependable in the assessment of water quality'.

The importance of micro- and macro- invertebrates as indicators of the trophic nature of water has been realized by many workers. Classical contributions have been made to such studies by Ruth Patrick (1950), Arora (1966), Walsh (1993) and Jack et al (1996). Kolkwitz and Marsson (1909) classified the organisms into three distinct categories depending upon the ecological niches which they inhabit. Those occupying clean water were named Oligosaprobic; semiclean, mesosaprobic and grossly polluted zones as polysaprobic.

Materials and Methods

To understand the role played by planktons in the determination of trophic nature of different environments, present work was carried out on five different localities in the city of Vizianagaram belonging to the state of Andhra Pradesh, India. They include moderately polluted (Pond-1), semi clean (Pond-2), polluted (Pond-3), clean (Pond-4) water bodies and highly polluted sewage ditch (Pond-5).

While certain populations of planktons were observed to be more abundant in certain habitats, others completely absent or found in limited number in certain other habitats. When a study was made to understand the inter relationship between hydrographical parameters and bio-composition in relation to trophic nature of ponds was studied, many interesting results were obtained. These observations led to the following conclusions:

1. Some species of rotifers can survive only in certain specific environments.
2. Certain species appear in abundance in certain environments while they were in limited in other areas.
3. The physical and chemical factors like temperature, turbidity, dissolved oxygen; hydrogen-ion concentrations play an important role in controlling the abundance of rotifers.
4. The pH of natural waters usually varies between pH 06 and 09. It is only under certain circumstances that the pH of natural waters is more acidic or more alkaline than these levels. A common factor causing pH levels to rise over 09 is intense photosynthetic activity resulting from algal growth in enriched waters causing eutrophic condition (Gabriela & Paez, 2005).
5. The chemical factors such as the carbonates, bicarbonates, chlorides and hardness also play important role in controlling the abundance and species composition of rotifers. As a whole, it results into specific identification of trophic nature of a particular environment.

Observation

The solid waste products such as sewage, domestic wastages, plastics, wastes from slaughterhouses, food industry, agricultural products, pesticides, heavy metals (Pb,Zn,Cu,Al etc.) are dumped regularly into these ponds from many years. Metals such as copper and cadmium may eventually reach aquatic ecosystems affecting the planktonic communities through their influence on the prey-predator interactions. The impact of all these pollutants is so heavy that species diversity of the ponds change much frequently.

Planktons as indicators of Pollution

As revealed from the present study Filina longiseta, Brachionus, and Rotatoria were obtained from ponds in heavy pollution i.e., pond-1, pond-3 and sewage ditch. Some others like B.bidentata and B. urceolaris were obtained from moderately polluted waters.

As indicator of Water Quality

Presence of Fillinia, Rotatoria, Polyarthra and Epiphanes indicate poor water quality (observed in pond-3 & sewage ditch), while Monostyla, Asplanchna, Euchlanis and Keratella indicate comparatively better water quality as observed in water reservoir.

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Dissolved Oxygen
Rotifers respire by their whole body since they do not have respiratory organs. They were unable to live in anaerobic conditions. Rotatoria neptunia and R.rotatoria, obtained from sewage ditch and pond-3 indicate that they can tolerate micro aerobic habitats, showing poor DO_2 content in the ponds.Keratella cochlearis, B.urceolaris and Monostyla bulla were found in water where good sunlight falls up to the depth. Lecanes and more algal bodies were observed in the water reservoir where more numbers of hydrophytes were found.

Chloride content
The chloride content in the body regulates badly the process of osmoregulation. L.ovalis, Heliodiaptomous, Cypris, Heterocypris and P.vulgaris were found in ponds having low chloride contents. Lecane luna could tolerate chloride content up to 25-60 mg/lt. Hexarthra fennica, Cypris and B. Plicatilis had shown high chloride toleration capacity.

Indicators of pH Concentration
In ponds having pH of water above 7.5(7.5-9.0ppm) such as pond-1, pond-3 and sewage ditch; following rotifers were recorded e.g., B. plicateles, B. calyciflorus, B. quadridentata, Hexathra, and Polyarthra vulgaris, Whereas ponds those having pH below 7.5(6.0-7.4ppm), following rotifers were noticed, they were Chironomous larvae, Keratella cochlearis, Lecane papuna and Lecane lunaris. pH below 7.5 was obtained at several occasions in pond-2 and water reservoir after fresh spell of rain. Rotifers such as B. angularis, B. caudatus and Lepadella having better tolerance for alkalinities were obtained from both the ponds.

Variation of Temperature
Mytilina ventralis were obtained when the water temperature was above 30 degrees, while B. urceolaris, Asplancha seiboldi, Pompholyx sulcata and Hexarthra fennica were recorded below 20 degrees. Rests of the rotifers were obtained between 20-30 degrees range of temperature.

Fertility of ponds
In the plankton samples of pond-1 and pond-3, B. bidentata, B. calyciflorus, B. caudatus and F.longiseta were observed indicating eutrophication of water. When the ponds were fertilized with Calcium lime for production of fisheries B.forficula and Hexarthra population was rich. It is felt that the rich increase of zooplanktons such as euglena, blue green algae (Mycrocystis) and large number of chlorophycea help in the random increase of rotifers. In shallow water bodies, turbidity is generally high because of mixing of bottom sediments by wind action or by movement of macroscopic invertebrates or by fishes. This brings particles with adsorbed toxicants into the water column and eventually, as they were ingested by zooplankton and fish, they have an adverse effect on their demography.

In addition to the above-described species, some others rotifers were also considered as indicators of eutrophy. The species like K.cochlearis, P.vulgaris, P.remata, B.caudatus, B.forficula, A.intermedia, Platyias quadricornis & Pedalia fennica exclusively been collected from eutrophic areas like pond-1. Epiphanus clavulata, Eosphora najas, Rotaria neptunia and Rotaria rotatoria have been recorded only from heavily polluted waters.

Conclusion
Owing to urbanization and large scale destruction of natural habitats, the ponds are now on the way to extinction. Some of the ponds which used to contain a bizarre biodiversity are now sinking for obliteration. Men made urbanized depositions are not only causing destruction of rich biological forms but also imbalance of aquatic ecosystem. Studies carried out by Yi-Lomg Xi, Xiao-ping and Zhao-Xia Chu (2006) had shown that DDT, Dicophol, Estradiol and other pesticides do had a direct impact on growth, fecundity and survival of rotifers.

Similarly, the Plankton distributions in these ponds too vary as per the growing level of pollution. It was noticed that the zooplankton fauna comprising of Rotifers like Filinia, Brachionus, Rotatoria, Polyarthra and others such as Neodiaptomous striglipes, Heliodiaptomous and Phylodiaptomous, Mesocyclops leucarrta, Microcyclops varicans and Thermocyclps crasas populations were at their peaks during high pollution levels corresponding to the bacterial, algal and euglenoid population. Devetter (1998, 2003) had the opinion that 'the physical and chemical natures of clean water vary a great deal and hence it becomes difficult to declare water healthy merely on the basis of chemical analysis. A simple chemical constituent never acts independently as a limiting factor but it is the interaction of many factors that constitutes an environment. The studies on the biological indicators are therefore more dependable in the assessment of water quality'.

REFERENCE
American public Health Association 1979 (APHA). "Standard Methods for the Estimation of | water and Wastewater" U.S.A. | | A.P.H.A., A.W.W.A., W.P.C.F., 2002. "Standard Methods for the Estimation of water | and Wastewater". Amer. Public Health Assoc., Washington, 874 pp | | Aramen Iván -Meléndez, & Jonathan R. Sánchez-Ortíz, Sarma & Nandini- Combined effects of | temperature and heavy metal (Pb) on the population growth of the rotifers B. havanaensis | and Brachionus rubens.Hydrobiologia,(2007) | | Arora, H.C., 1966b. Studies on Indian Rotifera V. On some species of the genera of the family | Brachionidae, Sub-Family Brachioninae from India. Arch. Hydrobiol. 61: 482-493. | | Arora, J and N.K.Mehra., 2003. Limnology unit, D.U, Delhi.Seasonal dynamics of Rotifers in relation to physical and chemical conditions of the Yamuna ,India. Hydrobio491: 101-109, 2003. | | Cereghino R.J.Bigs.B.Oretli,S.Declerck,,2008.,Ecology of European ponds, Hydrobiologia 597:1-6 | | Choudhury, A.H. & A.A.Mamun,2006.,Physico-chemico conditions and planktonic population of two fish ponds of Khulana,Bangladesh.Univ.j.Rajasahi;25:41-44. | | De Meester,L.S.,De clerck,stocks,R.,2005.,Ponds and pools as model system in conservation | Biology:Aquatic conservation-marine & fresh water ecosystems 15:715-726 | | Duncan, A., 1984. Assessment of factors influencing the composition, body size and turnover rate of Zooplankton in Parakrama Salmdra,an irrigation reservoir in Sri Lanka. Hydrobiologia 113:201-215. | | Gracia G.G., B.Nandini.Sarma S.S.S.,Paez .,2007,Combined effect of sediments and lead on | Brachiounus, Hydrobiologia 393:209-218. | | I.Elizabeth,C.Soto,Nandini & Sarma,2007,Combined effect of algal food concentration & | temperature on population of brachionus,Rotifera XI,Mexico. | | José Luis Gama-Flores, M de J Ferrara-Guerrero, S.S.S. Sarma & S. Nandini,2006.,Influence of | heavy metal (Cu and Cd) exposure time and concentration on the predator's (Asplanchna brightwelli) population growth. Rotifera XI, Mexico. | | Jose Luis Gama-Flores, M .E. Castellanos-Paez, S.S.S. Sarma & S. Nandini.,2006.,Effect of pulsed exposure to heavy metals (Cu and Cd) on some population variables of Brachionus calyciflorus Pallas (Rotifera: Brachionidae), Rotifera XI Mexico 2006. | | Rao, T. R. & S. S. S. Sarma, 1988. Effect of food and temperature on the cost of reproduction in | Brachionus patulus (Rotifera). Proc.Indian natn. Sci. Acad. B54, No. 6: 435–438. | | Snell, T.W., 1998.Chemical ecology of rotifers, Hydribiolo 387/388:267-276 | | Sheffer ,M.Geest. Zimmer.K.,Sodergard De Meester,2006.,Second order effects of biodiversity in | shallow water ponds,Oikos 112:227-231 |