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Seasonal variations with physico-chemical correlation of *B. plicatilis* in Lonar Meteorite Crater, India.

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ABSTRACT

In present study, *B. plicatilis* species of rotifers and their seasonal variation were determined along with physical and chemical parameters of water from April 2009 to March 2010. The correlation of rotifers population relative to physical-chemical characteristics varied in different sites. However, *B. plicatilis* expressed, usually, positive correlation with water temperature, pH, TS, TDS, Cl-, Salinity and EC. The positive correlation has indicated that the abundance of *B. plicatilis* has significantly positive correlation with temperature as there was an increase in all chemical parameters such as water temperature, pH, TS, TDS, Cl, Salinity and EC in the Lonar lake water.

KEYWORDS

B. plicatilis, correlation coefficient, Lonar Lake

Research Article

INTRODUCTION

Despite the worldwide simplicity of highly saline lakes, in terms of biological diversity, ecosystem structure and habitat homogeneity, no complete picture of the ecology of any salt lake has yet been produced (Williams, 1996). Lonar Crater is an impact crater situated in the Buldana District of the Indian state of Maharashtra. Geologically located at Latitude 19^0 58'45''N and Longitude 76^0.50' Altitude 1852 ft, of the lake is 1.83 km (6000 feet) in diameter and 170 meter in depth and its age is estimated to be 52000 ± 6000 years in the late Pliocene (Fudali, 1980). Mythology associated the crater with the underground abode of demon Lonasura, who was killed by Lord Vishnu. Scientific studies were carried out in recent times attribute the probable origin of Lonar crater by the impact of large meteoritic body (Mahabal, 2008). It is the largest impact crater in basaltic rock and partially filled by saline water. It was also once thought of to be volcanic origin. The crater was first noticed by an Englishman, C J E. Alexander in 1823. Lonar crater is now recognized as an impact crater created by a hypervelocity impact comet or meteorite. The study of seasonal fluctuations in Physico-chemical variables and the inter-relationship with zooplankton communities were carried out by Marsh (1899), Beach (1960), King (1972). The study of ecological fluctuations of rotifera were carried out by Sharma and Srivastava (1986), Shayestehfar (1995), Bezerra et al., (1999), Neves et al., (2003).

The aim of this study is to determine annual cycle of zooplankton also the effective limnological parameters. Since the monthly densities of zooplankton with co-relation of physico-chemical parameters in Lonar Lake are firstly described in this study, it can be contribute to related studies.

MATERIALS AND METHODS

The zooplankton samples were collected monthly from the selected 3 sites from April- 2009 to March 2010. For zooplankton samples, sampling was done by filtering the 40 lit of water by using plankton net of 50µ mesh size. Samples were collected from the surface (0.5 m). Zooplankton samples were preserved in 4% formalin at the site itself. Observation and identification was done in the laboratory as per suggested by (Koste, 1978). The quantitative analysis of zooplanktons was done by using Sedgwick rafter cell and Lackey's drops method (APHA, 1991., Trivedy and Goel, 1887). The water quality parameters were analyzed using the methods described by APHA (1991). Temperature, pH (Hanna pH Meter), TS, TDS, Chloride, Salinity and electric conductivity were measures by using EC-TDS Analyzer (Elico, CM 183).

Statistical Analysis: The relationship between the different physico-chemical studied parameters with *B. plicatilis* were assigned by computing the correlation coefficients (r) using Microsoft Office Excel (2003).

RESULTS

The monthly average density of *B. plicatilis* was observed 56.2±10.3, 55.2±10.1 and 55.7±10.2 org/100 ml at site A, B and C respectively. In the present study, *B. plicatilis* possessed a strong positive relationship with water temperature, pH, TS, TDS, Cl^-, salinity and EC at $P< 0.05$ (r = 0.87, 0.40, 0.87, 0.78, 0.50, 0.82 and 0.83 at site

A, 0.87, 0.36, 0.84, 0.76, 0.51, 0.86 and 0.84 at site B and 0.89, 0.21, 0.88, 0.81, 0.85, 0.85 and 0.84 at site C). Water temperature average ranges from 26.8 ± 1.9, 27.3 ± 1.9 and 27.6 ± 1.9^{0}C at site A, B and C. water temperature values are positive correlation with pH, TS, TDS, Cl^-, salinity and EC at P< 0.05 (r = 0.35, 0.77, 0.71, 0.71, 0.55, 0.94 and 0.97 at site A, 0.43, 0.84, 0.71, 0.54, 0.94 and 0.97 at site B and 0.27, 0.86, 0.82, 0.94 and 0.97 at site C). The average ranges of pH values were 9.6 ± 0.18, 9.8 ± 0.19 and 9.9 ± 0.20 at site A, B and C respectively. The pH values possessed a strong positive relationship with *B. plicatilis*, water temperature TS, TDS, Cl^-, salinity and EC at P< 0.05 (r = 0.50, 0.72, -0.10, 0.14, 0.28 at site A, 0.63, 0.78, 0.07, 0.31, 0.37 at site B and 0.34, 0.46, 0.05, 0.05, 0.20 at site C. The average range total solids 9685±541.5, 9657.4±599.1 and 9610±613.7 mg/l at site A, B and C respectively.

Table 1: Monthly Variation and Density of *Brachionus plicatilis* (org/100ml)

Parameter	Year 2009-10 Sampling Site		
	A ð ± SE	B ð ± SE	C ð ± SE
B. Plicatilis (org/100ml)	56.2 ±10.3	55.2 ±10.1	55.7 ±10.2
Water Temperature (C^0)	26.8 ±1.9	27.3 ±1.9	27.6 ±1.9
pH	9.6 ±0.18	9.8 ±0.19	9.9 ±0.20
Total Solids (mg/l)	9685.5 ±514.5	9657.4 ±599.1	9610.5 ±613.7
Total Dissolved Solids (mg/l)	7962.4 ±480.2	7693.5 ±555.0	7817.6 ±559.8
Chloride	3191.8 ±204.4	3185.5 ±208.7	3219.9 ±210.0
Salinity	5.75 ±0.36	5.75 ±0.37	5.81 ±0.37
Electric Conductivity	19273.5 ±764.9	19423.7 ±756.2	19493.4 ±746.8

Figure 1- *B. plicatilis* correlates with chemical Parameters at Site –A

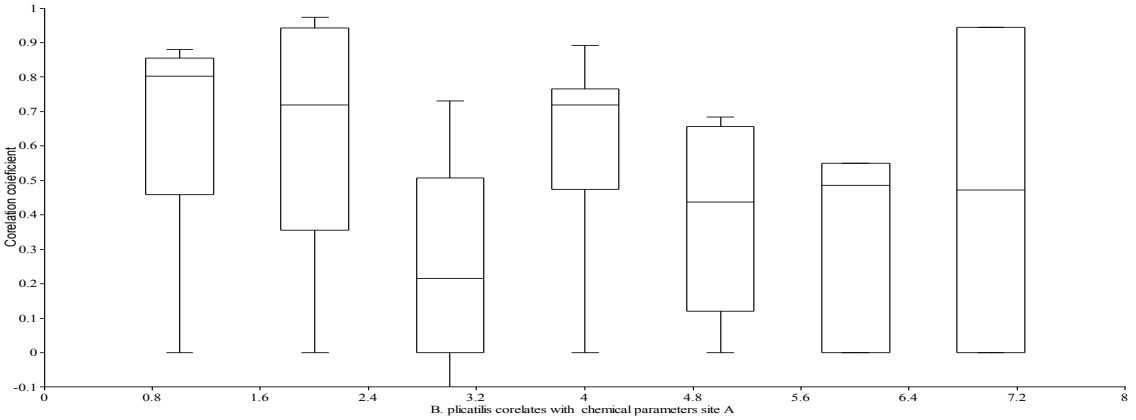


Figure 2- *B. plicatilis* correlates with chemical parameters at Site-B

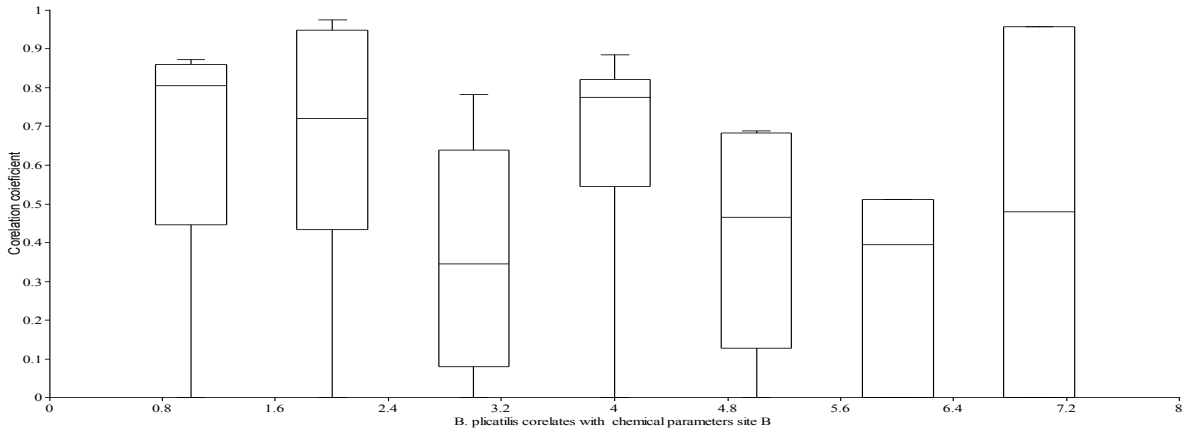
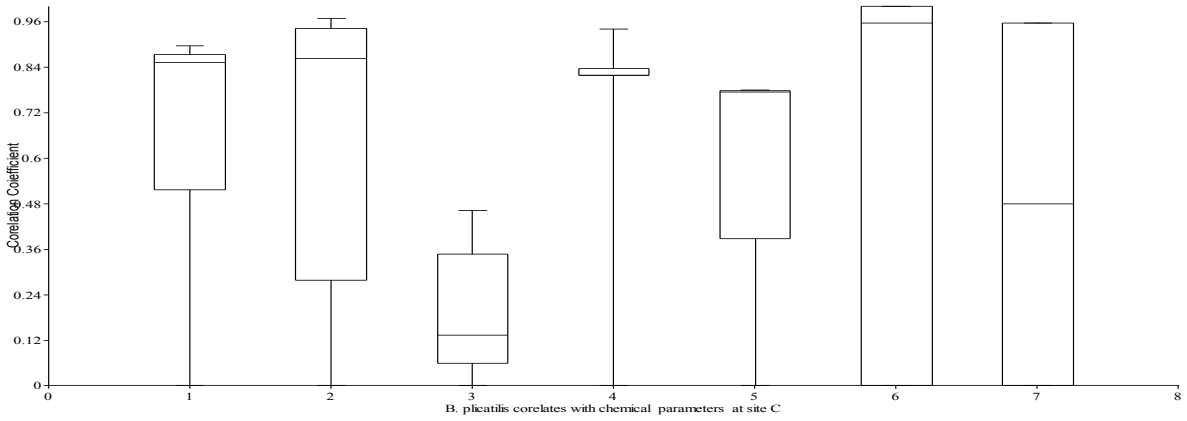


Figure 3- *B. plicatilis* correlates with chemical parameters at Site-C



The Total Solids values possessed a strong positive relationship with pH, TDS, Cl^-, salinity and EC at P< 0.05 (r = 0.09, 0.89, 0.47, 0.71, 0.76 at site A, 0.02 0.88, 0.54, 0.77, 0.82 at site B and 0.26, 0.94, 0.81, 0.81, 0.83 at site C). The average range of total dissolved solids was 7962.4±480.2, 7963.5±555.0 and 7817.6±559.8 mg/l at site A, B and C respectively and these Total Dissolved Solids values possessed a strong positive relationship with Cl^-, salinity and EC at P< 0.05 (r = 0.24, 0.63, 0.68 at site A, 0.25, 0.67, 0.68 at site B and 0.77, 0.77, 0.77 at site C). The average range of chloride was 3191.8±204.4, 3185.5± 208.7 and 3219.9±210.0 mg/l at site A, B and C respectively and these chloride values possessed a strong positive relationship with salinity and EC at P< 0.05 (r = 0.48, 0.54 at site A, 0.39, 0.51 at site B and 1, 0.95 at site C).The average range of Salinity 5.75±0.36, 5.75±0.37 and 5.81±0.37 mg/l at site A, B and C respectively and these salinity values possessed a strong positive relationship with pH and EC at P< 0.05 (r = 0.64, 0.94 at site A, 0.31, 0.95 at site B and 0.85, 0.95 at site C). The average range of Electric conductivity was 19273.5±764.9, 19423.7±756.2 and 19493.4±746.8 mg/l at site A, B and C respectively and these values possessed a strong positive relationship with pH at P< 0.05 (r = 0.37 at site A, 0.23 at site B and 0.52 at site C). The abundance of *B. plicatilis* has significantly positive correlation illustrated with graphs 1, 2 and 3.

DISCUSSIONS

These results indicate that the population dynamics of rotifers was strongly influenced by physico-chemical parameters of water during the period of observation (Ruttner-Kolisko, 1972). Since rotifers are opportunistic organisms, their population changes in relation to environmental conditions. Temperature is one of the essential and changeable environmental factors, since it influence the growth and distribution of flora and fauna. Water temperature range between 13.5 and 32 ^{0}C is reported to be suitable for the development of the planktonic organisms (Baloch et al., 2008). The abundance of B. plicatilis has significantly positive correlation with temperature as there was an increase in temperature in the lake. Similar results have also been obtained in various other studies (Malik et al., 2004, Baloch et al., 2008) and it had been found that the correlation coefficients between B. plicatilis were positively dependent on water temperature.

The pH of a solution is the negative common logarithm of the hydrogen ion activity pH= -log (H^+). In dilute solution, the hydrogen ion activity is approximately equal to the hydrogen ion concentration WHO, (1996). The pH value of the lake influences the chemical states of nutrients such as phosphates and ammonia and the form in which metals will be found. The Lonar Lake is always alkaline, observed pH value ranges from 10 to 10.5. (Dabhade, *et al*., 2006, Siddiqi, 2008, Satyanarayana, *et al*., 2008). The abundance of *B. plicatilis* has significantly positive correlation with pH as there was an increase in pH in the Lonar lake and this results indicated that the correlation coefficients between B. plicatilis were positively dependent on pH.

Solids refer to suspended and dissolved matter in water. They very useful parameters describing the chemical constituents of the water and can be considered as a general of edaphic relations that contribute to productivity within the water body, (Goher, 2002). The abundance of *B. plicatilis* has significantly positive correlation with total solids (TS) as there was an increase in total solids in the Lake. Similarly, the population density of *B. plicatilis* has positively correlated with Total dissolved solids, Chloride, Salinity and EC as there was increase these parameters as there was an increase in abundance of *B. plicatilis* with increase TDS, Cl^-, Salinity and EC of Lake water.

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