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TEMPORAL VARIATION IN PHYSICO-CHEMICAL AND PHYTOPLANKTON ANALYSIS IN A DESERT WATER BODY, CHURU(RAJASTHAN)

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ABSTRACT

In desert region aquatic ecosystems are in the form of small man made reservoirs known as Johra, perennial lake and small canal systems. Water is the most important limiting factor in harsh climatic conditions. Johra was conceived in this region to overcome adverse environmental conditions. Phytoplankton diversity responds rapidly to changes in the aquatic environment. The present study was made to explore the diversity and ecology of phytoplankton in Sethani ka Johra in Churu (27^0 24'N to 29^0 00' N latitude and 73^0 40' E to 75^0 41' E longitude). The study was carried out for a period of six months (January 2022 to June 2022). Physico-chemical limnology revealed that the pond was shallow with turbid, alkaline, hard and well oxygenated water. Phytoplankton was represented by six classes: Zygnematophyceae, Zygnemophyceae, Chlorophyceae, Bacillariophyceae, Myxoophyceae and Euglenophyceae.

Keywords: Phytoplankton, Limnology, Johra and Diversity.

Introduction:

Rajasthan is known as the desert state as it covers more than 60% desert, while Gujarat covers 20% of the total area. About 40% of total state population lives in desert region and having 83 people/km^2 population density. In desert region aquatic ecosystems are in the form of small man made reservoirs known as Johra, perennial lake and small canal systems. Water is the most important limiting factor in harsh climatic conditions. Johra was conceived in this region to overcome adverse environmental conditions. Phytoplankton diversity responds rapidly to changes in the aquatic environment. The present study was made to explore the diversity and ecology of phytoplankton in Sethani ka Johra in Churu (27^0 24'N to 29^0 00' N latitude and 73^0 40' E to 75^0 41' E longitude. The study was carried out for a period of six months (January 2022 to June 2022). In ponds where nitrogen is limiting, organic and inorganic fertilization programme may be directed towards increasing the availability of nitrogen for phytoplankton (Hargeves, 1998).

Objectives:

The present work aimed to study Temporal Variation in Physico-Chemical and Phytoplankton Analysis in a Desert Water Body, Churu (Rajasthan).

Study area:

Churu is located in the state of Rajasthan in northwestern India. The present study was made to explore the diversity and ecology of phytoplankton in Sethani ka Johra in Churu (27^0 24'N to 29^0 00' N latitude and 73^0 40' E to 75^0 41' E longitude. The study was carried out for a period of six months (January 2022 to June 2022). The Johra is situated in the west of Churu city at triangle of Ratangarh and Sardarshahar roads about 5 km. away from Churu.

Materials and Methods:

The study was carried out in the month of January 2022 to June 2022 at three study stations. Water samples were examined for water temperature, pH, electrical conductance, total dissolved solids, dissolved gases (oxygen carbon dioxide), alkalinity and hardness. The chemical analysis was done by following the standard methodology of APHA-AWWA-WPCF. For parameters like temperature, pH, electrical conductance and total dissolved solid, respective meters were used. Transparency was recorded with the help of a standard secchi disc. Phytoplankton samples were collected from water. They were collected with plankton net of blotting silk (no. 25, .03 mm mesh). The samples were preserved in modified Lugol's solution (Vollenweider, 1996). Identification of phytoplankton was done with the help of standard works (Fritsch 1935, Desikachary 1959, Randhawa 1959).

Results and Discussion:

Physico-chemical limnology revealed that the pond was shallow with turbid, alkaline, hard and well oxygenated water. Water temperature was ranged from 21.3 ^{O}C to 38.5 ^{O}C and average value of temperature was recorded as 28.65 ^{O}C. The annual average of water temperature in desert region was reported by Rukasana (2017) upto 23.93 20°C and Srivastava (2009) upto 24°C. Value of transparency of water was 0.5 m. High value of turbidity was 80 JTU. Rukasana (2017) also observed transparency as 0.44 m in desert water. The Secchi disc transparency is essentially the function of the reflection of light from its surface and therefore, influenced by both the absorption characteristics of water and of its dissolved and particulate matter (Akbar, 2014). Transparency of water is inversely proportional to turbidity, which in turn directly proportional to the amount of suspended organic and inorganic matter (Saxena, 2001). Electrical conductance and total dissolved solids were maximum in June month. pH was recorded from 8.0 to 8.7 over the study period. Sharma R. *et al.* observed values between 6.9 to 9.2. It increases during day largely due to photosynthetic activity (consumption of CO_2), whereas decreases at night due to respiratory activity. Factor like exposure to air, temperature and disposal of industrial wastes also bring about changes in pH (Saxena, 2001). DO values fluctuating between 2.9 to 5.8 mg/l. The recommended DO concentration for healthy and productive water body is 8 mg/l (Wetzel, 1973). Variation of oxygen in water depends upon the temperature of water, which influence oxygen solubility (Zutshi & Vass, 1979). Dissolved oxygen in water is a very important parameter of water quality and is an index of physical and biological processes going on in water (Saxena, 2001). Srivastava (2009) recorded average of dissolve oxygen ranging between 7.45 to 9.45 mg/l in desert waters. Bugalia (2010) recorded gradual increase in DO from November to March and very low values were recorded in months of extreme summer i.e. May and June. Free CO_2 was not recorded during study period. Rukasana (2017) alsio recorded most of the time Free CO_2 was absent. Bugalia (1990), Bahura (1990), and Khanam (2002) observed absence of free carbon dioxide in desert ponds. Khan *et al*. (2012) also reported total absence of free CO_2 in Triveni lake, (M.S.). Rathore (2003), Arora (2009), Lata (2009), Srivastava (2009) and Jailal (2016) recorded infrequent CO_2 in desert waters. Ayoade *et al.* (2009) documented presence of large population of phytoplankton is responsible for absence of free CO_2. Average of total alkinity was 82.17 mg/l. Natural water with high alkalinity is generally rich in phytoplankton (Saxena, 2001). The alkalinity in itself is not harmful to human beings and other living organisms (Reddy *et al.*, 2012). Hardness of water was ranged between 100 mg/l to 162 mg/l. Srivastava (2009) also recorded high values of hardness during winter season, especially in December. Water was hard in winter consequently it was more productive in the season (Ayoade *et al.*, 2009).

Table1: Monthly variations in Temporal Variation in Physico-Chemical and Phytoplankton Analysis in a desert water body, Churu (Rajasthan) during January 2022 to June 2022.

Variables	Months						
	Jan. 2022	Feb. 2022	Mar. 2022	Apr. 2022	May 2022	Jun. 2022	Average
Temperature (^{0}c)	17.5	17.9	20.6	23.2	24.5	27.6	21.83
Transparency (m)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
pH	8.2	8.0	8.6	8.5	8.7	8.7	8.45
EC (mmho/cm)	0.17	0.19	0.21	0.18	0.25	0.31	0.28
TDS	170	190	210	180	250	310	218.67
Turbidity (JTU)	40	40	30	50	70	80	51.66
DO (mg/l)	5.8	4.0	4.0	2.9	3.0	3.10	3.8

Free CO_2	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Total Alkalinity (mg/l)	86	75	80	95	72	85	82.17
Hardness (mg/l)	162	140	110	102	100	120	122.33

Phytoplankton was represented by six classes: Zygnematophyceae, Zygnemophyceae, Chlorophyceae, Bacillariophyceae, Myxoophyceae and Euglenophyceae. Zygnematophyceae include three species: *Spirogyra* species, *Spirotaenia* species and *Mougeotia* species. Zygnemophyceae represented by two species: *Closterium* species and *Genicularia* species. Chlorophyceae presented in maximum number of species (six): *Volvox mononae*, *Zygnema cyaneum*, *Closterium acerosum*, *Chlamydomonas* species, *Draparnalidia* species and *Ulothrix zonata*. Bacillariophyceae represented by three species: Naviculata viridis, Nitzschila palea and Fragilaria species. Myxophyceae was observed to be represented by three species: *Anabaena* species, *Microcystis aeruginosa and Spirulina* species. Euglenophyceae represented only by one species: *Euglina viridis*. Among these genera Spirogyra and Closterium indicated the eutrrophic nature of water bodies (Bajpai & Agarkar,1997;Adesalu & Nwankwo, 2008).

Table 2: Temporal Variation in Physico-Chemical and Phytoplankton Analysis in a Desert Water Body, Churu (Rajasthan) during January 2022 to June 2022. Values are expressed as No./l.

Class	Phytoplankton	Jan. 2022	Feb. 2022	Mar. 2022	Apr. 2022	May 2022	Jun. 2022
Zygnaematophyceae	*Spirogyra* species	+	+	+	+	+	+
	Spirotaenia species	+	+	-	+	-	-
	Mougeotia species	+	-	-	+	-	-
Zygnaemophyceae	*Closterium* species	-	-	+	+	+	+
	Genicularia species	+	-	-	+	+	+
Chlorophyceae	*Volvox mononae*	+	-	+	+	+	+
	Zygnema cyaneum	+	+	+	+	-	-
	Closterium acerosum	+	+	+	+	-	-
	Chlamydomonas Species	+	+	+	+	+	+
	Draparnaldia species	+	+	+	+	+	+
	Ulothrix zonata	+	+	+	+	+	+
Bacillariophyceae	*Navicula viridis*	+	+	+	+	+	+
	Nitzschia palea	-	+	-	-	+	-
	Fragilaria species	+	-	-	-	-	+
Myxophyceae	*Anabaena* species	+	+	+	+	+	+
	Microcystis aeruginosa	+	+	+	+	+	+
	Spirulina species	-	-	-	+	+	+
Euglenophyceae	*Euglena viridis*.	-	-	-	-	+	+

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