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BIO-DIVERSITY OF PHYTOPLANKTON OF SONG RIVER IN DOON VALLEY, UTTARAKHAND

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ABSTRACT :

The present study was undertaken for a period of one year from November 2015 to October 2016 to assess the diversity of phytoplankton of Song river in Doon Valley, Uttarakhand. The samples was analysed for different physico-chemical attributes and phytoplankton diversity. In total phytoplankton include 35 taxa, belonging to three different families; Chlorophyceae, Bacillariophyceae and Myxophyceae were recorded. The physico-chemical conditions were favourable for the growth and survival of aquatic organisms.



KEYWORDS: Phytoplankton, Physico-chemical, Song River.

INTRODUCTION

Song river is a spring fed river originated different small rivulets of the mountainous range of Dhanolti, crossing with Sahastradhara stream flow downward towards Doon Valley basins and finally it assimilated into river Ganga at 78° 48' 27' longitude and 30° 2' latitude after crossing Satyanarayan area. The Song river is located at 30° 28' latitude and 78° 8' longitude with which peoples of Raiwala, Doiwala, Chiddarwala, Lacchiwala and Nepali Farm are very much attached because this river is the only ultimate source of water for them. The river travels a total distance of approximately 42.5 Km (Khanna et.al. 2007). Therefore in the present study of the Song river its physico-chemical characteristics viz. temperature, velocity, turbidity, pH, alkalinity, hardness, conductivity, nitrates, sulphate and phosphates and bio-diversity of phytoplankton. Phytoplanktons are vital and important organisms which act as producer to the primary food supply in any aquatic ecosystem (Sharma et.al. 2015). They are the initial biological components from which the energy is transferred to higher organisms through food chain. The physico-chemical parameters are the major factors that control the dynamics and structure of the phytoplankton of aquatic ecosystems. Changes in physico-chemical parameters of ecosystems have a substantial impact on the species that live within them (Sharma et.al. 2015). Seasonal variations in these parameters have an important role in the distribution periodicity and quantitative and qualitative composition of freshwater biota.

Water is an important component of all living beings. It also performs unique and indispensable activities in ecosystem, biosphere and biochemical cycles. The growth and diversity of aquatic microflora in river systems is influenced by several physico-chemical and biological parameters. River plays a major role in integrating and organizing the landscape and moulding the ecological setting a basin. They are the prime factors controlling the global water cycle and in the hydrological cycle, these are the most dynamic agents of transport. The physical and chemical properties of fresh water body and characterized by the climatic, geochemical, geomorphological and

pollution conditions.

MATERIALS AND METHODS

The present study was conducted on river Song and three sites were selected along the lower stretch of river which includes Raiwala (S1), Nepali Farm (S2) and Chhidarwala (S3). The study was carried out for a time period of one year from November 2015 to October 2016 on monthly basis. Water samples were collected every month early in the morning in sterilized sampling bottles and were analysed for physical and chemical parameters. Few Physico-chemical parameters like Temperature ($^{\circ}\text{C}$), Velocity (m/s), pH were performed on spot and other parameters like Turbidity (JTU), Conductivity ($\mu\text{mho/cm}$), Total alkalinity (mg/l), Total hardness (mg/l), Phosphate (mg/l), Nitrates (mg/lit.), Sulphates (mg/lit.) were analysed in the laboratory by following the methodology of APHA (2005). The plankton collection was made by hauling of water by plankton net (0.1 mm mesh size) and preserved in 4% formalin solution. The plankton count was made in Sedgewick rafter cell under the microscope by using formula.

$$\text{No. of species} = \frac{C \times 1000 \text{ mm}^3}{L \times D \times W \times S}$$

Where C = No. of organism counted
 L = Length of each stripe (mm)
 D = Depth of each stripe (mm)
 W = Width of each stripe (mm)
 S = No. of stripes

The qualitative analyses of the plankton samples were made the help of Bellinger and Sigee (2010).

RESULTS AND DISCUSSION

From the result minimum water temperature 16.42°C noticed at Raiwala (S1) and maximum water temperature 18.17°C recorded at Chiddarwala (S3). The highest value of velocity 1.30 m/s was obtained at Chiddarwala (S3) and lowest value of velocity 1.26 m/s was found at Nepali Farm (S2). The highest pH value 8.2 recorded at Nepali Farm (S2) & Chiddarwala (S3) and minimum value 7.8 was recorded at Raiwala (S1), that showing little variation from each other. Total alkalinity 73.14 mg/lit was recorded to be highest at Chiddarwala (S3) and it was noticed 69.92 mg/lit minimum at Raiwala (S1). The turbidity obtained to be highest 171.74 JTU at Chiddarwala (S3) and it was obtained minimum at Raiwala (S1) 163.84 JTU. The total hardness was obtained to be highest at Chiddarwala (S3) 258.47 mg/lit. and it was recorded minimum 239.229 mg/lit at Nepali Farm (S2). The parameters like phosphate, nitrate and sulphate showed as irregular trend and little variations in their concentration from Raiwala (S1), Nepali Farm (S2) and Chiddarwala (S3) during the study period.

Table 1 : Physico-chemical parameters of Song river at Raiwala (S1), Nepali Farm (S2 and Chiddarwala (S3) for the year November 2015 to October 2016.

Parameters (↓)	Sites (→)	S1	S2	S3
Water Temperature (°C)		16.42	17.18	18.17
Velocity (m/s)		1.28	1.26	1.3
Turbidity (JTU)		163.84	170.08	171.17
Conductivity (µmho cm ⁻¹)		0.17	0.177	0.18
pH		7.8	8.2	8.2
Total alkanity (mg/l)		69.92	73.57	73.14
Total hardness (mg/l)		241.03	239.29	258.47
Phosphate (mg/l)		0.51	0.56	0.60
Nitrates (mg/l)		0.58	0.59	0.64
Sulphates (mg/l)		0.54	0.56	0.66

DIVERSITY OF PHYTOPLANKTON

The phytoplankton inhabiting the Song river at Raiwala (S1), Nepali Farm (S2) and Chiddarwala (S3) comprises of 35 taxa out of which chlorophyceae constitutes 15 genera, Bacillariophyceae 14 genera and Myxophyceae 6 genera. Seasonal Mean variation of phytoplankton of all three sites is shown in Table 2, 3 & 4.

Table 2 : Seasonal variation of Phytoplankton in Song river at Raiwala (S1) during the year 2015-2016

	Winter	Summer	Rainy
<i>Chlorophyceae</i>	679.75	552.25	352.75
<i>Bacillariophyceae</i>	497.75	756.25	244.75
<i>Myxophyceae</i>	66.5	100	48.5

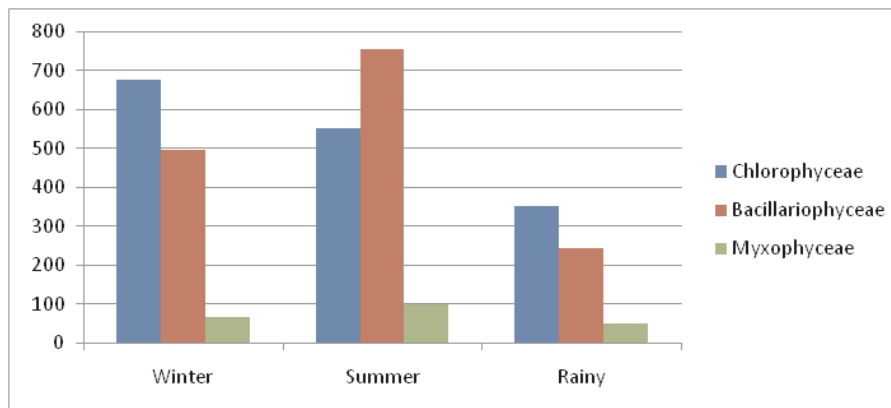


Table 3 : Seasonal variation of Phytoplankton Song river at Nepali Farm (S2) during the year 2015-2016

	Winter	Summer	Rainy
<i>Chlorophyceae</i>	507	452.5	324
<i>Bacillariophyceae</i>	462	717.75	230.25
<i>Myxophyceae</i>	562.5	96.75	49.5

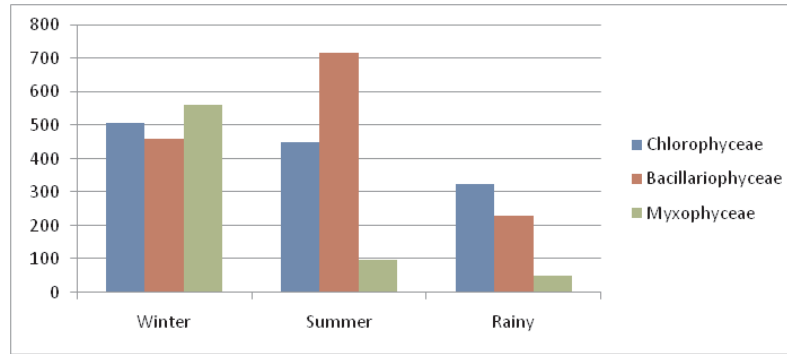


Table 4 : Seasonal variation of Phytoplankton in Song river at Chhidarwala (S3) during the year 2015-2016

	Winter	Summer	Rainy
<i>Chlorophyceae</i>	499	463.75	301.25
<i>Bacillariophyceae</i>	369.75	713.25	204
<i>Myxophyceae</i>	74.75	91.75	50

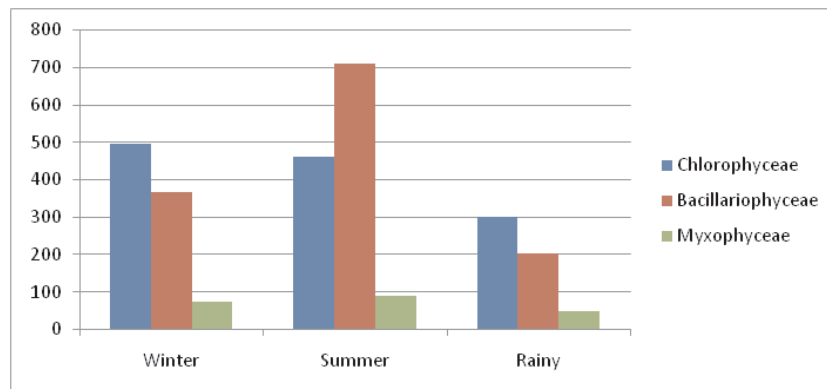
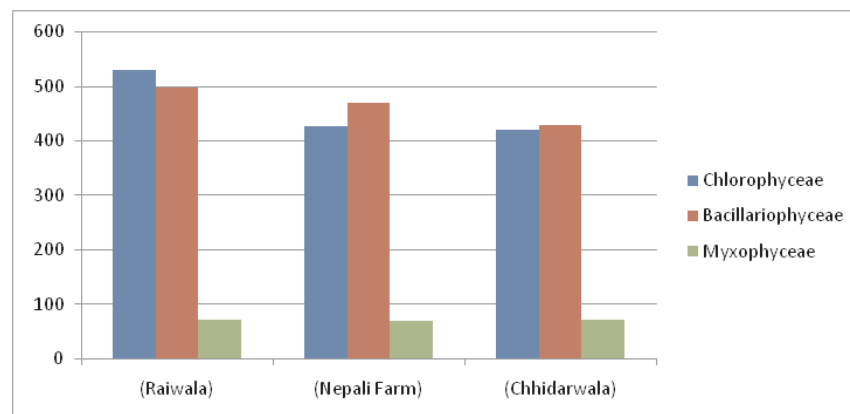


Table 5 : Annual variation of Phytoplankton in Song river at Raiwala (S1), Nepali Farm (S2) and Chhidarwala (3) during the year 2015-2016

	Site 1 (Raiwala)	Site 2 (Nepali Farm)	Site 3 (Chhidarwala)
<i>Chlorophyceae</i>	530.7	427.8	421.3
<i>Bacillariophyceae</i>	499.5	470	429
<i>Myxophyceae</i>	71.6	70	72.16



The phytoplankton in the three stations of the Song river (Raiwala, Nepali Farm and Chiddarwala) showed variations because of the diverse physico-chemical condition of water. The algae (phytoplankton)

component of Song river consisted of the members of *Chlorophyceae*, *Bacillariophyceae* and *Myxophyceae*.

Study of phytoplankton shows number of genera and species varies monthly and seasonally available in the water of Song. Similar biodiversity of plankton reported (Singh et.al. 2007) in various water bodies of river Indus Ladakh, Pathani and Upadyay (2006) reported population of plankton in river Suyal. The annual mean occurrence and population of phytoplankton was observed high in Winter and thereafter decline during Summer and minimum in Rainy season as show in Table 5. Plankton distribution and seasonal variability reported Chakarbarti et.al. (1955), Pahwal and Mehrota (1966), Soma Shekhar (1984), Nautiyal (1985), Singh and Das (2006), Singh et.al. (2007), Kanswal and Pathani (2012) and Bhutiani (2014). According to earlier opinion the species composition of diatoms is dependent on a set factors i.e. temperature, water current, hardness, alkalinity, pH and water quality.

The diversity of Bacillariophyceae in river was observed to be maximum 499.5 unit/lit at Raiwala (S1) and minimum 429 unit/lit was at Chiddarwala (S3) and highest value of Mxyophyceae 72.16 unit/lit. at Chiddarwala (S3) and minimum value 70.00 unit/lit. recorded at Nepali Farm (S2). (Table 5)

Mean variation of phytoplankton in all the three sites of Song river is shown in table 2, 3 & 4.. The diversity of phytoplankton in river was recorded to minimum of chlorophyceae 53.07 unit/lit. at Chiddarwala (S3) and minimum 421.3 unit/lit. at Chiddarwala (S3). Among the phytoplankton the family chlorophyceae was represented by *Chlorella*, *Chlaydomonam*, *Spirogyra*, *Ulothrix*, *Hyrodictyon*, *Cladoophora*, *Cosmarium*, *Oedogonium*, *Syndesmus*, *Volvox*, *Chara*, *Desmidium*, *Microspora*, *Chlorococcum*, and *Zygnemopsis*. Among the phytoplankton the family Bacillariophyceae was represented by *Ceratonesis*, *Amphora*, *Calonesi*, *Fragllaria*, *Navicula*, *Synedra*, *Diatoms*, *Gomphonema*, *Pinnularia*, *Melosira*, *Tabellaria*, *Denticula*, *Cymbella* and *Cyclotella*. The family Myxophyceae was represented Six genera i.e. *Nostoc*, *Anabena*, *Oscillatoria*, *Rivularia*, *Cocchohloris* and *Phomidum*.

Members of Chlorophyceae and Bacillariophyceae were the main contributors to the phytoplankton population in Song river. Among phytoplankton the chlorophyceae dominate other groups in the present study. Similar results recorded were also made by Kumar (2014) in river Gorigana of Kuman Himalaya. In the present study phytoplankton followed the distribution pattern as Chlorophyceae > Bacillariophycease > Myxophyceae. Some total 35 taxa of phytoplankton belonging Chlorophyceae (15), Bacillariophyceae (14) and Myxophyceae (6) at different collection sites with variations in months and seasons of the year have recorded in the water. The highest population diversity of phytoplankton was recorded in winter season and lowest in rainy season at all three sites in present study. Similar finding were also noticed by Sharma (1985) in the Bhagirathi river. It was also recorded that abundance of diatoms was attributed to less current velocities, little turbidity and low temperature. High velocity and turbidity were responsible for fall in diatoms population is also reported by Nautiyal (1986). During winter season in Song river, when the water temperature and velocity was low water with little turbidity and water level was comparatively low, the replacement of nutrients declined and there was increase in phytoplanktonic population. The fast flowing water river might be the reason for the poor representation of phytoplankton distribution and abundance especially during rainy season.

CONCLUSION

Studies were conducted on diversity of phytoplankton of Song river in Doon Valley (Dehradun District), Uttarakhand from November 2015 to October 2016. Some total 35 genera of phytoplankton were identified during the study period. *Chlorophyceae* and *Bacillariophyceae* accounted for the major share at phytoplankton diversity, represented by 15 genera. *Chlorophyceae* were appeared to be the dominating group in terms of phytoplankton diversity and second dominating group *Bacillariophyceae*, represented 14 genera while the *Myxophyceae* represented only 06 genera. Maximum phytoplankton diversity was recorded during winter season and minimum during rainy season.

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