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Seasonal status of density of phytoplankton in Asiganga River of Uttarkashi (Uttarakhand)

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A B S T R A C T

Phytoplankton play important role in biosynthesis of organic material and influence the river ecosystem, aquatic food chain and water characteristic. The biological productivity as ecological indicator to identify the ecological quality of River Asiganga. In River Asiganga the overall total density fluctuates from 0.0 ± 0.00 Unit l-1 (April) to 673.5 ± 303.35 Unit l-1 (March). During study period the total of phytoplanktons (29 genera) were noticed during different seasons. Present study concluded that seasonal differences of planktons density will help in further planning of water management and their use for beneficial purpose like agricultural, drinking for mankind.

K E Y W O R D S

Phytoplankton | Plankton density | Seasonal variation | River Asiganga

C I T A T I O N

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Introduction

Phytoplankton as primary producer plays a pivotal role in fixation of solar energy and makes it available to the higher level. It also forms an important link between the abiotic and biotic in the aquatic ecosystem. Phytoplankton consists of diverse assemblage of algae in the streams having different physiological requirements in response to physical and chemical parameters such as light, temperature and nutrients. Seasonal variation in planktons density are result of a complex interplay of physical, chemical and biological process, which indicate the diversity in ecological niches (Bansal *et al*., 1989). Planktons diversity is controlled by seasonal chages as well as by the rate at which plant nutrients are supplied. Nitrogen, phosphorus and silica are three main nutrients needed for the phytoplanktons to grow at different times and in different ratio (Pilkaityte, 2003).

Materials and methods

River Asiganga is located in district Uttarkashi which is formed by the confluence of Kaldi Gad and Gajoli Gad at Sangamchatti (1540 msl). River Asiganga is the one of the major tributary of River Bhagirathi which merges with River Bhagirathi at Gangori (1436 msl). In the present investigation focus were made on the study of phytoplankton of River Asiganga of Garhwal Himalaya.

Two sampling sites *viz*., S1 (Sangamchatti) and S2 (Gangori) were selected and sampling was done at both the sites at monthly interval from November 2008 to October 2009. Phytoplankton samples were collected by filtering 100 litre of water through phytoplankton net of 20 μm size and preserved using 4% formalin. Phytoplankton was identified up to the lowest recognizable taxonomic unit mostly genus following keys by Needham and Needham (1962); Ward and Whipple (1959); Sarode and Kamat (1984). Phytoplankton was enumerated using Sedgwick-Rafter Cell Counter and number of phytoplankton ml-1 of water was calculated according to Welch (1952).

Results

A total of 29 genera of phytoplankton were collected and identified from the River Asiganga during the study period from November 2008 to October 2009. The Phytoplankton diversity inhabiting river Asiganga comprised of 29 genera out of which chlorophyceae constituted 15 genera, bacillariophyceae with 12 genera and myxophyceae had just 2 genera. The diversity of bacillariophyceae biomass was dominating the river Asiganga.

The chlorophyceae had the maximum contribution 51.70% (August) at S2 to minimum 4.40% (December) at S1. The bacillariophycae contributes maximum of 95.05% (December) at S1 to minimum 48.25% (August) at S2. At site S1 the myxophyceae contributes varied from 0.00% (November, March, April, May, June, August, October) to 9.60% (February) (Table 1).

Monthly variation in the abundance of important phytoplankton of river Asiganga has been presented in table 2. Quantitative fluctuation in the phytoplankton density of River Asiganga during the study period has been depicted in figure 1. In River Asiganga the overall total density fluctuates from 0.0 ± 0.00 Unit l-1 (April) to 673.5 ± 303.35 Unit l^{-1} (March). The green algae (chlorophyceae) had the largest contribution followed by diatoms (bacillariophyceae), than followed by myxophyceae.

The total density of chlorophyceae was minimum 25.0 ± 12.73 (December) to maximum 157.0 ± 111.72 (March). Seasonal density of chlorophyceae ranged from minimum 28.0 ± 4.32 Unit l-1 (winter) at site S2 to maximum 108.0 ± 20.17 Unit l-1 (summer) at site S1.The total density of bacillariophyceae ranged from 103.0 ± 24.04 Unit l-1 (September) to 673.5 ± 303.35 Unit l-1 (March). Seasonal density of bacillariophyceae ranged from minimum 2.89 ± 123.60 Unit l-1 (winter) at site S1 to maximum 345.0 ± 303.82 Unit l-1 (summer) at site S1.The total density of myxophyceae varied from 0.0 ± 0.00 Unit l-1 (April) to 15.0 ± 12.73 (February). Seasonal density myxophyceae ranged from minimum 4.0 ± 2.00 Unit l-1 (monsoon) at site S1 to maximum

15.0 ± 12.73 Unit l-1 (summer) at site S2. (Table 3 & Figure 2).

Discussion

Phytoplanktons are microscopic single celled aquatic plants forming the prime component in the food chain of an aquatic ecosystem. Some phytoplankton species are also often used as good indicators of water quality including pollution (Rajashree, 1993). Phytoplankton can be used as bio-indicators since they reflect even the slight changes taking place in their immediate environment by changing their species composition, biomass, community structure, chlorophyll pigment content and productivity moreover and marine ecosystem is largely determined by their phytoplankton population (Mohamed *et al*., 2009). Phytoplankton abundance and composition in aquatic ecosystems are regulated by abiotic factors such as, nutrients related to physico-chemical variability and biotic, trophic interactions (Sin *et al*., 1999; Lewis, 2000; Matta *et al.,* 2018).

A total of 29 phytoplankton genera was identified during the study period, the over all total density fluctuates from 0.0 ± 0.00 Unit l-1 (April) to 673.5 ± 303.35 Unit l-1 (March).

A total of 3 groups of Phytoplankton were identified such as chlorophyceae, bacillariophyceae and myxophyceae. Bacillariophyceae was the dominant group at both the sites followed by chlorophyceae and myxophyceae. Changes in the phytoplankton populations were clearly evident more in relation to physical than to chemical conditions of the water. Changes in water-level, nutrients contents and temperature affected the growth of the phytoplankton. Maximum concentration of bicarbonate and pH increased the growth of growth of diatoms and blue-green algae. Higher concentrations of phosphates and silicates with nitrates and nitrites contents were responsible for high phytoplankton yields in summer and winter seasons (Matta *et al*., 2015). Bhatnagar *et al*. (2013) have also reported a similar trend of phytoplankton dominance in River Yamuna.

It has noticed that density of phytoplankton was maximum in summer, minimum in monsoon season and intermediate in winter season. Data of average value of seasonal density of recorded phytoplankton in the Asiganga River at study area has given in table 3. Present findings are in accordance with the finding of other workers. Singh (1990) reported that plankton population showed bimodel, pattern of fluctuation with one peak in pre winter and other in summer. Shinde *et al*., (2012); Kumar and Khare (2015); Hassan *et al*. (2010) observed minimum density of phytoplankton during monsoon and maximum during in summer.

In the hill streams water temperature, flow and substrate composition may be considered as the major factor controlling the phytoplankton communities (Wetzel, 1983). Factors controlling phytoplankton growth includes light, temperature, water current, substrate, water chemistry and invertebrate grazing, all these factors have potential effects on periphytonic populations (Whitton, 1975; Hynes, 1971; Biggs, 1996). According to Hynes (1971) water movement, turbidity, temperature and

Months	**Cholrophyceae**		**Bacillariophyceae**		**Myxophyceae**	
	S_1	**S_2**	**S_1**	**S_2**	**S_1**	**S_2**
November	8.77	6.49	91.23	92.97	0.00	0.54
December	4.40	13.30	95.05	83.59	0.55	3.13
January	23.10	8.61	73.08	90.73	3.85	0.66
February	28.30	24.80	69.81	65.60	1.89	9.60
March	21.00	14.40	79.00	84.53	0.00	1.10
April	33.10	24.40	66.90	75.61	0.00	0.00
May	19.10	28.70	75.77	71.33	5.12	0.00
June	23.60	16.10	75.67	82.93	0.76	0.00
July	22.70	20.40	76.29	77.42	1.03	2.15
August	38.50	51.70	65.38	48.25	3.85	0.00
September	36.60	24.70	60.56	74.07	2.82	1.23
October	29.70	17.70	70.33	79.75	0.00	2.53

Table 1: Percentage fluctuation of Phytoplankton of River Asiganga during November 2008 to October 2009.

Turbidity has a negative impact on the growth of plankton in the river Chandrabhaga (Sharma *et al*., 2007). Similar observations have been recorded by Hynes (1971) in Volga River. Chandler (1937) and Cushing (1965) report that mechanical destruction of plankton occurs by the grinding action of water heavily laden with silt. Same reason may be of low phytoplankton density during the study period in monsoon season in river Asiganga.

Months	**Chlorophyceae**	**Bacillariophyceae**	**Myxophyceae**
November	32.0 ±11.31	380.0 ± 50.91	2.0 ± 0.00
December	25.0 ± 12.73	280.0 ± 93.34	5.0 ± 4.24
January	55.0 ± 41.01	270.0 ± 5.66	8.0 ± 8.49
February	76.0 ± 19.80	193.0 ± 41.01	15.0 ± 12.73
March	157.0 ± 111.72	673.5 ± 303.35	6.0 ± 0.00
April	88.0 ± 11.31	221.0 ± 38.18	0.0 ± 0.00
May	71.0 ± 21.21	218.0 ± 5.66	15.0 ± 0.00
June	49.0 ± 18.39	193.5 ± 7.78	2.0 ± 0.00
July	41.0 ± 4.24	146.0 ± 2.83	3.0 ± 1.41
August	104.0 ± 62.23	120.0 ± 25.46	6.0 ± 0.00
September	46.0 ± 8.49	103.0 ± 24.04	3.0 ± 1.41
October	41.0 ± 18.37	127.0 ± 1.41	4.0 ± 0.00

Table 2: Class wise Mean ± SE total density of Phytoplankton of River Asiganga during November 2008 to October 2009.

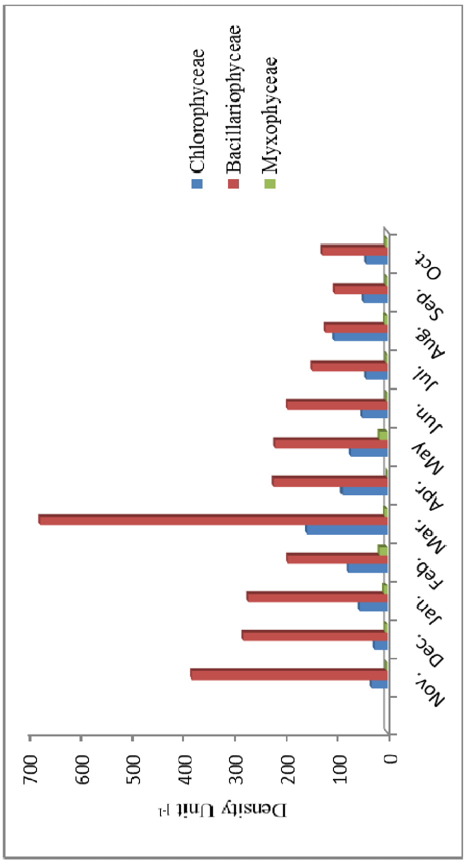

Fig. 1: Graph showing fluctuation in total density of phytoplankton during November 2008-October 2009.

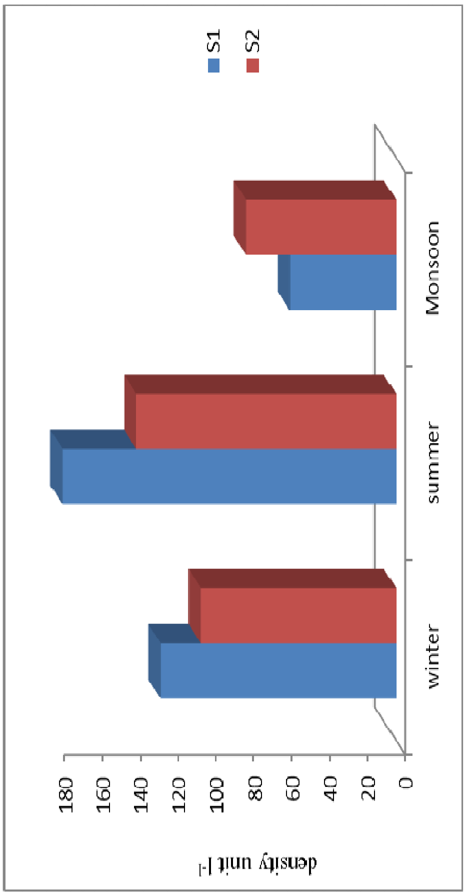

Fig. 2: Graph showing fluctuation in seasonal density of phytoplankton during

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