



Identificaltion of algal diversity of Ghagghar river, Sri Ganganagar, Rajasthan

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Abstract

In the current investigation, algal flora was identified in water sample collected from Ghagghar river, Sri Ganganagar, Rajasthan. Water samples were collected over a period of two years (2020-2021, 2021-2022) during the rainy, post rainy, winter and summer seasons. As a result, total number of algae belonging to various families (Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Euglenoidae) during different seasons of the year 2020-2021. For nearly all the algal species, maximum number of algae was found during the rainy season followed by post-rainy season and minimum number during summer season.

Keywords: Algal flora, Ghagghar river, classes, different seasons etc

Introduction

Algae are simple, thalloid organisms that are green and capable of photosynthesis. They are typically found in water, but can also be found in many damp environments, including marine and freshwater ecosystems, desert sands, hot springs, and even snow and ice. They are regarded as the foundation of the aquatic food chain, serving as primary producers and also generating oxygen for other aquatic organisms by absorbing excessive amounts of carbon dioxide from the environment. Algae can cause widespread death of other animals during algal blooms, but they also play a significant role in supporting the economy through the production of food, medicine, fertilizer, and other valuable industrial products (Shrestha and Rai, 2017) ^[5].

The Ganganagar district, which is in Rajasthan State's most northern region, is situated between latitudes 28°42'30" and 30°12'00" N and longitudes 72°39'15" and 74°18'30" E. The district, which has a total area of about 11154.66 sq km, is bordered to the south, east, north, and west by the districts of Bikaner and Hanumangarh in Rajasthan, Ferozpur in Punjab, and the international border with Pakistan.

The Ghaggar-Hakra River is an intermittent river in India and Pakistan that flows only during the monsoon season. The river is known as Ghaggar before the Ottu barrage at 29.4875°N 74.8925°E, and as Hakra downstream of the barrage in the Thar Desert. In pre-Harappan times the Ghaggar was a tributary of the Sutlej. It is still connected to this paleochannel of the Sutlej, and possibly the Yamuna, which ended in the Nara River (Britannica *et al.*, 2000) ^[2].

Materials and methods

Collection of water samples: water samples were collected from Gagghar river, Sri Ganganagar during year 2020-2022.

Samples were collected during different seasons like post rainy, winter, summer and rainy.

Algal identification: Algal collection and water samples were brought to the laboratory for present research. To differentiate between the blue green and green algae, dilute iodine solution and methyl blue, 1% solution of neutral red crystal and iron haematoxylin stain were used. The gelatinous sheath was stained by chloro-zinc iodide solution, iron-haematoxylin (1%) and iodine solution. Samples were then rinsed with distilled water and collected by centrifugation, using two successive runs at 3000 r·min⁻¹. Temporary objective slides of 0.10 ml fresh and preserved water sample were prepared and observed specimens under light microscope (Leica DM 100). Micrographs were taken with Nikon D-3300 camera at 100X, 400X and 1000X magnification. The algae were examined mostly in living condition.

Identification was done on the basis of their external appearance, colour, morphological characteristics, size, cellular structure, pigments and reproductive characteristics. The taxa were first assigned to the orders, then the families and genera were determined and the diagnostic keys for the species prepared.

Results

In the present work, 4 classes of algae were determined which included Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenoidae. The table 1 represent the number of algae found during different duration during the study years. It was recorded that out of all classes, maximum number of algae belonged to Cyanophyceae (2506 and 2777) followed by Chlorophyceae (1962, 2113) Bacillariophyceae (961, 892) Euglenoidae (750, 745).

In the study of whole year, maximum algae were recorded during rainy season followed by post rainy season and winter. During summer season, lowest number of algae were recorded for all classes.

In 4 claaes, total 38 types of algae were identified details of which are given in Table 2.

Table 1: Classes of algae identified in water sample collected from Ghagghar river, Sri Gnaganagar

Name of class	Year	Post rainy	Winter	Summer	Rainy	Annual total
<i>Cyanophyceae</i>	2020-21	635	334	286	1284	2506
	2021-22	625	425	380	1324	2777
<i>Chlorophyceae</i>	2020-21	420	111	282	991	1962
	2021-22	404	120	299	1014	2113
<i>Bacillariophyceae</i>	2020-21	178	130	155	480	961
	2021-22	164	138	141	400	892
<i>Euglenoidae</i>	2020-21	147	151	129	323	750
	2021-22	161	144	124	316	745

Table 2: Details of algae identified in water sample collected from Ghagghar river, Sri Gnaganagar

Name of algae	Year	Post-rainy	Winter	Summer	Rainy	Total annual
<i>Microcystis aeruginosa</i> Kutz.	2020-21	29	8	10	107	154
	2021-22	36	31	10	85	162
<i>Merismopedia minima</i> Beck	2020-21	39	20	22	67	148
	2021-22	55	32	30	83	200
<i>Arthrospira platensis</i> (Nordst.) Gomont	2020-21	59	40	28	113	240
	2021-22	68	46	51	109	274
<i>Oscillatoria princeps</i> Vaucher ex Gomont	2020-21	145	107	88	228	568
	2021-22	176	126	83	327	712
<i>Oscillatoria nigra</i> Vaucher	2020-21	115	101	71	288	575
	2021-22	101	110	71	203	485
<i>Oscillatoria agardhii</i> Gomont	2020-21	55	10	0	107	172
	2021-22	34	18	21	114	187
<i>Oscillatoria acuminata</i> Gomont	2020-21	18	0	18	87	123
	2021-22	37	8	30	105	180
<i>Lyngbya gracilis</i> (Menegh.) Rabenh.	2020-21	18	16	2	46	82
	2021-22	22	5	15	59	101
<i>Anabaenopsis arnoldii</i> var. <i>indica</i> Ramanathan	2020-21	57	32	32	123	244
	2021-22	45	49	52	109	255
<i>Anabaena spiroides</i> Klebahn	2020-21	31	26	15	81	153
	2021-22	29	18	17	84	148
<i>Calothrix javanica</i> de Wilde.	2020-21	10	0	0	37	47
	2021-22	22	5	0	46	73
<i>Chlamydomonas mucicola</i> Schmidle	2020-21	33	22	18	59	132
	2021-22	27	38	25	63	153
<i>Pediastrum duplex</i> Meyen	2020-21	0	30	23	47	100
	2021-22	14	36	8	56	114
<i>Pediastrum tetras</i> (Ehr.) Ralfs	2020-21	0	0	0	34	34
	2021-22	0	0	0	44	44
<i>Chlorella vulgaris</i> Beijerinck	2020-21	60	59	52	154	325
	2021-22	68	46	33	85	232
<i>Oocystis crassa</i> Wittrock	2020-21	12	0	0	18	30
	2021-22	0	0	0	17	17
<i>Coelastrum microporum</i> Naegeli	2020-21	11	0	0	38	49
	2021-22	26	5	0	53	84
<i>Scenedesmus dimorphus</i> (Turpin) Kuetzing	2020-21	9	17	8	55	89
	2021-22	10	10	23	64	107
<i>Scenedesmus opoliensis</i> P. Richter	2020-21	31	27	28	70	156
	2021-22	33	40	30	67	170
<i>Ulothrix zonata</i> (Weber & Mohr) Kuetzing	2020-21	38	26	40	79	183
	2021-22	32	12	19	47	110
<i>Oedogonium pyriforme</i>	2020-21	51	31	33	130	245
	2021-22	41	51	41	133	266
<i>Cladophora glomerata</i> (L.) Kuertz.	2020-21	19	8	14	57	98
	2021-22	27	14	10	52	103
<i>Spirogyra rhizoides</i>	2020-21	27	9	15	49	100
	2021-22	21	15	16	56	108
<i>Closterium acerosum</i> (Schroeder) Ehr.	2020-21	28	25	10	51	114
	2021-22	20	15	20	52	107
<i>Euastrum spinulosum</i> Delp.	2020-21	11	0	0	34	45
	2021-22	8	0	0	45	53
<i>Cosmarium margaritatum</i> Malham	2020-21	34	27	33	69	163
	2021-22	30	46	28	64	168
<i>Xanthidium armatum</i> Tarn.	2020-21	28	16	8	47	99
	2021-22	20	19	18	52	109

<i>Melosira granulata</i> (Ehr.) Ralfs.	2020-21	35	19	16	106	176
	2021-22	43	25	19	92	179
<i>Fragilaria intermedia</i> Grun.	2020-21	35	31	35	80	181
	2021-22	38	13	19	40	110
<i>Fragilaria tenera</i> (WM Smith) Lange-Bertalot	2020-21	16	25	32	52	125
	2021-22	14	25	6	45	90
<i>Navicula elginensis</i> (Greg.) Grun.	2020-21	5	0	0	32	37
	2021-22	8	0	8	33	49
<i>Gomphonema lanceolatum</i> Ehr.	2020-21	31	29	37	69	166
	2021-22	29	46	48	61	184
<i>Cymbella tumida</i> (Breb.) V.H.	2020-21	25	26	25	40	116
	2021-22	30	29	18	50	127
<i>Cymbella aspera</i> (Ehr.) H. Peragallo	2020-21	31	18	10	101	160
	2021-22	32	19	23	79	153
<i>Euglena acus</i> Ehrenberg	2020-21	22	22	6	36	86
	2021-22	15	11	18	43	87
<i>Euglena convoluta</i> Korshikov	2020-21	52	53	47	152	304
	2021-22	77	54	51	163	345
<i>Euglena Spirogyra</i> Ehrenberg	2020-21	39	41	29	68	177
	2021-22	36	23	15	49	123
<i>Trachelomonas pulcherrima</i> Playfair	2020-21	34	35	47	67	183
	2021-22	33	56	40	61	190

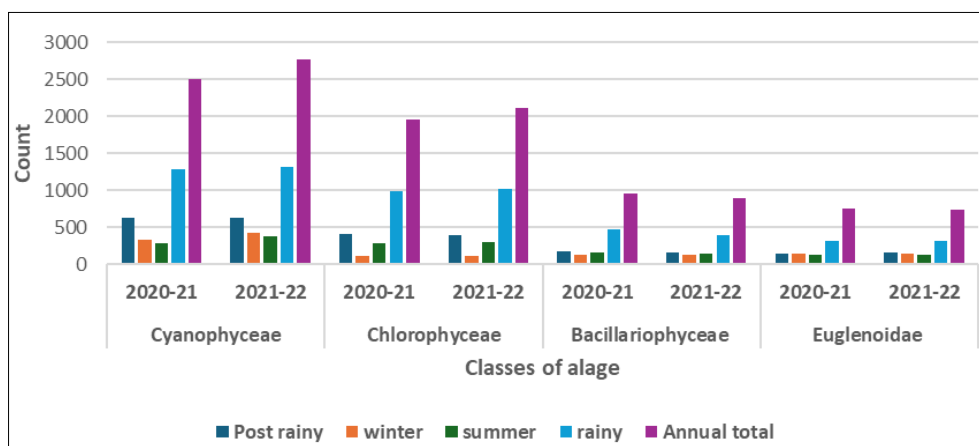


Fig 1: Algae identified at Ghagghar river

Discussion

Another important factor that aids in algal growth and multiplication is availability of optimum sunlight. Since algae are photosynthetic organisms, any compromise with the light intensity hampers algal growth by disrupting photosynthesis. Increased algal growth during the monsoon season is indicative of optimum light intensity. Moreover, the results show increased dissolved oxygen content in water of all the sites during monsoon season, in comparison to pre-monsoon and post-monsoon.

Also, algal growth is particularly high during the monsoon season due to improved gaseous availability. The turbulent mixing of gases during torrential rainfall aids in mixing of gases and promote algal growth. Salinity is also an important factor for assessing algal growth in aquatic ecosystems. Salinity refers to the presence of sodium in the water bodies. Sodium is naturally present in water bodies owing to leaching from sodium containing rocks and sediments by the flowing water. Low amount of sodium in water bodies is essential for osmoregulation, however, increase in amount of sodium, owing to anthropogenic activities may have maleficent effects, both on the health of aquatic organisms as well as the migratory birds and other species. Optimum amount of sodium is needed for algal growth and multiplication in water bodies. Occurrence of

salinity stress may greatly affect algal growth and its biochemical composition. Exposing algae to high salinity stress may compromise their photosynthetic efficiency and adversely affect their growth kinetics (Srivastava *et al.*, 2021) [7].

Also, most of the algae belonging to the families considered in this study (Chlorophyceae, Cyanophyceae, Bacillariophyceae, Xanthophyceae and Euglenoidae) are freshwater and intolerant to extreme salinity conditions. Therefore, high algal density during the monsoon season maybe attributed to optimum water salinity, which is favorable for algal growth and division. The crucial effect of temperature on algal growth and productivity of different algal species have also been highlighted in previous studies (Béchet *et al.*, 2013; Singh and Singh, 2015) [1, 6].

Besides these, algal growth may be due to presence of good nitrate in the water. Nitrate acts as a major nutrient for algal growth and its crucial role as an indispensable macroelement in algal metabolism and growth has been highlighted in a number of previous studies (Crawford, 1995; Taziki *et al.*, 2015; Domingues *et al.*, 2011) [3, 8, 4].

Conclusion

From the results of the current study, it can be concluded that the study area is rich in algal flora belonging to five

different families- Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Euglenoidae. Results indicated significant algal growth in the collected water sample, with maximum algal numbers observed in Cyanophyceae followed by Chlorophyceae, Bacillariophyceae, and Euglenoidae. Maximum number of algal species at all the sites was found during the rainy season owing to high dissolved oxygen, high availability of nitrogen and phosphorus as well as optimum water temperature supporting algal growth.

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