

Vol 4 Issue 9 June 2015

ISSN No : 2249-894X

*Monthly Multidisciplinary
Research Journal*

*Review Of
Research Journal*

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RNI MAHMUL/2011/38595

ISSN No.2249-894X

Review Of Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial Board readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

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ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR
TO JAJMAU, KANPUR



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Short Profile

Sachendra Kumar Tripathi is working as a Assistant Professor at Department of Botany, Brahmanand College, Kanpur (U. P), India. He has completed M. Sc., Ph.D. He has professional experience of 20 years and research experience of 25 years.



ABSTRACT:

Present study deals with the study of algae in Ganga water from Bithoor to Jajmau, Kanpur (U.P.). During present study a total number of 316 algal species spread over 83 chlorophyceae, 108 cyano phyceae, 121 bacillariophyceae, and 4 euglenophyceae were recorded from Ganga water between Bithoor to Jajmau

A very large number of planktonic algae including diatoms formed broad chunk of algae. Algae showing luxuriant growth and qualitative abundance are of major significance and their implications in self-purification, disease spread and maintenance of water quality is

crucial. Broad synoptical background of algal infestation at various stations has been illustrated with special reference to major algae. It has been observed that qualitatively the number of algae is maximum at Jajmau and minimum at Bithoor.

Observations indicate that members of bacillariophyceae outweigh both cyanophyceae and chlorophyceae. Cyanophyceae and chlorophyteae are gradually next in qualitative abundance. Euglenophyceae is the least represented group. Qualitatively algae increase gradually from winter to summer months and highest number has been recorded in May. Algae play important role in determination of pollution and quality of water. Certain algae play important role as indicator of water quality and show specific colour, odour, taste and pollution extent. There are certain algae which play

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important role in self-purification of water characteristics as well as in biotic components of ecosystem. Different indices to evaluate the organic pollution of a water body on the basis of algal groups have been used.

KEYWORDS

Chlorophyceae, Bacillariophyceae, Cyanophyceae, Euglenophyceae, Pollution, Self-purification, Sewage, Indicator.

INTRODUCTION

The life of indogangetic plains pulsates through ganga as a perennial source of water from times immemorial. The lotic water of river Ganga is closely wedded to human life that it is difficult to discern the service of river to the vast humanity. Ganga has been always looked upon with a sentiment of religious fervor for its pristine purity of water.

Kanpur is situated at 26.58° N latitude and 80.34°E longitude at an elevation of 110 meters from level on the Bank of river Ganga. The river receives domestic and industrial wastes and the water shows high degree of pollution. Algae have been reported from different localities of Kanpur. Algae are the organisms with multiple significance, more so they are looked upon as organisms for excellence in environmental studies. The environmental requirements of algae are little known. There are plenty of species capable of tolerating varying degree of organic pollution and hence can be used as indicators of organic pollution. There is evidence of algae as source of organic pollution (Ingram and Palmar 1952; Kulikova 1960; Palmer 1980; Tripathi 1991). There are as yet only few studies exploiting algae as the biological indicators of pollution. (Palmer 1969; Moore 1974; Hosmani and Bharti 1980; Prasad and Singh 1982; Kant 1983; Somoshekhar and Rama Swami 1983). But little is known about algae as source of toxin (Hughes, Gorban and Zehander 1958; Aziz 1979; Michael 1981). Significance of such pollution indicators have wide application for creation of cleaner water. Utilization of diatoms as biological indicators of water quality (Whitton 1975; Palmer 1980; Tripathi and Shukla 2001) are in nascent stage and need greater attention for monitoring and abatement of river pollution. There are certain diatoms which play an important role in disease spread (Shukla 1983; Nigam 1986; Tripathi 1991; Gupta 1991; Tiwari 1991) in cattle, animals and human beings. Role of diatoms as fish food is also in record (Venkatraman and Becker 1982; Shukla 1983; Tripathi and Shukla 2001) Diatoms have been reported from flowing water by Nair 1967; Shukla 1983; Tripathi and Shukla 1989; Tripathi, Gupta and Tiwari 1989; Tripathi 1991 from river Ganga water; Nigam 1980 from Agra canal Delhi. Present investigation deals with the role of algae in Ganga water as biological indicator of water quality vis-a-vis odor, toxicity, taste, pollution extent etc.

MATERIALS AND METHODS

An exhaustive collection of algae from different localities of river Ganga between Bithoor to Jajmau, Kanpur was made to prepare an algal profile listing indicator organisms. Samples were collected fortnightly during 2012-13 from river Ganga. The algae were collected in specimen tubes. They were then brought to the laboratory in living condition and preserved in 4 percent formalin. The samples were examined microscopically, camera Lucida figures prepared and on the basis of

morphology, structure and measurements these algae were identified using standard texts.

Monthly water sampling was also carried out in Ganga water. One litre of sample was filtered through a bolting silknet of 20 xxx. Ten ml of plankton concentrate obtained was preserved in 5-6 percent formalin. The concentrate was assayed for plankton quantity using haemocytometer. Nygard's algal indices (1949) and Palmer's algal pollution indices (1969) for genera and species were to express the nature of water quality.

RESULTS AND DISCUSSION

During present study a total number of 316 algal species spread over 83 chlorophyceae, 108 cyanophyceae, 121 bacillariophyceae, and 4 euglenophyceae were recorded from Ganga water between Bithoor to Jajmau (Table -1).

There is fairly large number of algae recorded from Ganga water at Bithoor. The algae comprise 76 genera spread over 273 species belonging to 78 chlorophyceae, 92 cyanophyceae, 100 bacillariophyceae and 2 euglenophyceae. Various classes of algae recorded are entered in Table. 2, 3 & 4.

Algal infestation at Jajmau Ganga water is enormous. Both benthic and planktonic algae abound during various months. A perusal of Table 5, 6 & 7 shows that 291 species spread over 79 chlorophycean, 102 cyanophycean, 114 bacillariophycean, and 4 euglenophycean, forms could be recorded from Shuklaganj. Qualitatively and quantitatively bacillariophyceae outnumbered other classes of algae followed by cyanophyceae and chlorophyceae. Euglenophyceae were represented the least (Table 5, 6, 7).

Algal infestation at Jajmau Ganga water is enormous. Both benthic and planktonic algae abound during various months. A perusal of Table 8, 9, & 10 shows that 309 species spread over 82 chlorophycean, 104 cyanophycean, 119 bacillariophycean, and 4 euglenophycean forms could be recorded from Jajmau. Qualitatively and quantitatively bacillariophyceae outnumber other classes of algae followed by cyanophyceae and chlorophyceae. Euglenophyceae were represented the least. Observations recorded in Table indicate that number of species recorded increases in a sequential manner from November till May and then with the onset of rains marks a slight decline (Table. 8, 9, 10)

Table: 1- LIST OF ALGAE OBSERVED BETWEEN BITHOOR AND JAJMAU IN GANGA WATERS

ALGAL SPECIES	OCCURRENCE		
	BITHOOR	SHUKLAGANJ	JAJMAU
CHLOROPHYCEAE			
<i>Actinasuum hantzschii</i>	P	P	P
<i>A. hantzschii var fluviatile</i>	A	P	P
<i>Ankistrodesmus convolvulus</i>	P	P	P
<i>A. falcatus</i>	A	P	P
<i>Bulbocheate rectangularis</i>	P	P	A
<i>Closterium lanceolatum</i>	P	P	P

<i>C. acerossum</i>	P	P	P
<i>C. acutum</i>	P	P	P
<i>C. gracile</i>	P	P	P
<i>C. linula</i>	P	P	P
<i>C. Moniliferum</i>	A	P	P
<i>C. turgidum</i>	P	P	P
<i>Cosmarium granatum</i>	P	P	P
<i>C. ambiguum</i>	P	P	P
<i>C. birectum</i>	P	P	P
<i>C. broomei</i>	P	A	P
<i>C. constrictum</i>	P	P	P
<i>C. depressum</i>	P	P	P
<i>C. formosulum var. northorstii</i>	A	P	P
<i>C. formosulum</i>	P	P	P
<i>C. meneghini</i>	P	P	P
<i>C. nitidulam,</i>	P	P	P
<i>C. prigshemia</i>	P	P	P
<i>C. punctulatum</i>	P	P	P
<i>C. reniforme</i>	P	P	P
<i>C. humicola</i>	P	P	P
<i>C. proboscidium</i>	P	P	P
<i>C. reticulatum</i>	P	P	P
<i>C. sphericum</i>	P	P	P
<i>Chara excelsa</i>	P	P	P
<i>Characiumnaegeli</i>	P	P	P
<i>Chlorella vaulgaris</i>	P	P	P
<i>Chlorococcum infusionum</i>	P	P	P
<i>Cladophora glomerata</i>	P	P	P
<i>Closteriopsis longissima</i>	P	P	P
<i>Coelastrum cambricum</i>	P	P	P
<i>Crucigenia tetrapedia</i>	P	A	P
<i>Euastrum inermius</i>	P	P	P
<i>Golenkinia radiate</i>	P	P	P
<i>Hydrodictyon reticulatum</i>	P	P	P
<i>M. calcaria</i>	P	P	P

ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR

ALGAL SPECIES	BITHOOR	SHUKLAGANJ	JAJMAU
<i>G. raciborskii var. conica</i>	P	P	P
<i>G. longicauda</i>	P	P	P
<i>G. ghoshei</i>	P	P	P
<i>Gloeotheca rhodochlamys</i>	P	P	A
<i>Lyngbya infixa</i>	P	P	P
<i>L. majuscula</i>	P	P	P
<i>L. dendrobia</i>	P	P	P
<i>L. polysiphonae</i>	A	P	P
<i>L. limnetica</i>	P	P	P
<i>L. porphyrosiphonis</i>	A	P	P
<i>L. contorta</i>	P	P	P
<i>L. putealis</i>	P	P	P
<i>Microcystis aeruginosa</i>	A	P	P
<i>M. robusta</i>	P	P	P
<i>M. viridis</i>	P	P	P
<i>M. flos-aquae</i>	A	P	P
<i>M. incerta</i>	P	P	P
<i>Merismopedia punctata</i>	A	P	P
<i>M. convoluta</i>	P	P	P
<i>M. tenuissima</i>	P	P	P
<i>M. elegans</i>	P	P	P
<i>M. glauca</i>	P	P	P
<i>Myxosarcina spectabilis</i>	P	A	P
<i>Nostoc linckia</i>	P	P	A
<i>N. linckia var. arvense</i>	P	P	P
<i>N. muscorum</i>	P	P	P
<i>N. carneum</i>	P	P	P
<i>N. ellipsoforum</i>	P	A	P
<i>Nodularia spumigena</i>	P	P	P
<i>N. herveyana</i>	P	P	P
<i>Oscillatoria limnetica</i>	P	P	P
<i>O. formosa</i>	P	P	P
<i>O. limosa</i>	P	P	P
<i>O. Princeps</i>	P	P	P
<i>O. ornate</i>	P	P	P
<i>O. chalybea</i>	P	P	P
<i>O. acutissima</i>	A	P	A
<i>O. subbrevis</i>	P	P	P
<i>O. boryana</i>	P	P	P
<i>O. tenuis</i>	P	P	P
<i>O. tanganyikae</i>	P	P	P
<i>O. acuta</i>	P	P	P
<i>O. tubuliformis</i>	P	P	P
<i>O. minnesotensis</i>	P	A	P
<i>O. curviceps</i>	P	P	P
<i>O. okeni</i>	P	P	P
<i>Phormidium ambiguum</i>	A	P	P

ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR

ALGAL SPECIES	BITHOOR	SHUKLAGANJ	JAJMAU
<i>P. anomala</i>	P	P	P
<i>P. purpurensense</i>	A	P	P
<i>Rivularia aquatica</i>	P	P	P
<i>R. hansgirg</i>	P	P	P
<i>Spirulina major</i>	P	P	P
<i>S. gigantean</i>	A	P	P
<i>S. subsalsa</i>	P	P	P
<i>S. laxissima</i>	A	P	P
BACILLARIOPHYCEAE			
<i>Asterionella formosa</i>	P	P	P
<i>Amphora ovalis</i>	P	P	P
<i>Achnanthes lanceolata</i>	P	P	A
<i>A. exilis</i>	P	P	P
<i>A. minutissima</i>	P	P	P
<i>A. linearis</i>	P	P	P
<i>A. lancolata</i>	P	P	P
<i>A. affinis</i>	P	P	P
<i>Cymbella cistula</i>	P	A	P
<i>C. purvas</i>	P	P	P
<i>C. affinis</i>	P	P	P
<i>C. tumida</i>	P	P	P
<i>C. pusilla</i>	P	P	P
<i>C. laevis</i>	P	P	P
<i>C. leptoceras</i>	P	P	P
<i>C. microcephala</i>	A	P	P
<i>C. cuspidata</i>	P	P	P
<i>C. amphicephala</i>	P	P	P
<i>C. obtuse</i>	P	P	P
<i>C. cymbiformis</i>	P	P	P
<i>Cyclotella glomerata</i>	P	P	P
<i>C. kuetzingiana</i>	P	P	P
<i>C. operculata</i>	A	P	P
<i>C. glomerata</i>	P	P	P
<i>Cocconeis placentula</i>	P	P	P
<i>C. costata</i>	P	P	P
<i>Cymatopleura elliptica</i>	P	P	P
<i>Diatoma heimale</i>	A	P	P
<i>D. vulgare</i>	P	P	P
<i>Denticluea elgans</i>	P	P	P
<i>Epithemia gibba</i>	P	P	P
<i>E. gibba var. ventricosa</i>	A	P	P
<i>E. gibberula</i>	P	P	P
<i>E. zebra</i>	P	P	P
<i>E. sores</i>	P	A	P
<i>Encyonema caespitosum</i>	P	P	P
<i>E. caespitosum var. lata</i>	P	P	P

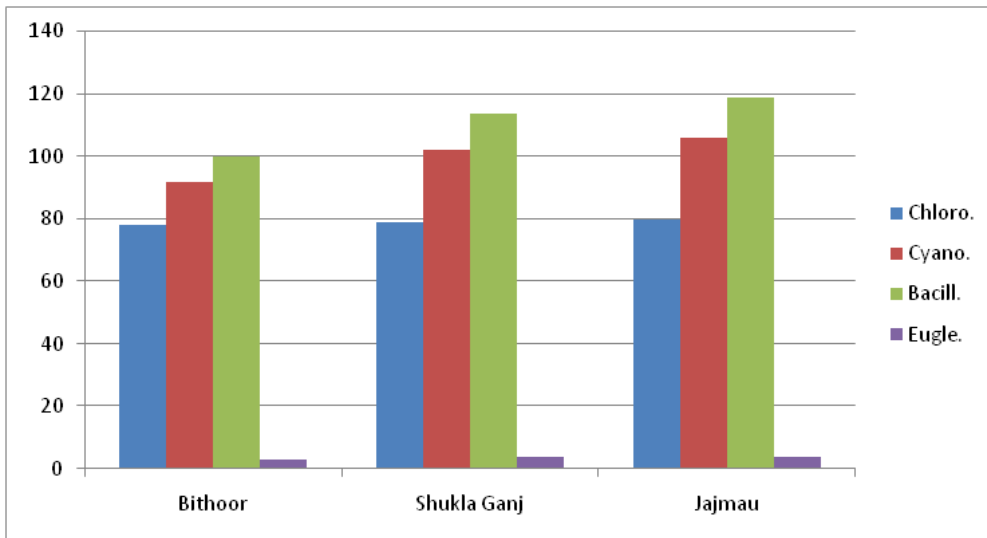
ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR

ALGAL SPECIES	BITHOOR	SHUKLAGANJ	JAJMAU
<i>Fragilaria capusina</i>	A	P	P
<i>F. construense</i>	A	P	P
<i>F. crotonensis</i>	P	P	P
<i>F. mutabilis</i>	P	P	P
<i>Gyrosigma spenceri</i>	P	P	P
<i>G. scalproides</i>	A	P	P
<i>G. kuetzingiana</i>	P	P	P
<i>Gomphonema montanum</i>	A	P	P
<i>G. constructum</i>	P	P	P
<i>G. geminatum</i>	P	A	P
<i>G. augar</i>	A	P	P
<i>G. exiguum</i>	P	P	P
<i>G. olivaceum</i>	P	P	P
<i>G. parvalum</i>	A	P	P
<i>Gomphoneis herculaena</i>	P	P	P
<i>Melosira distans</i>	A	P	P
<i>M.echinulata</i>	P	P	P
<i>M. italic</i>	P	P	P
<i>M. varians</i>	A	P	P
<i>M. granulata</i>	P	P	P
<i>Navicula gastrum</i>	P	P	P
<i>N. ambigua</i>	P	P	P
<i>N. exigua</i>	P	P	P
<i>N. anglica</i>	P	P	P
<i>N. sphaerophora</i>	A	P	P
<i>N. perpussila</i>	P	P	P
<i>N.laevissima</i>	P	P	P
<i>N. dicephala</i>	P	P	P
<i>N.capitata</i>	P	P	P
<i>N. cryptocephala</i>	P	A	P
<i>N.protracta</i>	P	P	P
<i>N. pupula</i>	P	P	P
<i>N. tuscula</i>	A	P	P
<i>N. seminulum</i>	P	P	P
<i>N. radiosa</i>	P	P	P
<i>N. lanceolata</i>	P	P	P
<i>N. inaquiletera</i>	A	P	P
<i>N. cocconeiformis</i>	P	P	P
<i>N. mutica</i>	P	P	P
<i>N. platystoma</i>	A	P	P
<i>N. ventricosa</i>	P	P	P
<i>N. brebissonii</i>	P	P	P
<i>N. salinarum</i>	P	P	P
<i>N. humilis</i>	P	P	P
<i>Navicula peregrine</i>	P	P	P
<i>N. gallica</i>	P	P	P
<i>N. borealis</i>	P	A	P

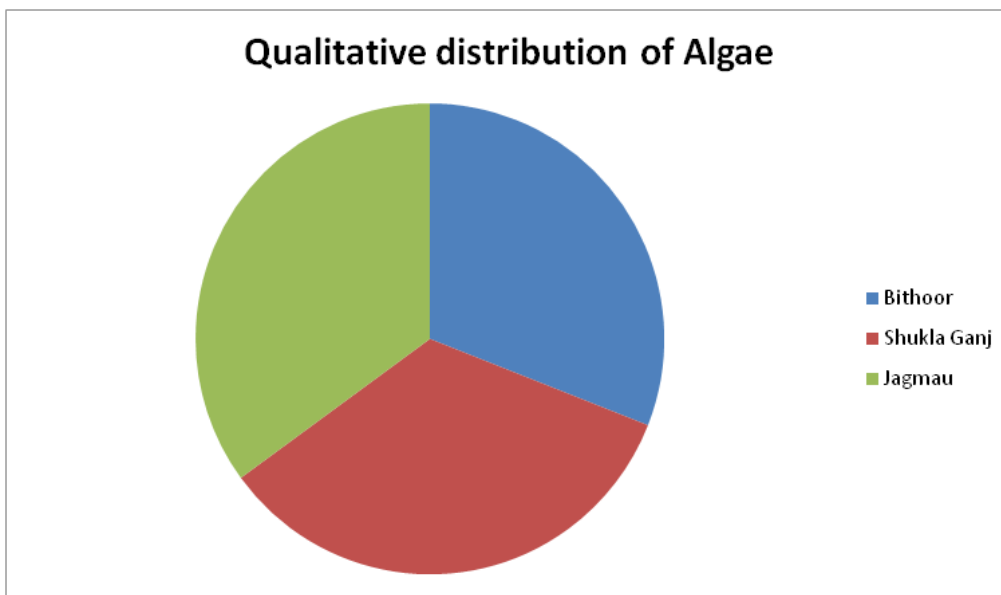
ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR

ALGAL SPECIES	BITHOOR	SHUKLAGANJ	JAJMAU
<i>N. amphisbaena</i>	P	P	P
<i>Nitzschia linearis</i>	P	P	P
<i>N. linearis</i>	P	P	P
<i>N. palea</i>	P	P	P
<i>N. angustata</i>	P	P	P
<i>N. acicularis</i>	P	P	P
<i>N. dessipata</i>	A	P	P
<i>N. thermalis</i>	A	P	P
<i>N. obtuse</i>	P	P	P
<i>N. microcephala</i>	P	P	P
<i>N. apiculata</i>	P	P	P
<i>N. debilis</i>	P	A	P
<i>N. subtilis</i>	P	P	P
<i>N. amphibian</i>	P	P	P
<i>N. vermicularis</i>	A	P	P
<i>N. hungarica</i>	P	P	P
<i>Plurosigma spencerii</i>	P	P	P
<i>P. spencerii var. nodifera</i>	A	P	P
<i>P. perkeri</i>	P	P	P
<i>P. scalprodiis</i>	P	P	P
<i>Pinularia undulata</i>	P	P	P
<i>Rhopalodia gibba</i>	P	P	A
<i>R. ventricosa</i>	P	P	P
<i>Stauroneis anceps</i>	P	P	P
<i>S. acuta</i>	P	P	P
<i>S. smithii</i>	P	P	P
<i>Synedra ulna</i>	P	P	P
<i>S. ulna var. denica</i>	P	P	P
<i>S. ulna var. obtuse</i>	A	P	P
<i>S. vaucherii</i>	P	P	P
<i>S. radians</i>	P	P	P
<i>S. pulchella</i>	P	A	P
<i>S. acus</i>	A	P	P
<i>Surirella robusta</i>	A	P	P
<i>S. elgans</i>	P	P	P
<i>S. ovalis.</i>	A	P	P
EUGLENOPHYCEAE			
<i>Euglena viridis</i>	P	P	P
<i>E. gracilis</i>	A	P	P
<i>Euglena sinuta</i>	A	P	P
<i>Phacus aminatus</i>	P	P	P

ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR

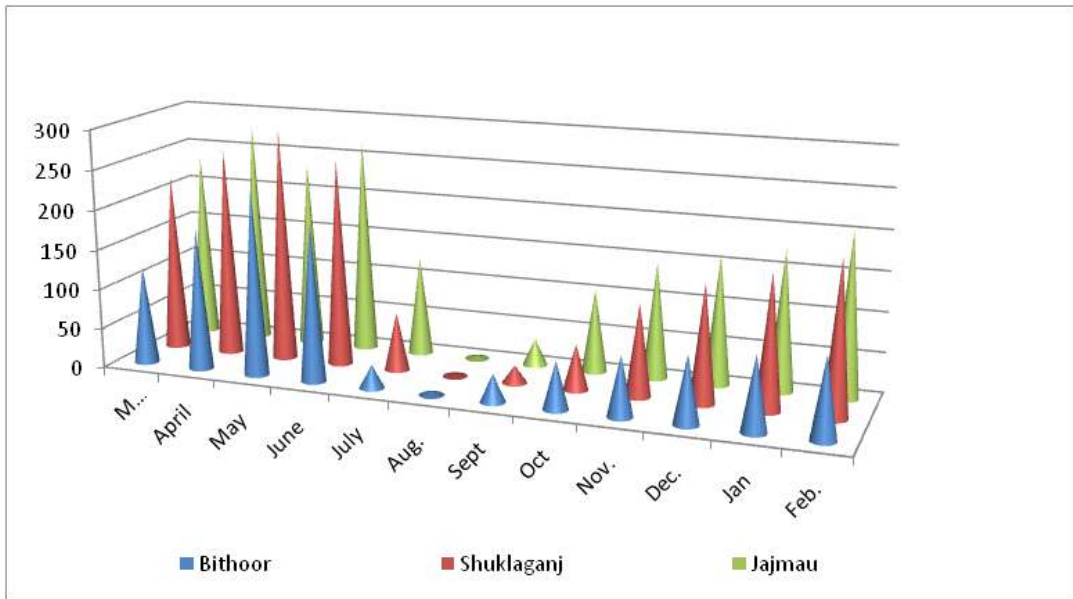


Occurrence of members (genera) of different classes of algae at selected sites of river Ganga

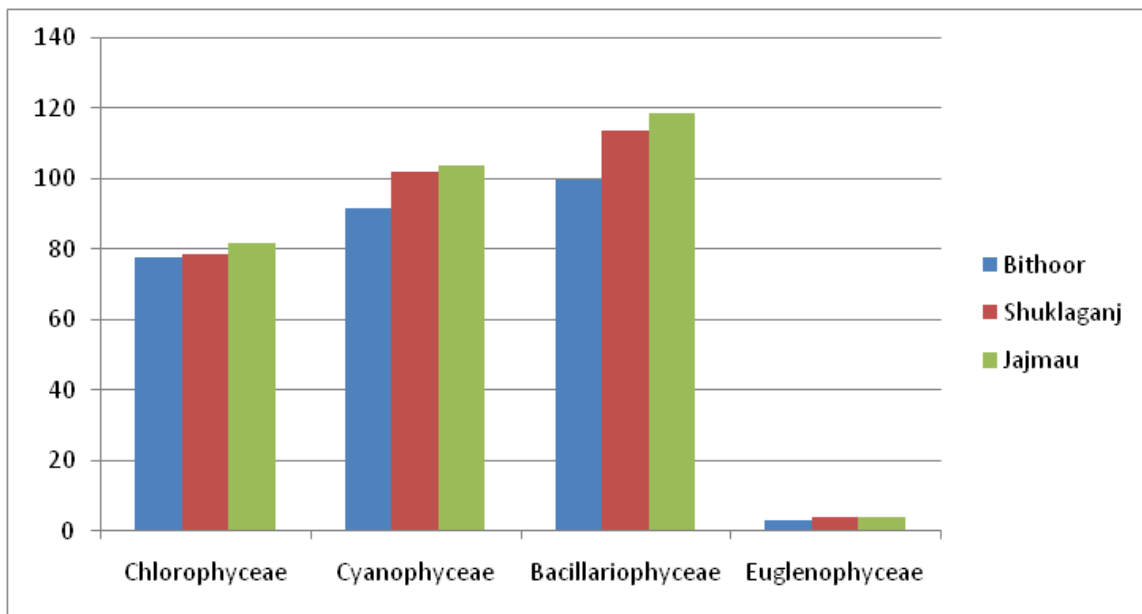


Occurrence of total algae at selected sites of river Ganga

ALGAE OF RIVER GANGAWATER BETWEEN BITHOOR TO JAJMAU, KANPUR



Comparative Occurrence of Algal species at Selected Sites During Different Months of the Year



Quantitative Occurrence of Different Classes of Algae

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TABLE –2 : TOTAL NUMBER OF ALGAE IN EACH CLASS FROM MARCH TO FEBRUARY AT BITHOOR.

CHOLOROPHYCEAE	CYANOPHYCEAE	BACILLARIOPHYCEAE	EUGLENOPHYCEAE	TOTAL
78	92	100	3	273

TABLE – 3: TOTAL NUMBER OF ALGAE IN EACH MONTH AT BITHOOR

MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
123	178	235	197	29	09	35	60	75	84	93	101

TABLE – 4: TOTAL NUMBER OF ALGAE IN EACH CLASS AND MONTH AT BITHOOR

Months	Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae
MAR	28	51	44	-
APR	40	66	72	-
MAY	53	86	94	2
JUN	39	77	79	2
JUL	9	3	17	-
AUG	2	2	5	-
SEP	11	9	15	-
OCT	18	16	25	1
NOV	20	32	23	-
DEC	22	36	26	-
JAN	24	41	28	-
FEB	24	47	30	-

TABLE – 5 : TOTAL NUMBER OF ALGAE IN EACH CLASS FROM MARCH TO FEBRUARY AT SHUKLAGANJ.

CHOLOROPHYCEAE	CYANOPHYCEAE	BACILLARIOPHYCEAE	EUGLENOPHYCEAE	TOTAL
79	102	114	4	299

TABLE – 6 : TOTAL NUMBER OF ALGAE IN EACH MONTH AT SHUKLAGANJ

MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
221	262	292	260	73	22	2	57	116	148	168	192

TABLE –7: TOTAL NUMBER OF ALGAE IN EACH CLASS AND MONTH AT SHUKLAGANJ

Months	Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae
MAR	57	73	89	2
APR	63	96	101	2
MAY	74	99	116	3
JUN	68	88	100	4
JUL	20	22	29	2
AUG	5	9	8	0
SEP	2	0	0	0
OCT	16	28	13	0
NOV	36	48	32	-
DEC	38	57	51	2
JAN	41	61	63	3
FEB	52	65	73	2

TABLE – 8: TOTAL NUMBER OF ALGAE IN EACH CLASS FROM MARCH TO FEBRUARY AT JAJMAU

CHOLOROPHYCEAE	CYANOPHYCEAE	BACILLARIOPHYCEAE	EUGLENOPHYCEAE	TOTAL
80	106	119	4	309

TABLE – 9 : TOTAL NUMBER OF ALGAE IN EACH MONTH AT JAJMAU

MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
235	281	296	270	125	34	4	105	146	163	177	206

TABLE –10: TOTAL NUMBER OF ALGAE IN EACH CLASS AND MONTH AT JAJMAU

Months	Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae
MAR	57	87	88	3
APR	69	100	109	3
MAY	78	102	112	4
JUN	48	98	120	4
JUL	30	38	29	3
AUG	12	17	5	0
SEP	3	1	0	0
OCT	14	38	53	0
NOV	36	48	62	-
DEC	38	57	67	1
JAN	41	62	72	2
FEB	52	69	83	2

Urbanization is the main cause of pollution, as after use the water is discharged into the immediate surrounding and drained into the lotic water of river. The variation in algal population at different points or under different conditions of organic pollution constitutes one of the indices that can be applied to determine the presence or absence of domestic sewage or other putrescible wastes or measure of the degree of recovery from pollution. Algae are invariably involved in part, or most of the increased eutrophication growth. The qualitative and quantitative assessment of alga in river Ganga

shows the diatoms indicating eutrophic state of water.

Water free from sewage or other organic enrichment due to waste discharge usually shows the presence of clean water organisms. These organisms, particularly the algae are typical of oligosaprobic zone, where self-purification process of water or mineralization of waste material has been completed. Because of photosynthetic activity algae not only contribute to the oxygenation of water but also constantly form a biological film and act in beneficial manner towards maintenance of water quality. At the same time also the problems of clogging, taste, odor and impair water quality.

ACKNOWLEDGEMENT

Author is grateful to Dr. Vivek Dwivedi, Principal, Brahmanand College, Kanpur for his kind assistance and encouragement and University Grant Commission, New Delhi, for providing Minor Research Project grant.

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