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PHYTOPLANKTON POPULATION AND ANALYSIS - VARADA RIVER WATER

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***Abstracts*– The river ecosystem is enormously polluting day by day due to the anthropogenic impact and environmental pollutants, this is directly effecting on the aquatic organisms. The present investigation was undertaken to study the phytoplankton population and physico-chemical analysis of the Varada river water. It shows seasonal fluctuation in the alkalinity, calcium, magnesium and hardness contents, due to the small scale industries, environmental degradation on the bank of the river and also the environmental factors impact on the growth and development of aquatic organisms especially on phytoplankton are studied.**

***Keyword*– Phytoplankton Population, Physico-chemical factors, Varada River Water quality.**

INTRODUCTION

Rivers play a very important role to maintain the biodiversity of the nation. Rivers are the major sources of our water supply to the village, towns and cities. If availability of water is less due to failure of monsoons as it happens in south often, it gives rise to sever scarcity. In the name of development today most of the rivers of world receive millions of liters of sewage, domestic waste, industrial and agricultural effluents containing substances varying in characteristic from simple nutrients to highly toxic substances. Increasing industrialization and consequent urbanizations are the most significant causes of pollution of aquatic ecosystem due to a diverse kind of wastes produced by them. The rapid population, industrialization, urbanization, technological development, injudicious planning without due regard to the sustainable development have induced numerous changes in the environment. Water is a main concern as billions of people worldwide have no access to safe drinking water. Water is basic to life and health of all living organisms. Rivers are dynamic systems that receive minerals and nutrients through sedimentation, rain, surface and ground water and human generated pollution. In the present investigation involves the following objectives.

1. To study the phytoplankton population.
2. To analyze the physico-chemical factors of the river.
3. To assess the anthropogenic impact on Phytoplankton.
4. To check the water quality and Pollution assessment in the river.

MATERIALS AND METHODS

Monthly surface water samples were collected in two different sites, from Jun 2014 to May 2015. The reading is recorded for physico-chemical and Biological factors described in APHA (2005).

Haveri District at a Glance:

Haveri district was formed in the year 2001 by earlier Dharwad district into Dharwad, Haveri, and Gadag districts. Haveri district is located in the northern part of Karnataka State with geographical area of 4851 sq.km. The district is bounded by Davangere district on eastern and southeastern side, Gadag and Dharwad district on northside, Uttara Kannada district on western side and Shimoga district on the southwestern side. It lies between 14^0 16' to 15^0 10' North Latitude and 75^0 01' to 75^0 50'East Longitude. The major part of the soil is red sandy soil, followed by the medium black soil and deep black soil, the major crop is Maize, Jawar and Cotton etc.

Rain fall: The normal annual rainfall of Haveri taluk is 752.8 mm, during the period of study June 2014 to May 2015, the Haveri taluk total rainfall is received 868.26 mm, usually an excess of rain has received, as a result, there has been huge overflow of the river.

STUDY AREA:

Topography of the Varada River: The Varada river originates in Vardamoola in Sagar taluk (6 kms from Sagara in Shimoga district) and enters Banavasi through the Western Ghats.Later it enters the central districts of Karnataka (Haveri and Ballary). The place is remote and is picturesque. The place is also called as Theertha grama (Holy water village). Many temples are situated in this place along with two

Kalyani / Holy water tank from where the Varada river bubbles out. Varada river joins the Tungabhadra river near Galaganath village in Haveri district. The river flows as miniature stream through small valleys of Western Ghats, and widens in Haveri district near Sangur village. The Varada river water plays a vital role in supply of drinking, domestic and also for agriculture for the people living on the banks.

FIELD STUDY:

Collection of water sample: The water samples were collected on 1st of every month from two different stations and monthly reading were taken from Jun 2014 to May 2015. The data of sample collections were collecting in a clean sample bottles for the study of various physico-chemical parameters. The collection and observation of water samples from two different stations were made between 9.00 AM to 10.00 AM hours throughout the study period. A vehicle was used to maintain accuracy in reaching the stations on time from G H College, Haveri to Varada river approximately 18 KMS.

RESULTS AND DISCUSSIONS

In the present study large number of phytoplankton belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae were recorded (Table-3). They have shown fluctuation in their periodicity depending upon the availability of various nutrients.

Chlorophyceae: The distribution and periodicity of Chlorophyceae members recorded from Varada river is given in Tables 1 to 3. In present study the Chlorophyceae is mainly represented by 12 species. *Chlorella fusca, C. vulgaris (Beyerinck), Haematococcus lacusta (Girod), Euastrum Spinulosum, E. quadratum, Pediastrum bonyanum, Cosmarium subtumidium, Sphaerozosma Wallichii, Spirogyra Sabsalsa Keutezing, Chlosterium tumidum, Chlosterium acerosum and Scenedesmus sps*

Munawar 1970 states that the low nitrate, phosphate and high dissolved oxygen are the factors responsible for maximum occurrence of green algae, Pearsall (1924), Singh (1960), Seenayya 1971, have also made a similar observation and concluded that temperature, pH, phosphate, nitrate and dissolved oxygen play an important role in the growth of Chlorophyceae members. The highest number of organisms were recorded during North East Monsoon season (4911 O/L) and followed by the minimum (2080 O/L) in Summer. The variation in periodicity may be because of fluctuation in physico-chemical factors.

The occurrence of Desmides, the member of zygnematales of this group are very sensitive to pollution, which shows the water quality. *Chlorella fusca* and *chlorella vulgaris, Euastrum quadratum, spirogyra* have occurred at two sites during the peak at North East Monsoon. The fluctuation in distribution pattern of chlorophyceae can be attributed to high alkalinity, silicates and pH. The similar observations were also made by Philipose (1959) and Prescott (1982).

Bacillariophyceae: The distribution and periodicity of diatoms are given in the table No. 1 to 3. The Varada river is represented by 10 species of Baciliariophyceae, they are: *Navicula rhomboidis, Cyamatopleura tumida, Synedra ulna, Mastolgloia Smithii, Meridion Sps., Pinnularia viridis Ehrimb, Surirella robusta, Anomoneis sphacerophora, Dactylococcopsis rephidiodis hanegirg.* and *Fragilaria sps.* In the present study it was observed that the diatoms recorded slightly increase from South West Monsoon seasons (4295 O/L) to North East Monsoon season (4417) and maximum 5531 O/L during summer season.

The Diatoms have been studied by many workers. The important contributions were made by Pearsell (1923), Philipose (1959), more recently by Yin Zin Wel (2002), Oliveira *et. al.,* (2001), Kalchev *et. al.,* (2000), Cronborg (1999). Hosmani and Bharati (1988), states that high concentration of phosphates, silica and nitrates are factors favoured the growth and development of diatoms. Similarly Zafar (1986) and Munavar (1970) have opined that high phosphate and nitrate are favourable for the luxurient growth diatoms. Cronborg (1999) have observed the pH favoured the high number of diatoms. Oliveira *et. al.,* (2001) have opened that the BOD and phosphate concentration play an important role.

In the present study it was observed that high temperature, pH, dissolved oxygen, calcium, magnesium, total hardness, biochemical oxygen demand along with these factors. The most important was silica which favors the luxuriant growth of the diatoms. The observation made during the present study was in conformity with the above workers.

Cyanophyceae: In the present study, distribution and periodicity of Cyanophyceae members in the Varada river is represented in table 1 to 3. It was observed that the blue green algal population was in lesser number and had shown a slight increase from

South West Monsoon season to North East Monsoon season. A maximum during North East Monsoon season 1742 o/L and minimum of 1122 O/L during the Summer. Totally eight species have been recorded from the class Cyanophyceae. *Chrococcus varius A. Br, Gloeocapsa granosa, Lyngbya semiplena Gomont,, Lyngbya hieronymusii Lemm, Aphenocapsa endophytica G. M. Smith, Stichosiphon sansibariens (Hieron). Arthrospira sps and Microcystis aeruginosa.*

The higher number of blue green algal population during North East Monsoon season can be attributed to the high values of pH. Dissolved oxygen and BOD, as the presence of these factors favours the maximum growth of Cynaophyceae. The observation made in the present study is the conformity by the observations made by Desikachary (1955), and Prescott (1982). It was also being observed that sunshine and temperature played an important role in increased number of blue greens, as it is the fact in tropical belt that a bright sunshine and high temperature is the characteristic feature (Desikachary, 1955).

Euglenophyceae: The monthly variation, distribution and periodicity of Euglenophyceae is given in table 1 to 3. In the present study, it was observed that seasonal variation of Euglenophyceae population was low, however a slight more in summer. Totally 6 species represents the Euglenophyceae, that are: *Phacus caudate var ovalis Drejepolski, P. arbicularis Var caudatus skvortzon, Euglena acus, E. proxima Dangeard, E. polymorpha Dangeard, Lepocinchis fusiformis var major.*

Several workers have discussed on the distribution of Euglenophyeae in various types of freshwater environment. Most important contributions came from Davis (1962) and Chandler (1937). Munawar (1970) have attributed that the high percentage of Euglenophyceae to the high concentration of free carbon dioxide, Davis (1962), Seenayya (1971) opined that, the high temperature favours the growth of Euglenophyceae. Hegde and Bharathi (1985) observed that the high pH favoured the growth of Euglenophyceae.

In the present study it was observed that the Euglenophyceae members are steadily increase from South West Monsoon seasons (966 O/L) to North East Monsoon season (1012 O/L) but maximum of (1563 O/L) were recorded in the summer season. Presence of all species constant throughout the year, The high pH, CO_2, BOD, Mg played a significant role on growth of Euglenophyceae members. The result and observation made are in conformity with the workers as mentioned above.

CONCLUSION

The findings from the study summarized as follows. All the physico-chemical characters of Varada river water are within the desirable limit set by WHO except turbidity, Iron and Manganese. As water moves across the surface of a landscape and through the ground, nutrients and minerals can dissolve in the water and get carried into the rivers. High values of both iron and manganese may be the case of dissolution of ferrous iron and manganese in the Varada river water of the catchment area.

The water of Varada River was alkaline throughout the study period except during summer months. The hardness of the river water is moderately high in the post monsoon period. The low value of dissolved oxygen in both sites indicates the presence of significant flow of inorganic fertilizers. High concentration of iron and manganese during summer makes Varada river water not potable, while the values for other parameters in Varada are within permissible limits.

The Phytoplankton of Varada river shows the dominance order of Bacillariophyceae, followed by, Chlorophyceae, Cynophyceae and Euglenophyceae. It has been recorded that the Bacillariophyceae, population and their composition was more and dominant during the study period. It shows only 10 species but, quantitatively they are more in number, occurrence of *Surriella robusta, Navicula rhomboids*, *Synedra ulna, Fragillaria sp* and *Mastogloia smithi showed* maximum during North East Monsoon and Summer. The Chlorophyceae shows 12 members and are the second dominant group occurrence of *Chlorella fusca. C. vulgaris, Euastrum spinolosum, E. quadratum,* and *Spirogyra subsalsa* were recorded more in number during the South west Monsoon and North East Monsoon, remaining species showed a seasonal trend.

The third dominant group was the Cyanophyceae members, recorded 8 species showed *Chrococcus varius, Gloeocapsa granosa, Lyngbya hieronymusii* and *Microcystis aeruginosa* are more dominated in South West Monsoon and North East Monsoon. The Euglenophyceae members are the last in the dominancy, 6 species have been recorded *Phacus caudate, P. arbicularis, and Euglena acus* are the more common during the North East Monsoon and summer and remaining species showed a seasonal trend. During the present study period totally 36 species of phytoplankton belonging to 4

major classes of algae were recorded from the collection samples.

There is an urgent need to encourage the formers using the organic manures/bio fertilizers and biopesticides for their fields on the bank of the river, for avoiding the entry of chemicals into the river water, the concern authorities need to adopt indigenous technologies to make water fit for drinking, agriculture and domestic need for better feature.

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TABLE-1: LIST OF PHYTOPLANKTON FOUND IN THE VARADA RIVER,

DURING JUNE 2014 MAYS 2015

CYANOPHYCEAE	**CHLOROPHYCEAE**
Chrococcus varius A. Br.	*Chiorella fusca*
Gloeocapsa granosa	*Chlorella vulgaris (Beyerinck)*
Lyngbya semiplena Gomont	*Haematococcus lacusta Girod*
Lyngbya hieronysii Lemm	*Euastrum Spinulosum*
Abhenocapsa endophytica Smith	*Euastrum quadratum*
Stichosiphon sansibariens (Hieron)	*Pediastrum bonyanum*
Arthrospira sps	*Cosmarium subtumidium*
Microcystis aeruginosa	*Sphaerozosma Wallichii*
BACILLARIPHYCEAE	*Spirogyra Sabsalsa Keutezing*
Navicula rhomboidis	*Chlosterium tumidum*
Cymatopleura tumida	*Chlosterium acerosum*
Synedra ulna	*Scenedesmus sps*
Mastolgloia Smithii	**EUGLENOPHYCEAE**
Meridion Sps.	*Phacus caudate*
Pinnularia viridis Ehrimb	*Phacus arbicularis*
Surirella robusta	*Euglena acus*
Anomoneis sphacerophora	*Euglena proxima Dangeard*
Dactylococcopsis rephidiodis	*Euglena polymorpha*
Fragilaria sp	*Lepocinchis fusiform*

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TABLE-2: MONTHLY AVERAGE VALUES OF PHYSICO-CHEMICAL PARAMETERS OF VARADA RIVER (KUNIMELLIHALLI) NEAR HAVERI BELT, KARNATAKA, DURING 2014-2015

MONTHS	TEMP.		pH	DO	CONDUC-TIVITY	TURBI DITY	FREE Co2	DS	ALKA-LINITY	HARD-NESS	CHLO-RIDE	CAL-CIUM	MAGNE-SIUM	PHOS-PHATE	NO_3	NO2	SO4	IRON	FLORIDE	BOD
	WATER	AIR																		
JUNE	29.0	30.5	7.3	68	178	30	2.0	120	24	28	16	7.2	2.4	ND	12.1	ND	18	0.53	0.2	2.8

JULY	28.5	30.0	7.5	72	102	12	1.4	80	32	32	16	8	2.9	ND	4.61	0.13	6.12	0.11	0.2	1.5
AUG	27.6	28.4	7.8	82	96	15	1.2	60	20	26	14	7.6	1.7	0.06	8.2	ND	3.2	0.11	0.2	3.3
SEPT	28.5	29.4	7.7	90	123	3	0.8	80	32	38	16	11.2	2.9	ND	5.0	ND	6.4	0.08	0.2	2.4
OCT	27.4	28.5	7.4	78	204	3	1.6	140	60	62	26	17.6	4.3	0.016	6.1	ND	11	0.3	0.2	1.2
NOV	27.6	28.2	8.0	72	220	2	1.8	329	116	118	36	33.6	8.3	ND	5.1	ND	7.2	ND	0.2	1.1
DEC	26.6	27.8	7.8	68	337	2	2.2	220	110	112	44	31	8.3	ND	7	ND	5	ND	0.2	1.2
JAN	27.4	28.5	7.7	74	357	2	1.8	240	118	118	50	32	9.2	ND	0.97	ND	10.3	0.08	0.2	1.1
FEB	29.2	30.2	8.1	68	391	2	1.4	260	130	142	54	40	10.2	ND	4.9	ND	12.8	0.06	0.2	1.1
MAR	30.6	31.8	7.9	62	450	2	1.2	298	120	120	60	35.2	7.8	0.036	3.8	ND	25	0.09	0.4	1.1
APRL	30.2	31.4	8.0	66	354	3	1.8	240	126	120	48	34	3.4	0.092	5.4	ND	3.7	0.09	0.2	2.2
MAY	30.4	31.6	7.9	72	478	2	1.8	310	132	140	76	40	3.3	ND	4.7	ND	21.6	0.06	0.4	2.0

*All the values are expressed in mg/L, except temperature and pH.

TABLE-3: MONTH WISE DISTRIBUTION AND PERIODICITY OF PHYTOPLANKTON OF VARADA RIVER, DURING JUNE TO 2014 TO MAY 2015

Month	Chloro-phyceae	Bacillario-phyceae	Cyano-phyceae	Eugleno-phyceae	Total
JUNE	672	1018	532	187	2409
JULY	808	892	488	306	2494
AUG	602	1205	391	281	2479
SEPT	980	1180	276	192	2628
OCT	1230	880	686	87	2883
NOV	1460	902	568	195	3125
DEC	1241	1140	302	322	2978
JAN	1007	1495	186	408	3096
FEB	609	1610	138	611	2968
MAR	581	1808	207	402	2998
APRL	392	1206	409	309	2376
MAY	498	907	308	241	1954
TOTAL	**10,053**	**14,243**	**4,551**	**3,541**	**32,388**
%	**31.04**	**43.98**	**14.05**	**10.93**	**100.00**

*All the values expressed in O/L (Organisms per Liter).