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Anthropogenic Impact on Varada River with Special Reference to Phytoplankton

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ABSTRACTS: The aquatic ecosystem is enormously polluting day by day due to the human interference and environmental pollutants, this is directly effecting on the aquatic organisms. The present investigation was undertaken to study the 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 ecological factors impact on the growth and healthy development of aquatic organisms especially on phytoplankton are studied.

KEY WORDS: Varada River, Phytoplankton, Physico-chemical factors, Water quality, pollution.

I. INTRODUCTION

Rivers of the nation are the major sources of our water supply to the 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. 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.

Increased population, rapid 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 beings. Adequate drinking water quality is essential for the well being of all humans who use water not only for drinking but also at home, in industry, agriculture, recreation etc.

Rivers are dynamic systems that receive minerals and nutrients through sedimentation, rain, surface and ground water and human generated pollution. Chemical analysis of river water quality and indications of nutrient dynamics in the surrounding landscapes. In the present investigation involves the following objectives.

1. To study the Physico-chemical parameters of the river.
2. To study the diversity of phytoplankton.
3. To analyze the. Anthropogenic impact on Phytoplankton.
4. To assess the water quality and Pollution assessment in the River.

II. 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).

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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° 16' to 15° 10' North Latitude and 75° 01' to 75° 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 collected in 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.

III. RESULTS AND DISCUSSIONS

The physico-chemical factors play significant role on the growth of micro-organisms in the lotic ecosystem. This has been studied by several investigators. Some of the factors may independently promote the phytoplankton growth individually. However, combined effect of these factors with reference to the anthropogenic impact on ecosystem is also equally important. 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 Table No. 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 subtumidum*, *Sphaeroszma 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 zygnetatales 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).

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Bacillariophyceae: The seasonal distribution and periodicity of diatoms are given in the table No. 1 to 3. The Varada river is represented by 10 species of Bacillariophyceae, they are: *Navicula rhomboidis*, *Cyamatopleura tumida*, *Synedra ulna*, *Mastogloia 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 luxuriant 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 favours 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. *Chroococcus varius A. Br.*, *Gloeocapsa granosa*, *Lyngbya semiplena Gomont.*, *Lyngbya hieronymusii Lemm.*, *Aphenocapsa endophytica G. M. Smith*, *Stichosiphon sansibariensis (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 seasonal 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. arbutularis Var caudatus skvortzon*, *Euglena acus*, *E. proxima Dangeard*, *E. polymorpha Dangeard*, *Lepocinchis fusiformis var major.*

Several workers have discussed on the distribution of Euglenophyceae 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, CO₂, 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.

IV. CONCLUSION

The present investigations was undertaken to study the Ecological characteristics of Varada river. The study was carried out for a period of one years from June 2014 to May 2015, from two selected sites (mean reading was taken) at Kunimelihalli, near Haveri Belt. The water samples and phytoplankton were collected on first of every month on a

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regular monthly basis. 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 *Chroococcus 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. arbutularis*, 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 discourage the farmers using excess fertilizers for their fields on the bank of the river, the concern authorities need to adopt indigenous technologies to make water fit for drinking, agriculture and domestic need.

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REFERENCES

- [1]. APHA, AWWA, WPCF "Standard methods for the estimation of water and waste water, American Public Health Association, American Waste Water Association and Water Pollution Control Federation", 19th Edition Washington, 2005.
- [2]. Chandler D. C. "Fate of typical lake plankton in streams". *Ecol. Monogr.*, 7:445-79, 1937.
- [3]. Cronborg G. "Qualitative and Quantitative investigations of phytoplankton in lake Ragesjon, Scania Sweden", *Hydrobiologia* 404 (0) 27-40, 1999.
- [4]. Davis, C. C. "The plankton of the Cleveland Harbour area of Lakes Erie in 1956-57", *Ecol. Monoger.* 32: 209-247, 1962.
- [5]. Desikachary, T. V. "Cyanophyta", *JCAR*, New Delhi, 1955.
- [6]. Dutta, N., Malhotra J. C. and Bose, B. B. "Hydrobiology and seasonal fluctuations of the plankton in the Hooghly Estuary", *Symposium on marine and freshwater plankton in the Indopacific, Bangkok*: 35-47, 1954.
- [7]. Hegde C. R. and Bharati S. G. "Comparative phytoplankton ecology of fresh water ponds and lakes of Dharwad, Karnataka State", *India Proc. Nat. Symp. Pure and Appl. Limnology (ed) Adoni, A. D. Bull. Bot. Soc. Sagar* 32: 23-29, 1985.
- [8]. Hosmani and Bharati "Seasonal changes in Phytoplanktons communities in fresh water pond at Dharwad, Karnataka State, India", *Phycos*: 27: 82-87, 1988.
- [9]. Kalchev, R. K. Beshkova, M. B. Tsevetkova, R. L. and Botev, I. S. "Phytoplankton composition and structure of three sand pit lakes at different stages of their successional development", *phytologia balcanica* 6 (1): 119-13, 2000.
- [10]. Munawar, M. "Limnological studies on fresh water ponds of Hyderabad, India", I. The biotope. *Hydrobiologia*, 35: 127-162, 1970.
- [11]. Oliveira, M. A., Torgan, L.C. Lobo, E. A. and Scharzbold, A. "Association of Periphytic diatom species of artificial substrate in lotic environment in the Arroio Sampaio Basin, Brazil, relationship with abiotic variables", *Brazilial J. of Bio.* 61(4) 523-540, 2001.
- [12]. Pearsall W. H. "A theory of diatom periodicity", *J. Ecol.* 11: 165-183, 1923.
- [13]. Pearsall W. H. "Phytoplankton and environment in the lake district Rev", *Algol.* 1: 53-67, 1924

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- [14]. Phillipose, M. T. "Fresh water phytoplankton of the inland fisheries". *Proc. Symp. Algalogy*. ICAR New Delhi 272-291, 1959.
- [15]. Prescott G. W. "Algae of the western great lakes area Otto Koeltz" *Science publishers*, Dehra Dun, 1982.
- [16]. Seenayya G. "Ecological structures in the plankton of certain fresh water ponds of Hyderabad – India" , Physico-chemical complexes. *Hydrobiologia* 37 (1): 7-31, 1971.
- [17]. Sedamkar E. B. and Angadi S. B. "Physico-chemical parameters of two Fresh water bodies of Gulbarga – India, with special reference to Phytoplankton". *Poll Res.* 22 (3): 411-422, 2003.
- [18]. Singh V. P. "Phytoplankton Ecology of the inland waters of UP" *Proc. Symp. Algae*, ICAR New Delhi: 263-271, 1960.
- [19]. Yin Xin Wei "Species composition, horizontal distribution and seasonal succession of phytoplankton in the channel from Dongting lake to the Changjiang river", *Chinese, J. Ocean. Lim.* 20 (2) 142-148, 2002.
- [20]. Zafar A. R. "Seasonality of phytoplankton in some South Indian lakes", *Hydrobiologia* 138: 17, 1986.

**TABLE-1: LIST OF PHYTOPLANKTON FOUND IN THE VARADA RIVER,
DURING JUNE 2014 MAYS 2015**

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

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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	CONDUCTIVITY	TURBIDITY	FREE CO2	DS	ALKALINITY	HARDNESS	CHLORIDE	CALCIUM	MAGNESIUM	PHOSPHATE	NO ₃	NO ₂	SO ₄	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.

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TABLE-3: SEASONAL VARIATIONS IN THE PHYTOPLANKTON DISTRIBUTION AND PERIODICITY OF THE VARADA RIVER, DURING 2014-2015

Seasons	Chlorophyceae	Bacillariophyceae	Cyanophyceae	Euglenophyceae	Total
South West Monsoon	3062	4295	1687	966	10,010
North East Monsoon	4911	4417	1742	1012	12,082
Summer	2080	5531	1122	1563	10,296
Total	10,053	14,243	4,551	3,541	32,388
Percentage	31.04	43.98	14.05	10.93	100.00

*All the values are expressed in Organisms/Litre (O/L)