International Journal for Environmental Rehabilitation and Conservation
Volume II No. 2 2011 [70 - 78] [ISSN 0975 - 6272]

Pollution, a threat to conservation of Biodiversity in Fresh water body of Chulband River, Gondia Dist., Maharashtra

Cherian, K.J. and Shahare, P.C.

Received: May 07, 2011 | **Accepted**: September 30, 2011 | **Online**: December 27, 2011

Abstract

Algae are frequently found in polluted water as well as unpolluted water bodies. Every alga requires a specific condition for its luxuriant growth and multiplication. The presence of some alga influence the growth of other organisms, both plants and animals. Generally algae are used to determine the quality of water by assessing the degree of pollution or as an indicator of water pollution. Algal samples and water samples were collected from six different locations along the Chulband River in Gondia district. During the summer season of 2010-2011. The percentage of various constituents, colour, odour and turbidity makes the water non-palatable. The grazing animals too do not prefers this water even though the temperature is quite high. In all 18 forms of algae out of which 9 belongs to Cyanophyceae, 3 to Chlorophyceae and 6 to Bacillariophyceae were observed. The growth of these forms and the pollutants present prevent the presence of other algae as well as other zooplanktons and fishes

Keywords: Cyanophyceae | Chlorophyceae | Bacillariophyceae | Chulband River |

For correspondence:

Department of Botany, Hislop College, Nagpur, Maharashtra
Email: cherian_kj@yahoo.in

INTRODUCTION

Water is the most abundant and most useful constituent in the world. The fresh water constitutes rivers, streams, lakes, ponds and reservoirs. These water resources are being polluted day by day, due to increased human population, industrialization uses of fertilizers in agriculture and other man made activity. Biological assessment is a useful alternative for assessing the ecological quality of aquatic water bodies since biological communities integrate the environmental effects of water chemistry, in addition to the physical and geomorphologic characteristics of Rivers and lake.Thus Algal community encountered in the water body reflects the average ecological condition and therefore they may be used as indicator of water quality. The growth and abundance of each every algal form in a fresh

water body is influenced by several environmental factors of which the chemical constituents of water body is of prime importance. The physic - chemical charac-teristic of water plays an important role in algal biodiversity and it determines the algal bloom of any specific species. The study of soil algae in Gondia district were studied by different workers by soil cultures, Cyanophyceae were dominating in crops fields.

Phytoplankton communities respond quickly to anthropogenic inputs of nutrients and toxic substances making them good indicators of changes in environmental water quality. Algae are frequently found in polluted and unpolluted water and due to this behavior they are generally considered useful to determine the quality of water. These are very suitable organisms for the determination of the impact of toxic substances on the aquatic environment because any effect on the lower level of the food chain will also have consequence on the higher level. Algae are used for assessing the degree of pollution or as indicator of water pollution of different water bodies. Phytoplankton constitutes the vary basis of nutrient cycle of an aquatic ecosystem. They play a crucial role in maintaining proper equilibrium between biotic and abiotic components of an aquatic ecosystem. The algae are purifiers of environment on one hand and polluting organisms on the other hand. The phytoplankton diversity with the seasonal fluctuation indicates the diversity of ecological niches.

When the biomass of algae becomes too high or certain species become abundant, the water quality may be negatively impacted. The decreased water transparency and consumption of oxygen in bottom waters after settling are two principal consequences of algal over productivity. Decreased water transparency may affect growth and survival of vascular aquatic plants and cause changes in fish populations. Most of the water bodies in India need to be treated before using it in domestic applications by various ions, salts, etc. so if we were using such type of water as potable water then it leads to various water “borne diseases”. Analysis is necessary for monitoring the effectiveness of the treatment processes for human consumption, aquatic life and for other subsequent uses. The presence of *Nostoc commune* in water body affect the germination of various seeds and spores. Its growth hormone give a promoting effect in the germination as well as the seedling growth in rice. The presence of different types of plants influence positively or negatively the growth of micro-organisms in their vicinity. Rhizosphere of crops plant content more species than the non-rhizosphere in the same depth of soil.

Study area: Gondia (Lat. 21° 28' N & Lon. 80° 29' E) district is situated in the western part of Maharashtra state. The district covers an area of 4843.12 sq.km of which 2644.70 sq.km fall under forest area. The source streams of the Chulband River originate from the Salegaon Dalli near Dodake-Jambhali and Palasgaon hill complex. The Chulband flows southwards with a subparallel valley to that of the Wainganga to its east and joins it at the

southern limits of the district near the village Soni. The river has an overall length of 114 km. of which major part falls within the district. The river is crossed by the Great Eastern Highway near Sawangi over a bridge and by the Gondia-Nagbhir railway near Gond Umri.

MATERIALS AND METHODS

Study Sites

In all six sites were selected along the length of the river falling in the districts for the present study. The sites were 1.Jambhali 2.Murpar 3.Bothali 4.Sadak Arjuni- I 5.Sadak Arjuni- II 6.Saundad. The Site 1 is located in the forest area while Sites 2 to 5 are located in the village populated area. The Site 6 is located in crop field area. All the sites in the village area are polluted with organic wastes and wastes from Brick industries. The sites 4 & 5 are also exposed to pollution from Skin processing units which collect the skin from various slaughter houses in and around the districts.

Collection of water samples

Water samples for physico-chemical analysis of water were collected from all the six different selected sites of Chulband River in Gondia district from April to June in summer season of 2010-2011. Water samples were collected in 1 liter plastic bottles and 250 ml BOD bottles during morning hours.

Water analysis

The physical analysis like Colour, Temperature, pH and Turbidity was anayalized by using Methodology for water analysis by (IAAB).

Collection of algae from sampling site

Frequent visits to fields during summer season helped me to get maximum algal collections. These fresh collections were made with the help of scalpel, forceps and sieves and were collected in glass bottles. These were brought to the laboratory and identified and developed live cultures from it.

Algal cultures

1. ***Culture vessels*** Conical flasks, flat bottles, petridishes were used in the cultures. These glasswares were well washed first with vim powder, then twice with tap water. These were then rinsed with concentrated sulphuric acid and finally washed with distilled water, 3 to 4 times. Then the flasks and bottles were closed with plugs of non-absorbant cotton, whereas the petridishes were closed with its pair petridishes.
2. ***Culture Media*** Two types of cultures, liquid and moist, were prepared for studying the collected algae. The bottles and conical flasks were used for the liquid cultures whereas petridishes were used for the moist cultures.

The culturing vessels with culture media were sterilized in an autoclave at 2 lbs pressure for 20 minutes prior to inoculation.

The composition of De's (1939) modified Beneck's medium is as follows :

KNO_3	-	0.2 gm
$Mgso_4$ $7H_2O$	-	0.2 gm
K_2HPO_4	-	0.2 gm
$CaCl_2$ $2H_2O$	-	0.1 gm
$FeC1_3$ (1%)	-	2 drops
EDTA	-	Traces
Distilled water	-	1000 ml

Stock solutions of different chemicals were prepared in distilled water. Ferric chloride solution was freshly prepared whenever required. The pH of the culture media was adjusted prior to autoclaving.

Sterilized bottles and flasks were then filled with convenient amount of the medium and were again sterilized in an autoclave at 15 lbs pressure for 20 minutes. After the bottles had cooled down, approximately 5 ml of the water samples were introduced into separate bottles or flasks with the help of sterile pipettes in aseptic conditions. Sterilized culture solution was added to the cultures at suitable intervals to make up the loss of the culture solution partly lost due to evaporation.

Moist cultures were prepared in petridishes which were sterilized in the same way as in the case of bottles. Convenient amount of collected water sample depending on the size of the petridishes were spread evenly in each petridish and moistened with culture medium in the beginning to promote the algal growth. Later on, the petridishes were moistened with sterilized distilled water at intervals to prevent drying of the cultures.

All the cultures were placed near open windows facing north where cultures could get only diffused light. From dense growing cultures subcultures were made for the convenience.

Unialgal culture: - In making sub cultures, a few cells were drawn into a fine sterilized pipette and transferred to 1.5 per cent De's modified Beneck's medium with agar in petridishes and test tubes. 1.5 per cent agar medium was prepared by mixing 15 gm of agar in one liter of De's modified Benecks medium. This solution was poured into petri-dishes and test tubes aseptically after autoclaving.

After two weeks, individual algal units were picked up and transferred to fresh agar plates. After 3-4 transfers on agar plates groups of particular algae were transferred to Allen & Arnon's liquid medium for maintenance.

The result of identification of algae collected were given in Table-I. In all 18 forms were found growing abundantly of which, 9 belongs to Cyanophyta, 6 belongs to Chlorophyta and 3 belongs to Bacillariophyta. There can be more forms but must be in very small quantity. Their retardation of growth may be influenced by the physico-chemical condition of water and the dominant algal forms. The Cyanophyta includes *Microcystis protocystis* Crow., *Chroococcus micrococcus*. (Kutz.) Rabenh., *Oscillatoria curviceps*. Ag.

ex Gomont., *Phormidium foveolarum*. (Mont.) Gomont., *Lyngbya aerugineo-coerulea*. (Kutz.) Gomont., *Schizothrix tenuis*. Woronich., *Nostoc commune*. Vaucher. ex Born. et. Flah., *Anabaena anomala* Fritsch., *Anabaena* laxa. (Rabehn.). The chlorophycean forms are *Chlaorococcum humicola* (Naegeli) Rabnehhorst, *Ulothrix variabilis* (Kuetzing) Kuetzing, *Spirogyra biformis* Jao, *Closterium acerosum* (Schrank) Ehrenberg, *Euastrum dubium* Nageli and *Cosmarium granatum* Brebisson. The Bacillariophycean forms were *Fragillaria brevistriata* f. *elongata* Venk, *Synedra affinis* Kg and *Navicula clavata* Greg.

3 Cyanophycean, 3 Chlorophycean and 2 Bacillariophycean members were observed from Jambhali (site-I). It is comparatively less polluted. The water do not have any bad odour and its turbidity was also lower than others sites. The wild as well as grazing animals consume this water, which is evident from the foot prints around the banks of water body. The Cyanophycean members observed were *Phormidium*, *Schizothrix* and *Nostoc*. The Chlorophycean members were *Chlorococcum*, *Ulothrix* and *Spirogyra*. The bacillariophycean members are *Fragillaria* and *Navicula*.

The Murpar (site-2) and Bothali (site-3) are identical in pollution sources. Murpar showed the presence of 10 algal form out of which 5 belongs to Chlorophyceae, 3 belongs to Cyanophyceae and 2 belongs to Bacillariophyceae. The Chlorophycean members are *Chlorococcum*, *Ulothrix*, *Spirogyra*, *Closterium* and *Cosmarium*. The Cyanophycean members are *Chroococcus*, *Nostoc* and *Anabaena anomala*. The Bacillariophycean members are *Fragillria* and *Navicula*. The Bothali region showed 8 algal forms of which 4 belongs to Cyanophyta, 3 belongs to Chlorophyta and *Navicula* represent the lone member of Bacillariophyta.

The site 4 and 5 *i.e.* Sadak Arjuni I and II has maximum and dangerous source of pollution as sewage wastes, waste from bricks industries, crematorium and skin processing units reaches the Chulband river. Both sites are represented by 5 forms of algae each and 4 out of 5 forms are common. The common forms include *Microcystis*, *Anabaena laxa*, *Euastrum* and *Synedra*. *Oscillatoria* was present in site-4 while *Lyngbya* was observed in site-5.

Site-6 Saundad has the maximum types of algal forms i.e. 13 out of which 6 belongs to Cyanophyta, 4 belongs Chlorophyta and 3 belongs to Bacillariophyta. The Cyanophycean members are *Chroococcus*, *Phormidium*, *Lyngbya*, *Nostoc*, *Anabaena laxa*, *Anabaena anomala*. The Chlorophycean members are *Chlorococcum*, *Spirogyra*, *Euastrum* and *Cosmarium*. The Bacillariophycean members are *Fragillaria*, *Synedra* and *Navicula*.

The physical analysis of all the 6 sites of Chulband River is given in the Table-II. The maximum temperature i.e. 34°C was observed in site 2, 3, 4 and 5. The temperature was slightly low in site 1 and site 6. It may be due to the tall tress at the banks of river. The highest pH was observed in site 5 followed by site 4. The pH ranged from 6.8 to 8.6. The

taste and odour was proportional to the amount of pollutants. Pungent odour was present in site 4 and 5. It may be due to the washing of processed animal skin in these areas. The growth of algae and amount of pollution creates the colour of the water body. The colour ranged from light green to dark bluish. The turbidity was also high in site – 4 and site – 5. Only negligible turbidity was observed in site-1 and the water is also palatable. The turbidity ranged from negligible to 305. The highest turbidity makes the water like a syrup solution.

Algal Taxa	Site-1	Site-2	Site-3	Site-4	Site-5	Site-6
Cyanophyceae						
1. *Microcystis protocystis*. Crow	-	-	-	p	p	-
2. *Chroococcus macrococcus*. (Kutz.) Rabenh.	-	P	P	-	-	P
3. *Oscillatoria curviceps*. Ag.ex Gomont.	-	-	P	P	-	-
4. *Phormidium foveolarum*.(Mont.) Gomont.	P	-	P	-	-	P
5. *Lyngbya aerugineo-coerulea* (Kutz.) Gomont.	-	-	-	-	P	P
6. *Schizothrix tenuis*. Woronich.	P	-	-	-	-	-
7. *Nostoc commune*. Vaucher ex. Born. et.Flah.	P	P	-	-	-	P
8. *Anabaena laxa*. (Rabehn.)	-	-	-	p	P	P
9. *Anabaena anomala*. Fritsch.	-	P	P	-	-	P
Chlorophyceae						
1. *Chlorococcum humicolo*. (Naegeli.) Rabnehhorst.	P	P	P	-	-	P
2. *Ulothrix variabilis*. (Kuetz.) Kuetzing	P	P	-	-	-	-
3. *Spirogyra biformis*. Jao	P	P	-	-	-	P
4. *Closterium acerosum*. (Schrank) Ehrenberg.	-	P	P	-	-	-
5. *Euastrum dubium*. Nageli.	-	-	-	p	p	P
6. *Cosmarium granatum*. Brebisson.	-	p	P	-	-	P
Bacillariophyceae						
1. *Fragillaria brevistriata* f. *elongata* Venk.	P	p	-	-	-	P
2. *Synedra affinis*. Kg.	-	-	-	p	p	P
3. *Navicula clavata*. Greg.	P	p	P			P
Total	8	10	8	5	5	13

Table 1- Showing the presence of Algal Forms

Parameters	Site-1	Site-2	Site-3	Site-4	Site-5	Site-6
Temperature	29-32	32-34	33-34	32-34	32-34	30-31
pH	6.8	7.4	8.3	8.5	8.6	7.6
Taste	Agreeable	Disagreeable	Disagreeable	Disagreeable	Disagreeable	Disagreeable
Odour	Nil	Present	Present	Pungent Present	Pungent Present	Present
Colour	Light Greenish	Greenish	Greenish	Dark bluish	Dark bluish	Greenish
Turbidity	Negligible	139.33	204	282	305	210

Table 2- Result of water analysis

Pollutant sources of Chulband River of Gondia Dist., from different sites

Site 1

Site 2

Site 2

Site 3

Site 4

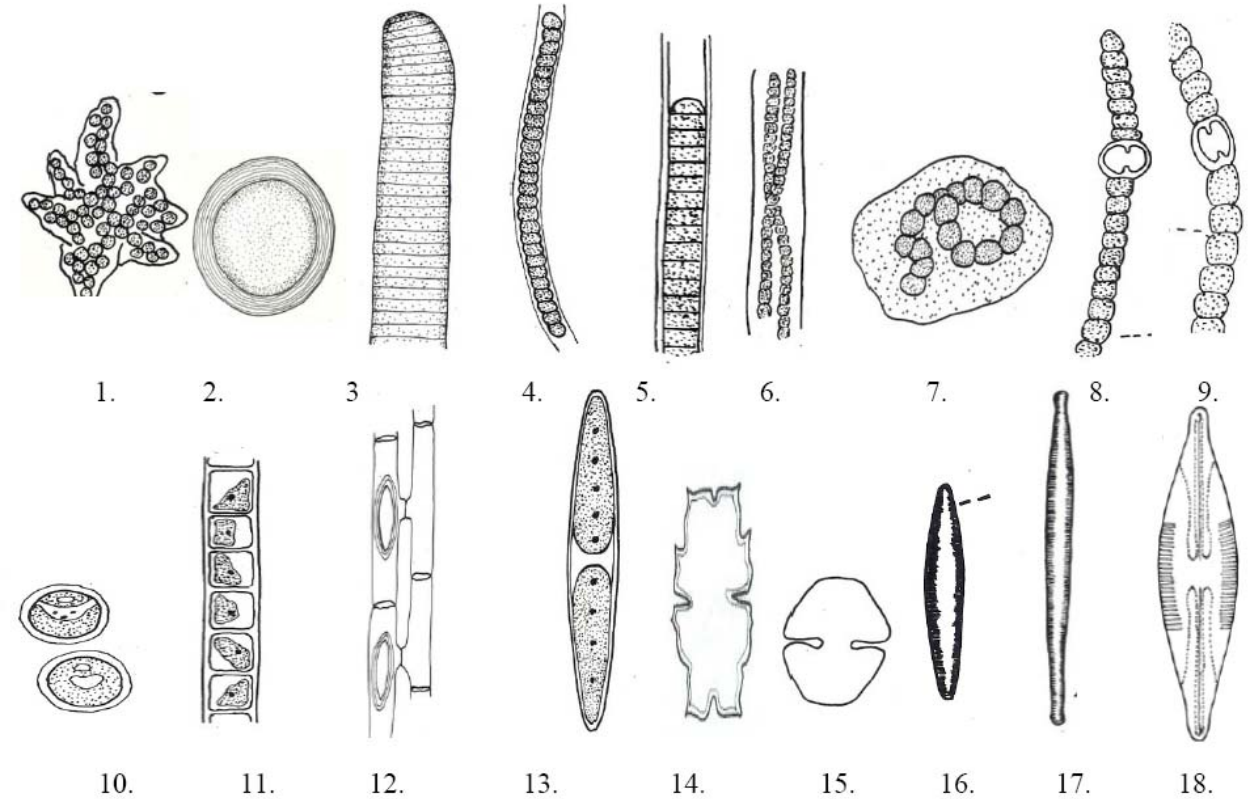
Site 4

Site 5

Site 5

Site 6

RESULT AND DISCUSSION



1. *Microcystis protocystis* Crow.
2. *Chroococcus micrococcus*. (Kutz.) Rabenh.
3. *Oscillatoria curviceps*. Ag. ex Gomont.
4. *Phormidium foveolarum*. (Mont.) Gomont.
5. *Lyngbya aerugineo-coerulea*. (Kutz.) Gomont.
6. *Schizothrix tenuis*. Woronich.
7. *Nostoc commune*. Vaucher. ex Born. et. Flah.
8. *Anabaena anomala* Fritsch.
9. *Anabaena laxa*. (Rabehn.)
10. *Chlorococcum humicolo* (Naegeli) Rabnehhorst.
11. *Ulothrix variabilis* (Kuetzing) Kuetzing.
12. *Spirogyra biformis* Jao.
13. *Closterium acerosum*. (Schrank) Ehrenberg.
14. *Euastrum dubium*. Nageli.
15. *Cosmarium granatum* Brebisson.
16. *Fragillaria brevistriata* f. *elongata*. Venk.
17. *Synedra affinis*. Kg.
18. *Navicula clavata* Greg

CONCLUSION

The polluting activity by human population has changed the Chulband river in to a Chulband nala. The only thing left is a change in the name in Government record. The river once upon a time was the main source of drinking water the people residing in Gondia

district. The depth of the river has decreased day by day due to dumping of non degradable waste in the river. In near future it will become drainage line during the rainy season. The pollution effected in the growth of some unwanted algal forms like *Microcystis protocystis*, *Oscillatoria curviceps*, *Anabaena laxa*, *Euastrum dubium*, *Synedra affinis* etc. In fact the growth of these organisms has wiped out the biodiversity in Chulband River. The few left behind fishes also gets killed by the algal forms due its toxic effects during their disintegration.

REFERENCES

Stevenson, R J; Y (1999). Assessing environmental conditations in Rivers and streams using diatoms. In: Stoermer, E F; Smol, J P (eds.) The diatoms. Applications for the environmental and earth sciences. Cambridge University Press, Cambridge. pp 11-40.

Bhatt, L R; Lecoul, P; Lekhal, H D; Jha, P K (1999). Physico-chemical characteristic and phytoplanktons for Taudha lake, Kathmandu. Poll.Res.18 (4): 353-358.

Saha, S B; Bhattacharya, S B; Choudhary, (2000) A Diversity of phytoplankton of sewage pollution brakish water tidal ecosystems. Environ.Biol. 21 (1): 9-14.

Cherian K.J and Matta G(2010), Soil above at the different depth of crop field of Nagpur Dist., Essence, Vol.1 No.1,2010(81-87).

Joubert, G (1980). A bioassay application for quantitative toxicity management using the green algae, *Selenastrum Capricornutum.* Water Res. 14: 1759-1763.

Trivedy, R K (1986). Role of algae in the biomonitoring of water pollution. Asian Environ. 8 (3): 31-42.

Dwivedi, B K; Pandey, G C (2002).Physico-chemical factors and algal diversity of two ponds (Girija Kund Maqubara Pond), Faizabad, India poll.Res.21 (3): 361-369.

Cherian, K.J., Vishwakarma S and Shahare P.C. (2010). Effect of Algal Extract on the germination of seedling growth of Rice seeds. Bionano Frontier, Vol.4.(1) jan-june2011.

Cherian K.J. (2010). Rhizosphere algae of Vidharbha region of Maharashtra. Essence,Vol.1. No.1 (59-65)

Indian Association of Aquatic Biologists (IAAB), Methodology for Water Analysis.