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Studies on the distribution and abundance of phytoplankton in river Damodar of Bermo sub-division of Jharkhand

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SUMMARY

The present study elucidate the species diversity and richness of phytoplanktons in river Damodar of Bermo sub-division. Damodar river is well known for establishment of coal mining industries along its basin areas. For this biosurvey 30Kms.stretch of river Damodar and three most productive collieries of Bermo sub-division namely Bokaro, Kargali and Dhori were selected. These selected stations releases tremendous amount of pollutants per day like coal dust, fly ashes, oils, grease, flocculation agents etc. which are directly added to river without recycling. This reflects the biological profile of the river Damodar. Pollution in this river has changed physico-chemical regime, which in turn have led to changes in biotic community. Phytoplanktons were collected regularly for a period of 12 months (Nov. 08 to Nov. 09). Altogether 51 taxa of three different classes *viz.*, Cyanophyceae, Chlorophyceae and Bacillariophyceae has been recorded. The species rich genera are *Microcystis, Lyngbya, Scenedesmus, Oedogonium, Zygnema, Closterium, Gyrosigma* and *Navicula*. Results indicate wide range of seasonal fluctuations in quality and quantity of phytoplankton.

Key words : Bermo sub-division, Damodar river, Phytoplankton, Seasonal variation Species diversity

The river Damodar originates from Chandwa village of Palamu district on the Chotanagpur plateau in the Jharkhand state and merges in the river Hooghly, a tributary of river Ganga in West Bengal. Major catchments area of the river falls in the mining belts. Damodar basin coal fields contribute 90% coal of Jharkhand and 40% of the National production of coal. It is the main reason for settlement of most of the coal based industries along its basin area.

Bermo is a sub-division of Bokaro district of Jharkhand state. It has six blocks and several collieries of East Bokaro division of C.C.L (Central Coalfield Limited).

Colliery areas of Bermo releases several tones of solid (raw and smallcoal stones, flotation agents, flocculation agents etc.), liquid (oils, grease, acid mine discharge) and gaseous (coal dust, fly ashes, SO_2, NOx etc.) pollutants per day. These effluents are directly added to the river Damodar and its tributaries without recycling. The condition is so alarming that it is considered to be one of the most polluted rivers of the country and said to be an "industrial sewer".

Phytoplankton being the autotrophs initiate the aquatic food chain. They serve as indicator of water quality and natural regions which are characterized by typical algal species of specific groups. So, analysis of phytoplankton becomes essential in any study concerning hydro biological investigations. Investigation on phytoplankton in relation to hydrography has been carried out by several workers but numerical strength of phytoplankton of Damodar river has not been explored earlier. The present study focuses attention on a comprehensive study of phytoplankton with reference to their diversity, species richness and seasonal variations.

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MATERIALS AND METHODS

30Kms. stretch of Damodar river was selected for study. Three sampling stations namely Bokaro (BK), Kargali (KG) and Dhori (DH) were equidistant from each other. They are well known collieries site with coal washery, coal dumping yards and good human population; hence receive coal dust, ashes, sewage, domestic wastes, run off water from over burden dumps and various other sources. To study the phytoplankton diversity, samples from the above three stations were collected regularly for a period of 12 months (Nov.08 to Nov.09) during different seasons namely Post Monsoon(PM), Winter (WN), Spring(SP) and Summer(SM). They were collected through planktonic net and samples were preserved in 4% formalin to prevent them from deterioration and drying out. Micrometric measurements and cameralucida drawings were made in the laboratory. They were identified with the help of standard systematic manuals recommended for identification and listed class wise in tabular form. Species diversity index (H') and Species richness were studied following the equations

Table 1 :

Sr. No.	Name of the Phytoplankton taxa	Three sampling stations during different seasons-											
		Bokaro (BK)				Kargali (KG)				Dhori(DH)			
		PM	WN	SP	SM	PM	WN	SP	SM	PM	WN	SP	SM
	Class- Cyanophyceae												
1.	*Microcystis flos-aquae* Wittr.	+	+	+	+	+	+	+	+	+	+	+	+
2.	*Microcystis protocystis* Kirch.	+	-	+	+	+	+	+	+	+	+	+	+
3.	*Microcystis aeruginosa* Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
4.	*Chrococcus turgidus* Naeg.	-	-	+	+	+	+	+	+	+	+	+	+
5.	*Gloeocapsa strata* Turp.	-	-	+	+	+	+	+	+	+	+	+	+
6.	*Gloeocapsa rupestris* Kuetz.	+	+	+	+	-	+	+	-	+	-	+	+
7.	*Gloeocapsa samoensis* Wille.	-	+	+	+	-	+	+	-	+	-	+	+
8.	*Aphanocapsa gravelli* Hass.	-	+	+	+	-	+	-	-	+	-	+	+
9.	*Phormidium corium* Ag.	-	-	-	+	+	-	-	-	-	+	+	+
10.	*Lyngbya ceylonica* Wille.	+	-	-	+	+	+	-	-	+	+	+	+
11	*Lyngbya majuscule* Har.	+	+	-	-	+	+	-	-	+	-	+	+
12.	*Anabaena ambigna* Rao.	+	+	-	+	-	+	-	-	+	-	+	+
13.	*Anabaena iyengarii* Bhard.	+	+	-	-	-	+	-	+	+	+	+	+
14.	*Rivularia globiceps* West.	-	-	-	+	-	-	-	+	+	-	+	+
15.	*Gloeotrichia pisum* Thurs.	-	+	+	-	+	+	-	+	+	+	-	-
16.	*Gloeotrichia majus* Raben.	-	-	-	+	+	+	+	-	-	+	-	-
	Class- Chlorophyceae												
17.	*Scenedesmus bijugatus* Turp.	+	+	+	+	+	+	+	+	+	+	+	+
18.	*Scenedesmus denticulate* Lag.	+	+	+	+	+	+	+	+	+	+	+	+
19.	*Scenedesmus serratus* Corda	+	+	+	+	+	+	+	+	+	+	+	+
20.	*Scenedesmus obliqus* Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
21.	*Scenedesmus serratus* Corda	+	+	+	+	+	+	+	+	+	+	+	+
22.	*Stigeoclonium lubricum* Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
23.	*Stigeoclonium tenue* Ag.	+	+	+	+	+	+	+	+	+	+	+	+
24.	*Bulbochaete annularis* Wittr.	+	+	+	+	+	+	+	+	+	+	+	+
25.	*Bulbochaete monile* Wittr.	+	+	+	+	+	+	+	+	+	+	+	+
26.	*Oedogonium amphulum* Tiff.	+	+	+	+	+	+	+	+	+	+	+	+
27.	*Oedogonium grands* Tiff.	+	+	+	+	+	+	+	+	+	+	+	-
28.	*Oedogonium oblongum* Wittr.	+	+	+	+	+	+	+	+	+	+	+	-
29.	*Oedogonium pusillum* Kirch.	-	+	+	+	+	+	+	+	+	+	+	-
30.	*Oedogonium vulgaris* Kirch.	-	+	-	+	+	+	+	+	+	+	+	-
31.	*Oedogonium reticulosporum*	-	+	+	+	+	+	+	+	+	-	+	-
32.	*Oedogonium varians* Wittr.	-	+	+	+	+	+	+	+	+	-	-	+
33.	*Oedogonium sociale* Wittr.	-	-	+	+	+	+	+	+	+	-	+	+
34.	*Zygnema czurdae* Randh.	+	+	+	+	+	+	+	+	-	-	+	+
35.	*Zygnema inconspicum* Randh.	+	+	-	+	+	-	+	-	+	-	+	+
36.	*Zygnema cylindrosporum* Czu.	+	+	-	-	+	-	+	-	+	+	-	+
37.	*Closterium navicula* Breb.	-	+	+	-	+	-	-	-	+	+	+	+
38.	*Closterium porrectum* Nortds.	-	+	-	-	+	-	-	-	-	+	-	-
39.	*Closterium subulatum* Kuetz.	+	+	+	-	+	-	-	+	-	+	+	-
40.	*Closterium tumidulum* Johns.	-	+	-	+	-	-	-	+	-	+	-	-
41.	*Closterium settacus* Breb.	+	+	+	+	-	-	-	+	-	+	-	+
42.	*Cosmarium monilifore* Turp.	-	+	+	+	-	+	-	+	-	-	-	+
43.	*Cosmarium nudum* Turne.	+	+	+	-	+	-	+	+	-	+	-	+
	Class- Bacillariophyceae												
44.	*Cyclotella kuetzingiana* Thw.	-	+	-	+	-	-	+	+	+	+	-	+
45.	*Melosira granulate* Nitz.	+	+	+	+	+	+	+	+	+	-	-	+
46.	*Synedra ulna* Nitz.	-	-	+	+	-	+	+	+	+	+	-	-
47.	*Gyrosigma spencerii* Smith	+	-	+	+	-	+	-	+	-	+	+	+
48.	*Gyrosigma acuminatum* Kuetz.	-	-	-	+	-	+	-	+	-	+	+	-
49.	*Navicula angilica* Ralfs.	-	-	+	+	+	-	-	+	-	+	+	-
50.	*Navicula exigus* Muell.	-	+	-	-	+	+	+	+	-	+	-	+
51.	*Gomphonema parvulum* Hantz.	+	-	-	+	+	-	-	+	-	+	-	+

PM = Post Monsoon, WN = Winter, SP = Spring, SM = Summer '+' connotes presence and '-' connotes absence.

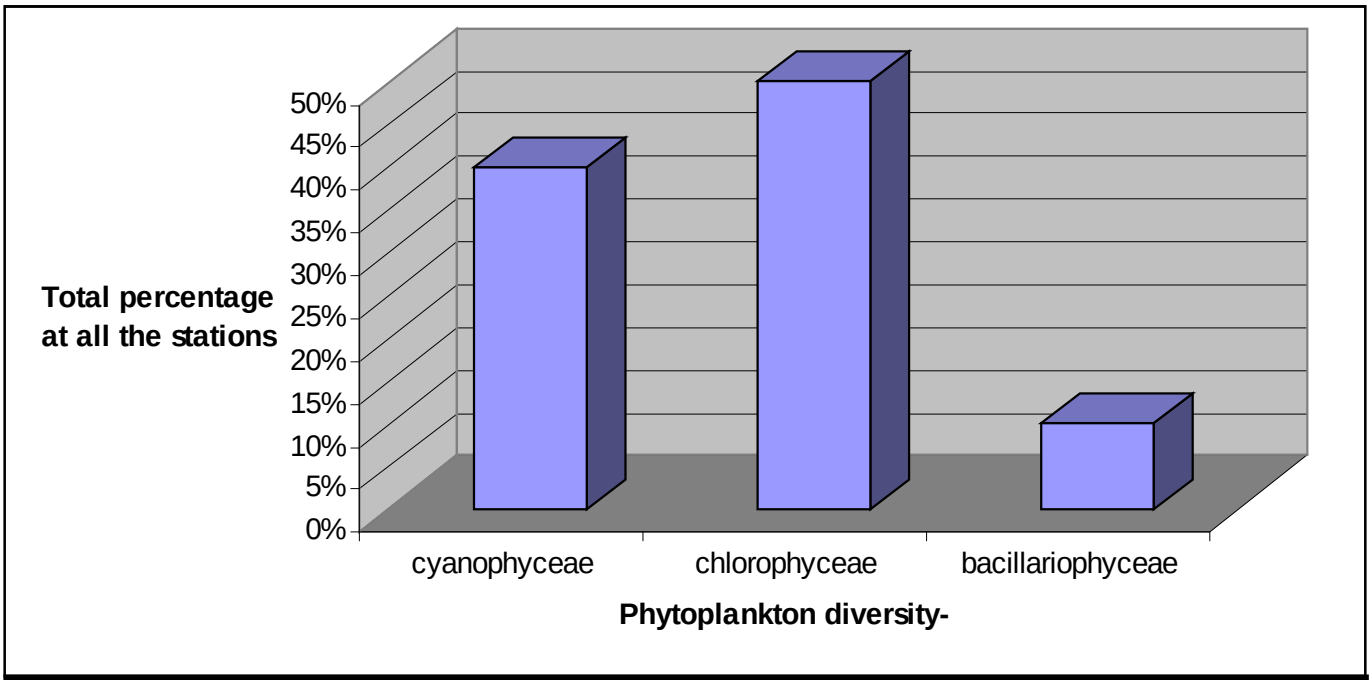

Fig. 1 : Total percentage of phytoplankton at all stations

given by Shannon and Wiener's (1949) and Gleason(1922).

RESULTS AND DISCUSSION

During the present investigation altogether 51 phytoplankton species belonging to 16 sp. of Cyanophyceae, 27 sp. of Chlorophyceae and 8 sp. of Bacillariophyceae has been recorded during Nov.2008 to Nov. 2009.in different seasons from the three sampling stations namely Bokaro (BK), Kargali (KG) and Dhori (DH) listed in Table 1 given below.

The distribution and abundance of species at different selected stations in different seasons reveals that cyanophycean and chlorophycean assemblage were most dominant because blue green algae(cyanophyceae) and green algae(chloropphyceae) are very sensitive to any change in the quality of water, air and soil. They act as pollution indicators.When any changes in ecological factors occur they make their cells much thicker and become very hard. It is one of the important adaptable features as per Saraswathi and Kanan(2003).

Several species collected during different seasons indicate dynamic type of seasonal variation. Maximum strength was found in spring and summer at all the stations as per Table 1. This is because of hydrographical features like pH, temperature etc. which was higher during summer due to heavy accumulation of fly ashes and coal dusts at all the stations. These are the favorable conditions for the proper growth of algae as per Palmer(1969).

Lower magnitude peak was observed during post monsoon period due to maximum rainfall.

All the three stations have better population of cynophyceae and chlorophyceae during spring, winter and summer seasons. They could eliminate other groups of phytoplankton from the environment by causing oxygen depletion as proved by Kamat 1962 (Table 1)

Diatoms (bacillariophyceae) species showed their maximum strength during post monsoon period at station-DH (Dhori) as per Table 1. They are also pollution tolerant due to their silicate walls which tolerate a wide range of salinity (Chandran, 1985).

Species richness was low in summer when blooming was observed like *Microcystis* and *Lyngbya* sp. because blooming made nutrient limitations especially arsenic as reported by Palmer (1969).

Species rich genera are *Microcystis, Gloeocapsa, Lyngbya, Anabena, Scenedesmus, Bulbochaete, Oedogonium, Closterium, Gyrosigma* and *Gomphonema.*

Overall study of phytoplankton showed that the change in density of algal communities directly depends on the disturbance to their habitat and ecological factors.

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