Research Article

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Studies on the river Yamuna at district Auraiya with special reference to Phytoplankton diversity.

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Abstract

The authors made a studies on the river Yamuna with special reference to phytoplankton diversity. The area of river Yamuna under taken for investigation extents for about 60 Km. length in District Auraiya. Five sampling stations were set up in varied ecological zones of the river Yamuna in the investigation area. Studies of the river Yamuna was carried out for a period of three years from December 2022 to November 2024.

The quantitative analysis revealed that the highest population of phytoplankton was noted at station 'C' as 818.5 individuals per litre during summer season in the month of June, 2024 whereas the minimum number of the phytoplankton was observed at the station 'D' being 17.2 individuals per litre in the month of December, 2024. The dominant forms among Chlorophyceae were Volvox, Spirogyra, Chlorella, Oedogonium, Consmarium and the Bacillariophyceae were diatoma, Cymbella, Rhyzosoloenia, Tabelaria and Milosira whereas the Myxophyceae were Nostoc, Spirulina, Oscillatoria and Nicrocystis.

Keywords: Studies, River Yamuna, Phytoplankton, Diversity

Introduction

Phytoplanktons are the main primary producers in the aquatic ecosystems. Primary production is an important biological phenomenon in the aquatic environment, on which the entire heterotrophic community depends directly or indirectly. Primary production by phytoplankton is greatly affected by pollution in the river (Mishra, 1990; Sahu, 1991, Srivastava, 1993).

Water is the most vital resource for all kinds of life on planet. Although water covers 71% of the total surface area of the earth but hardly 1% is available as fresh water. Rivers, dams, lakes, reservoirs, ponds, tanks, streams and other small water bodies are important part of fresh water system of the earth.

Indian rivers are important sources of fresh water which are being used for drinking, bathing, recreation, fisheries, irrigation and industrial purposes, almost all major rivers of India are facing acute water pollution. The river Yamuna in one of the most polluted rivers of the world. The sewage and industrial waste is being discharged into it throughout its course.

The plankton plays an important role as a supplier of organic matter, which directly or indirectly serves as food to all the living organisms in water. The growth and distribution of the plankton depends upon several physico-chemical factors, such as amount of gases, salts, minerals transparency, light intensity etc.

Therefore, a knowledge of the distribution of plankton in relation to the environmental conditions is of prime importance for proper utilization of natural waers. Recent investigations have revealed that the plankton ecosystem is far more complicated than what it was presumed by the earlier workers, Alam, (2013); Chandra et. al. (2014); Raghav et. al. (2022), Yadvanshi & Ghildiyal (2023).

Phytoplanktons are the main primary producers in the aquatic ecosystems. Primary production is an important biological phenomenon in the aquatic environment, on which the entire heterotrophic community depends directly or indirectly. Primary production by phytoplankton is greatly affected by pollution in the river (Mishra, 1990; Sahu, 1991, Srivastava, 1993).

Aims and objectives:

Objectives of this study was to conduct analysis of distribution onthe phytoplankton in the river Yamuna at district Auraiya.

The research sites:

Present study reveals that the river yamuna in district Auraiya (U.P.) in the stretch of about 60 Km. length. In all, five sampling stations were set up in varied ecological conditions of both the banks of the river.

The first sampling station 'A' was set up near the entry point in district Etawah at Dhanua village. Costal vegetation is full of wild weeds and the soil is saline. Surrounding area is a plain cropland with alluvial clay. The station 'B' was set up near the confluence of its tributary 'Sirsa' river at Chakwa which is about 30 Km away from the 1st sampling station. The soil is saline and coastal vegetation has wild weeds. The sampling site 'C' was set up near the village Morhi which is about 20 Km ahead from sampling station 'B'. The river path is very broad and deep with a sandy soil. Coastal vegetation is full of wild weeds and shrubs. The station 'D' is located near village Jua. The distance covered up to this station is about 15 Km from station 'C'. The river here is very wide deep with sandy substratum and river bed is sandy and costal, vegetation is full of wild shrubs.

Materials and Methods

Samples were collected fortnightly during morning hours by using wide method polythene bottles.

For qualitative analysis of phytoplankton population the standard plankton net was hauled through vertical and horizontal plane of the river. In the laboratory, the phytoplanktons were mounted on glass microslides cleaned with sulphuric acid and potassium dichromate. Identification was done at 1000 x and phytoplanktons were identified at different sampling stations.

The collected samples were than transferred into small plastic bottles. After sedimentation of the phytoplankton, the supernatant liquid was siphoned and the sediment portion was preserved in 4% formaldehyde. The quantification of phytoplankton was made using "Haemocytometer method" described by Trivedy and Goel (1986) and expressed in number per litre.

Results and Discussion

The river Yamuna passes through varied topographical and meteorological conditions, hence it provides heterogeneous ecosystem.

TABLE-1: Phytoplankton count (per lit)in the river Yamuna at Station 'A'

Phytoplankton	Winter			Summer			Monsoon			Autumn		
2022	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**
Chlorphyceae	9.2	14.3	17.2	20.6	32.8	83.2	86.3	90.5	65.3	42.5	26.5	12.3
Bacillariophyceae	8.4	9.3	11.5	17.5	64.4	72.3	62.4	60.7	52.4	27.6	16.2	13.6
Myxophyceae	14.1	18.7	20.6	32.3	75.2	96.3	82.4	77.5	60.6	31.5	21.2	15.8
Total	31.7	42.3	49.3	172.4	70.4	251.8	231.1	228.7	178.3	101.6	63.9	41.7
2023												
Chlorphyceae	14.5	20.4	18.5	34.6	43.5	205.7	215.3	249.6	127.5	66.5	33.8	20.8
Bacillariophyceae	13.8	13.5	12.5	27.5	104.5	166.5	207.5	132.8	115.8	46.6	18.9	16.7
Myxophyceae	22.9	20.6	25.6	48.5	155.2	212.8	204.5	222.9	118.9	54.8	25.6	18.9
Total	51.2	54.5	56.6	110.6	303.2	585.0	627.3	605.3	362.2	167.9	78.3	56.4
2024												
Chlorphyceae	13.5	15.5	21.5	36.5	37.8	198.8	213.8	243.8	122.8	58.6	36.5	15.8
Bacillariophyceae	12.3	10.5	14.8	25.8	97.8	162.5	202.8	191.8	117.5	47.5	21.8	11.8
Myxophyceae	20.5	23.8	25.8	48.5	145.5	223.5	200.9	218.5	110.8	50.8	26.2	17.5
Total	46.3	49.8	62.1	110.8	281.1	584.8	617.5	654.1	350.8	156.9	84.5	45.1

TABLE-2: Phytoplankton count (per lit)in the river Yamuna at Station 'B'

Phytoplankton	Winter			Summer			Monsoon			Autumn		
2022	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**
Chlorphyceae	16.3	20.4	20.7	46.3	210.5	240.4	280.5	190.3	80.3	56.2	36.2	18.3
Bacillariophyceae	10.2	14.3	16.8	28.2	105.3	186.3	227.3	105.7	55.4	36.2	23.7	15.7
Myxophyceae	24.3	23.5	32.4	57.3	215.5	265.6	310.5	165.2	74.3	40.3	30.2	16.3
Total	50.8	58.2	69.9	131.8	531.3	692.3	818.3	461.2	210.0	132.7	90.1	50.3
2023												
Chlorphyceae	12.3	15.1	20.0	31.6	42.5	190.3	201.1	245.0	125.5	63.3	31.4	18.3
Bacillariophyceae	10.5	12.3	12.8	25.3	101.3	170.3	201.3	187.0	112.8	51.3	20.4	11.3
Myxophyceae	19.5	22.1	28.1	40.1	150.3	221.0	139.7	214.0	110.3	51.3	23.4	14.3
Total	42.3	49.5	60.9	97.0	294.1	581.6	542.1	646.0	348.6	165.9	75.2	43.9
2024												
Chlorphyceae	10.3	17.2	20.1	36.5	40.7	202.8	215.2	246.2	124.2	63.3	34.8	16.8
Myxophyceae	19.8	21.8	25.3	45.1	152.1	214.4	204.5	218.3	115.4	50.7	22.5	15.2
Total	41.0	51.1	58.1	105.7	294.0	580.4	623.8	598.0	352.2	156.9	73.5	44.9

TABLE-3: Phytoplankton count (per lit)in the river Yamuna at Station 'C'

Phytoplankton	Winter			Summer			Monsoon			Autumn		
2022	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**
Chlorphyceae	4.3	10.2	11.4	15.0	25.2	55.3	57.1	62.8	35.3	21.1	20.2	6.8
Bacillariophyceae	6.9	6.6	8.2	11.5	40.5	61.3	52.6	50.7	30.2	18.0	11.2	8.5
Myxophyceae	11.1	10.5	16.0	25.1	42.5	64.2	61.0	64.0	41.0	22.1	14.5	11.0
Total	22.3	27.3	35.6	51.6	108.8	180.8	170.7	177.5	106.5	61.2	46.0	26.3
2023												
Chlorphyceae	13.8	17.5	20.5	45.2	210.5	240.3	280.5	190.7	85.3	53.2	36.3	18.2
Bacillariophyceae	9.4	11.2	12.7	26.3	103.2	183.2	228.2	100.5	60.3	36.3	24.2	13.3
Myxophyceae	19.3	23.3	27.3	56.8	205.7	270.5	301.2	160.7	74.3	40.7	20.5	14.5
Total	42.5	52.0	60.5	128.3	519.4	694.0	809.9	451.9	219.9	130.2	81.0	46.0
2024												
Chlorphyceae	17.9	20.4	23.2	47.5	213.3	246.5	283.4	195.2	84.5	57.3	37.5	20.0
Bacillariophyceae	11.5	13.6	15.3	27.6	105.5	185.5	227.3	103.5	62.2	38.4	25.0	15.2
Myxophyceae	23.2	24.8	30.8	56.6	210.3	267.2	307.8	167.8	75.5	42.0	21.8	17.5
Total	52.6	58.8	69.3	131.7	529.1	699.2	818.5	466.5	222.2	137.7	84.3	52.7

TABLE-4: Phytoplankton count (per lit)in the river Yamuna at Station 'D'

Phytoplankton	Winter			Summer			Monsoon			Autumn		
2022	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**
Chlorphyceae	9.4	12.5	16.2	18.2	28.2	82.4	85.2	88.7	63.2	40.3	24.3	13.7
Bacillariophyceae	7.9	10.4	10.5	18.6	57.6	70.3	60.5	61.2	50.3	28.7	18.2	14.2
Myxophyceae	12.2	20.3	21.3	30.2	74.5	97.4	78.3	74.7	58.3	32.6	23.4	16.1
Total	29.5	43.2	48.0	67.0	160.3	250.1	224.0	224.6	171.8	101.6	65.9	44.0
2023												
Chlorphyceae	6.2	11.3	12.5	15.1	16.5	24.5	52.3	59.3	35.1	22.0	18.1	6.5
Bacillariophyceae	7.1	6.5	6.3	11.5	41.3	55.3	55.1	52.4	31.1	18.2	11.1	7.2
Myxophyceae	11.1	12.5	13.3	20.1	42.4	60.3	61.4	62.8	41.0	21.1	16.0	11.2
Total	24.4	30.3	32.1	46.7	100.2	140.1	168.8	174.5	107.2	62.3	45.2	24.9
2024												
Chlorphyceae	4.8	12.3	12.5	16.1	25.3	51.3	60.1	61.3	44.1	22.3	20.1	5.3
Bacillariophyceae	3.1	7.5	6.9	13.1	43.1	61.3	53.3	57.1	32.1	17.1	13.1	9.3
Myxophyceae	9.3	11.4	16.3	23.5	41.3	63.4	63.3	71.3	41.3	22.1	19.3	11.3
Total	17.2	31.2	35.7	52.7	109.7	176.0	180.7	189.7	117.5	61.5	52.5	25.9

TABLE-5: Phytoplankton count (per lit)in the river Yamuna at Station 'E'

Phytoplankton	Winter			Summer			Monsoon			Autumn		
2022	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**
Chlorphyceae	10.5	14.5	12.5	20.5	28.0	85.0	82.5	87.5	66.0	42.1	25.1	16.9
Bacillariophyceae	10.8	11.6	9.5	21.5	52.5	71.2	56.5	60.8	54.2	25.5	20.5	15.5
Myxophyceae	12.3	22.3	21.0	27.6	70.5	99.5	78.6	74.6	61.5	28.8	25.8	18.5
Total	33.6	48.4	43.0	69.6	151.0	255.7	217.6	222.9	181.7	96.4	71.4	50.9
2023												
Chlorphyceae	11.4	17.3	19.7	34.7	40.3	195.8	210.5	240.5	120.5	60.5	34.3	17.3
Bacillariophyceae	10.3	11.4	12.6	26.4	100.5	160.7	200.8	188.6	115.7	45.3	18.7	12.4
Myxophyceae	18.2	21.5	28.3	45.2	148.8	220.3	197.6	215.6	108.3	52.7	24.2	15.7
Total	39.9	50.2	60.6	106.3	289.6	576.8	608.9	644.7	344.5	158.5	77.2	45.4
2024												
Chlorphyceae	12.3	18.2	20.7	36.8	41.7	203.2	217.3	247.5	125.3	64.3	35.6	17.7
Bacillariophyceae	11.5	12.3	13.8	25.2	102.4	164.3	205.2	134.2	113.7	44.3	17.8	14.6
Myxophyceae	20.8	22.5	27.3	46.2	153.2	215.6	205.4	219.7	116.6	51.4	23.2	16.8
Total	44.6	53.0	61.8	108.2	297.3	.583.1	627.9	601.4	355.6	160.0	76.6	49.1

There are definite interrelationships between plankton and physico-chemical factors of the river Yamuna and an analysis of data reveals the fluctuations and their bearings on the plankton population.

The investigations on the river Yamuna were conducted fortnightly at six sampling stations (A to E) within a stretch of nearly 60 Km. All stations were sampled from December 2022 to November 2024. The phytoplanktons are the producers in the aquatic food chain, which are consumed by zooplanktons. Three families of the phytoplankton, viz. Chlorophyceae, Bacillariophyceae and Myxophyceae were recorded. Steeman (1937) correlated the population of the phytoplankton and zooplankton in the sea.

Normally the highest and lowest number of phytoplanktons were observed during the monsoon season in July 2024 (654.1/litre) and winter season in December 2022 (31.7/litre) respectively at the first sampling station 'A'.At station 'B' the minimum number of phytoplankton was 41.0/litre on December 2024 and maximum 818.3/litre in June 2022 whereas at station 'C' minimum number of 22.3/litre in December 2024. Station 'D' has the minimum number of phytoplankton as 17.2/litre in December 2024 and maximum 250.1/litre in the month of May 2022. At station 'E' the minimum number of phytoplankton was 33.6/litre in December 2022 and maximum as 644.7/litre in July 2023.

Wojciechowask (1990) has given the correlations of biomass, chlorophyll 'a', photosynthesis and phytoplankton structure in a lake.
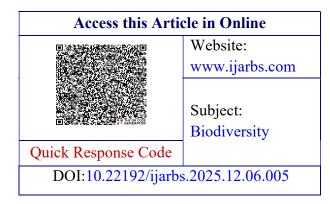
Acknowledgments

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