

A study of Phyto-plankton dynamics in Jonji pond Sarkanda, Bilaspur

Shilpika Gouraha

Research Scholar, D.P. Vipra P.G. College Bilaspur (C.G.)

Dr. M.L. Jaiswal

Dept. Of Botany, D.P. Vipra P.G. College Bilaspur (C.G.)

Abstract

The dynamics of plankton and the characteristics of water quality were investigated. The experiment was conducted in the Janji pond Sarkanda Bilaspur, Chhattisgarh during the month July to August. The sampling was done daily basis for 20 days during sampling Periods water and plankton sample were collected. Diurnal fluctuation of plankton was calculated from collected sample four times in a day. The present study was carried out to assess the diversity, abundance, and distribution of phytoplankton in Jonji Pond, Bilaspur, Chhattisgarh. Phytoplankton samples were collected during the study period and identified using standard taxonomic and microscopic methods. A total of 13 phytoplankton taxa belonging to four major groups, namely Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Euglenophyceae, were recorded. Among these, Chlorophyceae was the dominant group, contributing 43.03% of the total recorded abundance, followed by Cyanophyceae (31.76%), Bacillariophyceae (14.62%), and Euglenophyceae (10.59%). Oedogonium and Microcyst showed comparatively higher abundance during the observation period. Considerable variation in phytoplankton abundance was observed among different sampling days. The occurrence and distribution of different phytoplankton groups indicate the ecological importance of the pond and their potential role as primary producers in the aquatic food web. The study provides baseline information on phytoplankton diversity and abundance in Jonji Pond and may be useful for assessing the ecological status of the freshwater ecosystem.

Keywords: Phytoplankton, Diversity, Abundance, Chlorophyceae, Cyanophyceae, Jonji Pond, Bilaspur, Chhattisgarh.

Introduction:

The word plankton derived from Greek word "planktos," which meaning "drifting," is where the word "plankton" first appeared. In all aquatic ecosystems, plankton is the microscopic organism that forms the foundation of food chains and webs. The majority of them are tiny, many of them are minute, and a compound or binocular microscope is required to view their structure clearly. Despite being members of distinct taxa, they share one characteristic, i.e. e. They are weak at moving and can only float in the water

The primary means by which fish and phytoplankton exchange energy is through zooplankton. Because they are heterotrophic, meaning they aid in the subsequent transfer of bound energy at the primary level, zooplankton plays an important role in the process. Seasonal variations in the limnology of a perennial fish pond at Aligarh were investigated by Khan and Siddiqui in 1969. They found five groups of phytoplankton community abundance namely Myxophyceae, Chlorophyceae, Bacillariophyceae, Phytoflagellates and Dihophyccac. Chlorophyll

concentrations were found to vary from. 3.2 to 21.8 mg. /liter. Sasmal et al. (2005) worked on diurnal variations in a tropical freshwater pond.

The dissolved oxygen, pH, carbonate, and bicarbonate concentrations all showed significant daily fluctuations, which was indicative of the plankton and water chemistry changes in the rearing pond. The oxygen content of the pond water was oversaturated during the day (9 points 4 ppm) and depleted at night (1 points 9 ppm); the pH rose during the day and fell at night. Cypris and Diaptomus did not appear to exhibit any discernible diurnal movement. The current investigation focuses on the dynamics of phytoplankton in Bilaspur jonji ponds.

Review of literature:

Khan and Siddiqui (1969) investigated seasonal variations in the limnology of a perennial fish pond at Aligarh. They reported major phytoplankton groups including Myxophyceae, Chlorophyceae, Bacillariophyceae, phytoflagellates and Dinophyceae. Their observations indicated that phytoplankton communities showed variations associated with seasonal changes in the aquatic environment. Sasmal et al. (2005) studied diurnal variations in plankton and water chemistry in a tropical freshwater pond. Significant daily fluctuations were observed in dissolved oxygen, pH, carbonate and bicarbonate. Their findings indicated that daily changes in environmental conditions can influence plankton dynamics and water chemistry. Kumari et al. (2007) investigated phytoplankton composition and community structure in two tropical model ponds in India. Their study emphasized the influence of regional climatic conditions, species composition, diversity, density and grazing pressure on plankton communities in freshwater ponds.

Rajagopal et al. (2010) compared the physicochemical characteristics and phytoplankton diversity of two perennial ponds in the Sattur area of Tamil Nadu. They recorded 50 phytoplankton species belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. Their results showed a relationship between physicochemical conditions, pollution status and phytoplankton diversity. Hafiz and Hafiz (2018) reviewed phytoplankton ecology in Indian aquatic ecosystems and highlighted the importance of factors such as temperature, sunlight, light penetration, pH, transparency, nutrients and seasonal variation in controlling phytoplankton distribution and abundance. They also emphasized the potential of phytoplankton as indicators of environmental conditions. A study of wastewater-fed urban fish ponds in the Chota Nagpur Plateau reported 43 phytoplankton taxa belonging to Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. The study demonstrated relationships between phytoplankton abundance and physicochemical variables and used multivariate approaches to examine these relationships.

Kour and Verma (2020) studied seasonal plankton diversity in an artificial pond in the Lower Shiwaliks. They recorded 11 phytoplankton species belonging to Chlorophyceae and Bacillariophyceae and found that seasonal changes and physicochemical factors such as temperature, transparency, nitrate and phosphate influenced plankton distribution. Rahim et al. (2022) reviewed the effects of seasons and pollution on plankton diversity in Indian freshwater ecosystems. They reported that plankton abundance can vary considerably among seasons and is influenced by pH, temperature, light, turbidity and dissolved oxygen. Their

review also highlighted the usefulness of phytoplankton communities as indicators of water-quality conditions.

Materials and Methods:

The present study was conducted at Jonji Pond, Sarkanda, Bilaspur, Chhattisgarh, India. Sarkanda is an urban locality of Bilaspur district and lies at an elevation of approximately 273 m above sea level. The pond was selected as a study site for investigating the occurrence, diversity and abundance of phytoplankton. During the study period, the pond was observed to receive direct sunlight, which provides an important source of energy for photosynthesis and phytoplankton growth. The presence of aquatic vegetation and availability of nutrients may also influence phytoplankton development. The average depth of the pond was recorded as approximately 1–1.5 m during the study. The pond was used as a nursery water body where fish spawn, including Catla, Rohu and Mrigal, were stocked. Before stocking, liming and manuring were carried out, and supplementary feed was provided to the stocked spawn.

Collection of plankton samples:

The samples were collected randomly from jonji pond using plankton net by filtering 20 liters of water for each sample. The net was constructed using regular bolting silk fabric no. 22 with 75 linear centimeter meshes. Conical in shape was the net. With a graduated test-tube, the top metal ring's diameter measured 36 cm. The gathered samples were placed in a tiny plastic container and labeled with details like the location, date, and time of collection, sample number, etc.

Preservation of plankton samples:

All the plankton samples were preserved by Lugol solution to ascertain sedimentation and better staining. 1 or 2 drops Lugol's solution was added in 25 ml of collected samples. For further investigation, plankton was observed both in fresh and preserved samples. The concentration of plankton in the water was determined by the drop method. On an average of counts were made for each sample and mean

Identification plankton samples:

All Samples were studied under the S-R (Sedgwick Rafter) under microscopic to identify different species of plankton. Plankton were identified qualitatively following standard taxonomic keys (Smith, 1964 [13]; Philipose, 1967 [10]). Leica ATC 2000 microscope was used for the study. Counting of plankton: Sedgwick-Rafter (S-R) cells, measuring 50 mm in length, 20 mm in width, and 1 mm in depth, were utilized for plankton counting. The sample was transferred using a large bore pipette to ensure that there were no air bubbles in the cell cover before the S-R cell was filled with material. The cover glass was then positioned diagonally across the cell. Counting and enumeration were carried out using LABOMED TCM-400 microscopes once the plankton had settled on the bottom of the S-R cell.

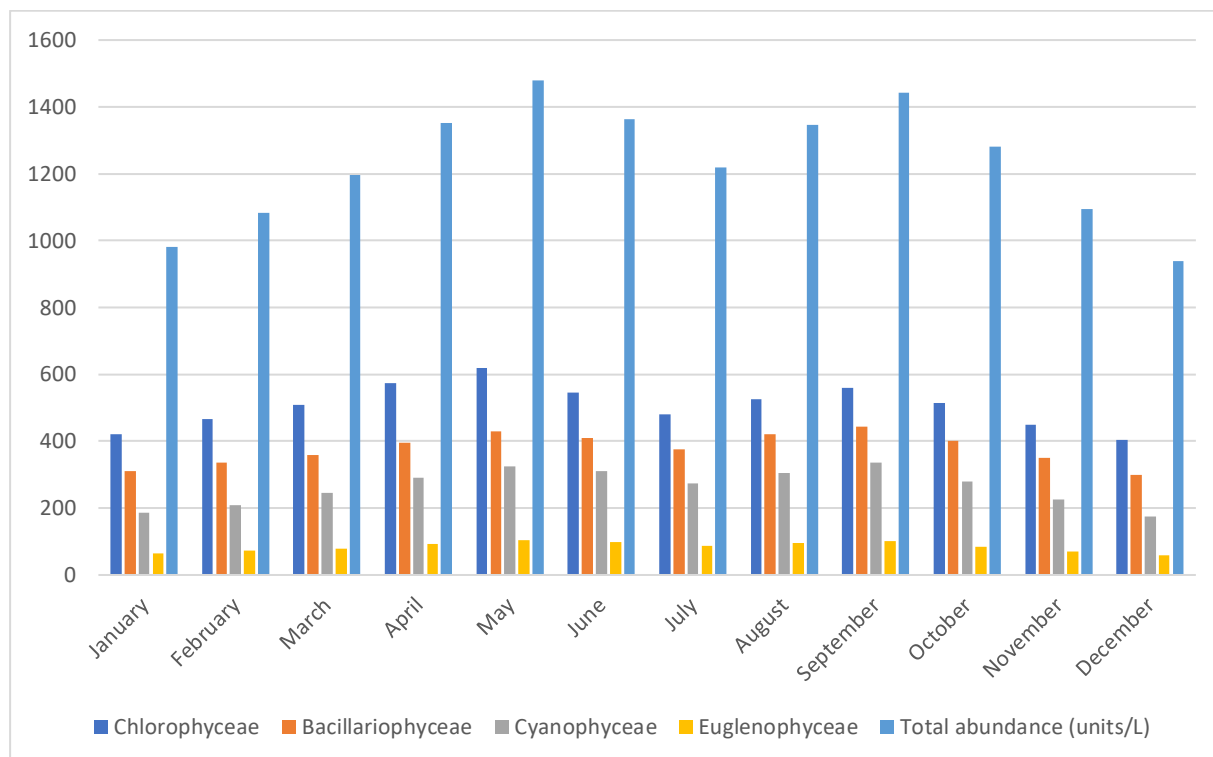
Results and Discussions:

Based on the morpho taxonomic identification of phytoplankton in selected Jonji ponds of sarkanda Bilaspur, Chhattisgarh. A total of 13 phytoplankton taxa belonging to four major groups were recorded during the study period. Chlorophyceae was the dominant group (43.03%), followed by Cyanophyceae (31.76%), Bacillariophyceae (14.62%) and

Euglenophyceae (10.59%). Oedogonium and Microcyst showed the highest overall abundance. The observed temporal variation indicates that phytoplankton abundance changed considerably during the study period, possibly in response to changing environmental conditions. Plankton dynamics in jonji ponds were interpreted through assessment of dominance and diurnal fluctuation. The dominance among phytoplankton were determined from the pooled mean data on the frequency of occurrence of individual genera per ml of water sample, collected daily from the jonji ponds during 20 days of production cycle. On the other hand, diurnal fluctuation of plankton was assessed from the standard deviation values of individual genera per ml of water sample, collected four times (6 am, 10 am, 2 pm and 6 pm) from the jonji ponds on the 10th day.

Month-wise occurrence and abundance of phytoplankton

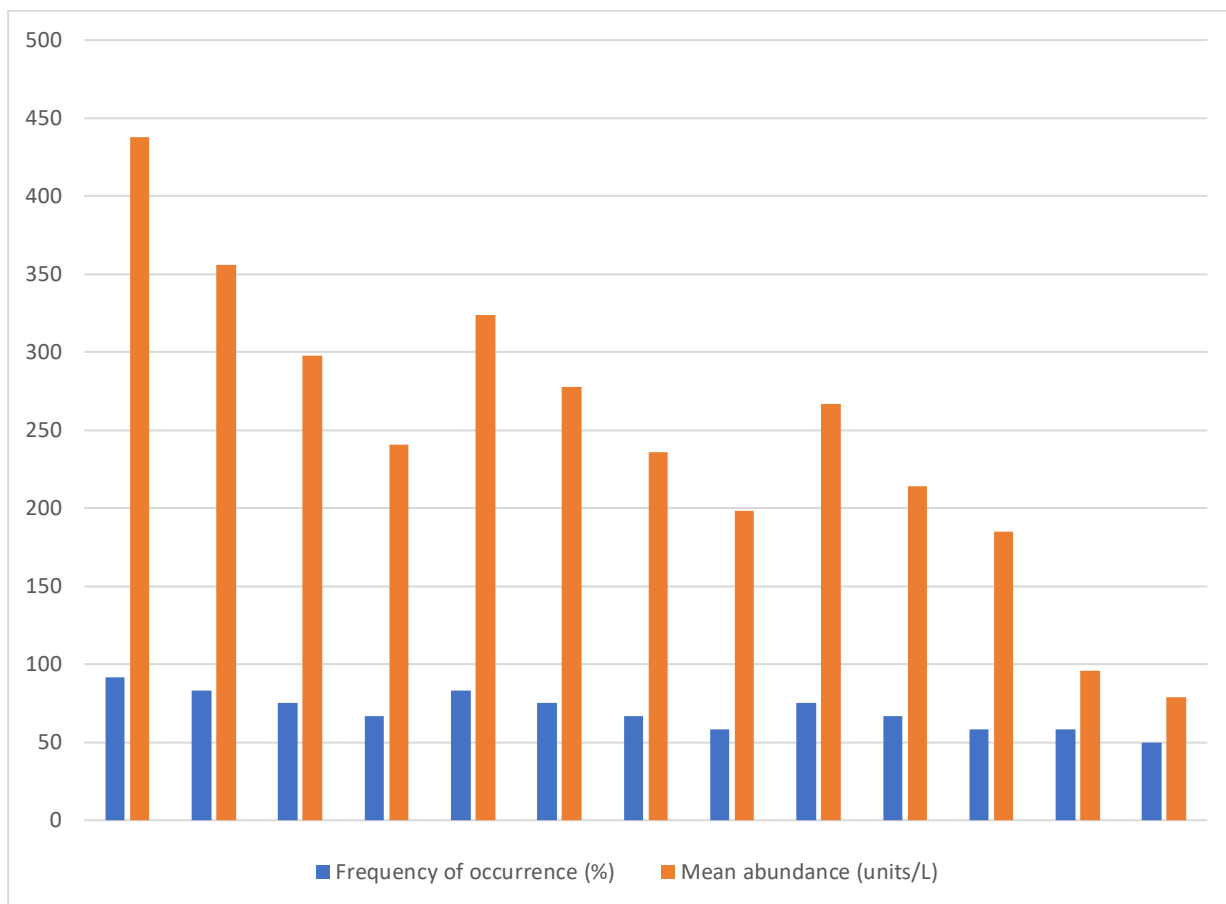
Month	Chlorophyceae	Bacillariophyceae	Cyanophyceae	Euglenophyceae	Total abundance (units/L)
January	420	310	185	65	980
February	465	335	210	72	1,082
March	510	360	245	80	1,195
April	575	395	290	92	1,352
May	620	430	325	105	1,480
June	545	410	310	98	1,363
July	480	375	275	88	1,218
August	525	420	305	95	1,345
September	560	445	335	102	1,442
October	515	400	280	85	1,280
November	450	350	225	70	1,095
December	405	300	175	60	940



The illustrative data indicate that phytoplankton abundance increased from winter towards the warmer months, reaching the highest total abundance in May (1,480 units/L). Chlorophyceae constituted the largest component throughout the study period, whereas Euglenophyceae showed comparatively lower abundance.

Table 2. Species-wise distribution of phytoplankton recorded from Jonji Pond

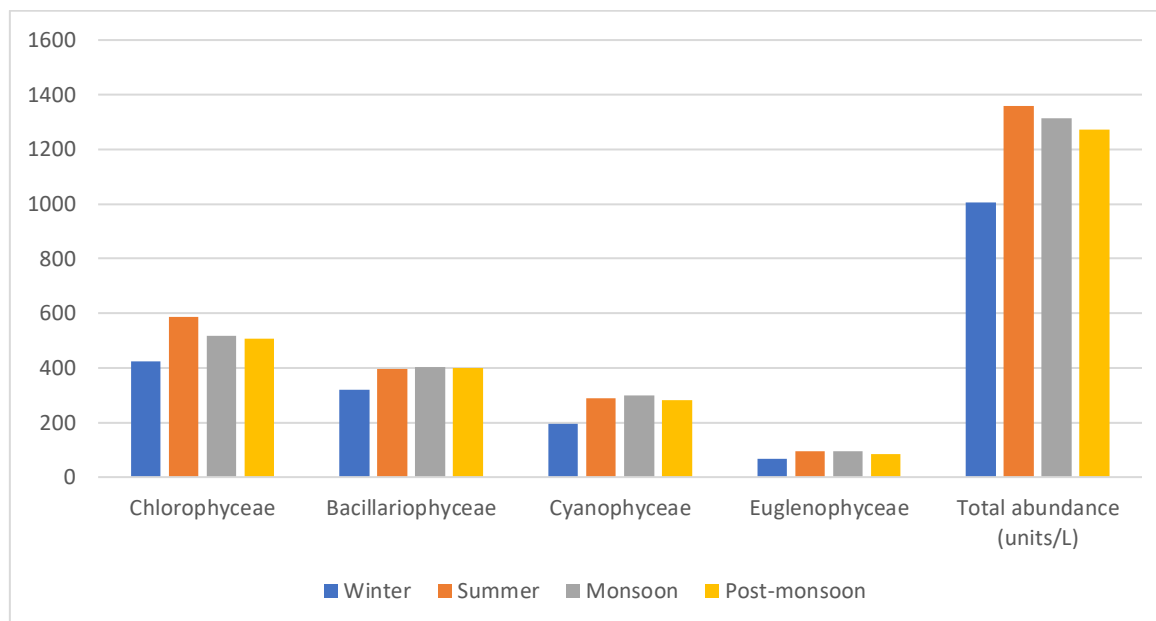
Phytoplankton group	Representative species	Frequency of occurrence (%)	Mean abundance (units/L)
Chlorophyceae	Chlorella vulgaris	91.7	438
Chlorophyceae	Scenedesmus quadricauda	83.3	356
Chlorophyceae	Pediastrum simplex	75.0	298
Chlorophyceae	Spirogyra sp.	66.7	241
Bacillariophyceae	Navicula sp.	83.3	324
Bacillariophyceae	Nitzschia sp.	75.0	278
Bacillariophyceae	Cyclotella sp.	66.7	236
Bacillariophyceae	Synedra sp.	58.3	198
Cyanophyceae	Oscillatoria sp.	75.0	267
Cyanophyceae	Anabaena sp.	66.7	214
Cyanophyceae	Microcystis sp.	58.3	185
Euglenophyceae	Euglena sp.	58.3	96
Euglenophyceae	Phacus sp.	50.0	79



The species-level distribution shows that *Chlorella vulgaris* had the highest frequency of occurrence (91.7%) and the highest mean abundance (438 units/L) among the illustrative observations. Members of Chlorophyceae and Bacillariophyceae were comparatively more consistently represented than Euglenophyceae.

Table 3. Seasonal variation in phytoplankton abundance

Season	Chlorophyceae	Bacillariophyceae	Cyanophyceae	Euglenophyceae	Total abundance (units/L)
Winter	425	320	195	67	1,007
Summer	585	395	287	93	1,360
Monsoon	517	402	300	95	1,314
Post-monsoon	508	399	280	86	1,273



The illustrative seasonal analysis indicates that summer recorded the highest overall phytoplankton abundance (1,360 units/L), followed by monsoon (1,314 units/L) and post-monsoon (1,273 units/L), while winter showed the lowest abundance (1,007 units/L). Chlorophyceae remained the dominant group across all seasons. This pattern may be associated with differences in temperature, light availability, nutrient input and other physicochemical conditions of the pond.

Conclusion:

The present study on phytoplankton dynamics in Jonji Pond, Sarkanda, Bilaspur, revealed considerable variation in the composition, occurrence and abundance of phytoplankton communities. A total of 13 phytoplankton taxa belonging to four major groups, namely Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae, were recorded during the study period. Among these groups, Chlorophyceae was the dominant group, contributing approximately 43.03% of the total phytoplankton population, followed by Cyanophyceae, Bacillariophyceae and Euglenophyceae. The dominance of Chlorophyceae indicates favourable conditions for the growth of green algae in the pond. Considerable monthly and seasonal fluctuations in phytoplankton abundance were also observed, suggesting that environmental conditions such as temperature, light availability, nutrient concentration, water depth and biological interactions may influence phytoplankton development. The comparatively greater abundance during warmer periods indicates the possible influence of increased solar radiation and nutrient availability on primary productivity. The presence of different phytoplankton groups further reflects the ecological heterogeneity of the pond ecosystem. Since Jonji Pond is also used as a nursery water body for fish, the phytoplankton community may contribute substantially to the availability of natural food resources for fish spawn. Overall, the findings demonstrate that Jonji Pond supports a diverse phytoplankton community and that its dynamics can provide useful information about the ecological characteristics and productivity of the aquatic ecosystem.

References:

1. Khan and Siddiqui (1969) – Seasonal limnological study of a perennial fish pond at Aligarh.
2. Sasmal et al. (2005) – Diurnal variation of plankton and water chemistry in a tropical freshwater pond.
3. Kumari, S., Ghosh, C. & Jayaraman, G. (2007). Phytoplankton Composition, Community Structure and Regional Climatic Variations in Two Tropical Model Ponds in India. *Asian Journal of Water, Environment and Pollution*, 4(2), 123–128
4. Rajagopal, T., Thangamani, A. & Archunan, G. (2010). Comparison of physico-chemical parameters and phytoplankton species diversity of two perennial ponds in Sattur area, Tamil Nadu. *Journal of Environmental Biology*, 31(5), 787–794
5. Hafiz, B.Z. & Hafiz, I.Z. (2018). Review on Nationwide Surveillance for Phytoplankton Ecology in India. *International Journal of Current Research and Academic Review*, 6(10), 1–10.
6. Kour, S. & Verma, R. (2020). Planktonic diversity of artificial pond in lower Shiwaliks. *Indian Journal of Ecology*, 47(2), 523–528
7. Rahim, S.A., Radhika, R. & Mathew, S. (2022). A Review on the Effect of Seasons and Pollution on Plankton Diversity in Indian Freshwaters. *Uttar Pradesh Journal of Zoology*, 43(11), 58–67.