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A STUDY ON THE IMPACT OF WATER USE ON PHYTOPLANTONE DIVERSITY AND WATER QUALITY OF FRESH WATER BODY OF KARAULI DISTRICT, RAJASTHAN

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ABSTRACT

Biodiversity has an impact on ecosystem functioning and services. It has been demonstrated that the diversity of phytoplankton communities in natural freshwater and brackish habitats increases ecosystem stability and resource use efficiency. Phytoplankton absorb nutrients from water and remove ammonia nitrogen from water, which is especially important in reducing concentrations of this potentially toxic metabolite. Phytoplankton has a number of other indirect effects on water quality. The main aim of this paper is to discuss the physicochemical parameters and phytoplankton community in surface water samples from Fresh Water Body of Karauli District, Rajasthan. Water samples were collected from the sampling site on a monthly basis for two years, from November from *November 2017 to October 2019, and seasonal data were analysed. The results show that the values of various physicochemical parameters fluctuated during each season of both sampling years. However, the values of most parameters were higher in the summer season, with the exception of pH and dissolved oxygen, which were slightly higher in the winter season, while fluoride and alkalinity were highest in the rainy season. A total of 25 genera and 38 species from four classes of algae have been identified, with 15 species belonging to the Chlorophyceae, 14 species belonging to the Cyanophyceae, 4 species belonging to the Euglenophyceae, and 5 species belonging to the Bacillariophyceae. Seasonal variation in the presence of different phytoplankton species has been observed. The majority of phytoplankton species were discovered to be abundant during the summer season, when most physicochemical factors were also elevated.*

Keywords *– Phytoplankton, water body, fresh water, Phytoplankton diversity, Karauli etc.*

1. INTRODUCTION

1.1 Overview

Aqua culturists understand that phytoplankton photosynthesis is a significant source of dissolved oxygen in ponds. The rate of photosynthesis is determined by the amount of light available. Photosynthesis begins at dawn, and on a typical day, the rate of photosynthesis and the concentration of dissolved oxygen in the

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water increase from morning until mid-day or early afternoon. Photosynthesis ceases at dusk, and dissolved oxygen concentrations tend to fall during the night.

When the water in a pond is supersaturated with oxygen, mechanical aeration accelerates the loss of this gas. Aeration in fish ponds can often be stopped during the day and reduced in shrimp ponds during the day to reduce the amount of oxygen lost from the water. Shrimp live on the bottom, so some aeration should be applied during the day to ensure that oxygenated water moves across the bottom. Mechanical aeration reduces the drop in dissolved oxygen concentration at night.

For photosynthesis, phytoplankton remove carbon dioxide from the water. Carbon dioxide is acidic in water, so as phytoplankton remove carbon dioxide for photosynthesis, the pH of pond water rises during the day. When phytoplankton remove all of the carbon dioxide from the water, bicarbonate is used as a carbon source in photosynthesis. Many aquatic plants have a physiologic pathway that allows them to remove one carbon dioxide molecule from two bicarbonate ions while releasing one carbonate ion into the water. Because the carbonate ion reacts with water to raise the pH, pH rises during photosynthesis even after all of the dissolved carbon dioxide has been removed. Phytoplankton abundance is typically high in aquaculture ponds due to high nutrient concentrations from fertiliser or feed inputs. Phytoplankton absorb nutrients from water and remove ammonia nitrogen from water, which is especially important in reducing concentrations of this potentially toxic metabolite. Phytoplankton has a number of other indirect effects on water quality.

1.2 Plankton

Plankton have no self-propelled mobility. They are propelled by the current in the surrounding water. This type of movement aids in the dispersal of organisms throughout a body of water. Plankton live in the water column's pelagic zone, which is named after its inhabitants.

Plankton organisms can range in size from less than 2 micrometres to more than 200 micrometres. Many different species of organisms in ocean and freshwater ecosystems fall into this category. Phytoplankton and zooplankton are the two types of plankton. Phytoplankton are photosynthetic organisms that serve as primary producers in aquatic environments. Zooplankton are heterotrophic, meaning they eat smaller plankton.

1.3 Phytoplankton

Phytoplankton are the primary producers of their environment, which means they are the first organisms to generate energy from light sources such as the Sun. Photosynthesis is the process by which they convert light energy into carbohydrates. The energy that the phytoplankton do not use for maintenance is available as food for the animals that consume it.

Phytoplankton absorb about 3% of the light that falls on the ocean. Plants on land, on the other hand, absorb about 15% of the available sunlight. This disparity is caused by the ocean's ability to absorb sunlight to varying degrees. This competition for

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essential light resources limits the rate of primary production in aquatic ecosystems.

2. LITERATURE REVIEW

Sharma, Amit and Kamboj (2021) Water quality boundaries assume a significant and significant part in deciding the variety of phytoplankton in any sea-going ecosystem. The current study was led to quantify the connection between's different physico-chemical boundaries and phytoplankton collections structure in chosen zones of the Tehri repository. Aftereffects of the current study plainly showed an expanded grouping of some physico-chemical boundaries for example all out disintegrated solids, turbidity, and electric conductivity during the storm season which affects the thickness of phytoplankton. The multi connection was likewise determined between significant physico-chemical boundaries and phytoplankton thickness. Broken down oxygen showed an extremely high certain connection with phytoplankton variety. It was additionally seen that during the rainstorm season, a high heap of residue in the repository region influences the development of phytoplankton and furthermore decline their number. Accepted Correspondence Analysis (CCA) was determined between some significant water quality boundaries and predominant taxa of phytoplankton which demonstrated the immediate impact of different physico-chemical boundaries on variety and dispersion of phytoplankton in Tehri repository at Garhwal Himalayas.

Borics, Gábor and Abonyi (2021) Our comprehension on phytoplankton variety has generally been advancing since the distribution of Hutchinson on the conundrum of the microscopic fish. In this paper, we sum up some significant stages in phytoplankton nature with regards to systems hidden phytoplankton variety. Here, we give a structure to phytoplankton local area gathering and an outline of measures on ordered and useful variety. We show how natural speculations on species rivalry along with demonstrating approaches and research facility tests comprehended species concurrence and support of variety in phytoplankton. The non-balance nature of phytoplankton and the job of unsettling influences in forming variety are additionally examined. Moreover, we examine the job of water body size, usefulness of environments and temperature on phytoplankton species lavishness, and what variety might mean for the working of lake ecosystems. Finally, we give a knowledge into sub-atomic instruments that have arisen somewhat recently and contend how it has widened our viewpoint on microbial variety. Other than verifiable foundations, some basic remarks have likewise been made.

Gulecal, Yasemin and Temel (2014) Seasonal changes in the variety of phytoplankton and its connections to the water quality in Buyukcekmece Watershed in Istanbul, Turkey were concentrated in this study during one-year time span, from January 2009 to December 2009. Physico-chemical boundaries, fundamental measures of water quality, were noticed. Having distinguished species from 6 divisions, including Bacillariophyta, Chlorophyta, Cyanophyta, Euglenophyta, Dinophyta and Cryptophyta inside the phytoplankton of Buyukcekmece Lake, and that of the named influent streams, Bacillariophyta among these divisions has been determined as the

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most extravagant gathering in species assortment. Among the streams having gone under inspecting, Tahtakopru Stream has shown the species assortment (48), and individually Karasu (45), Hamza Stream (32), Beylikcayiri Stream (21) and Ahlat Stream (7) have come from that point. Inside the phytoplankton of Buyukcekmece Lake, 66 species have been distinguished.

Baruah, Partha and Kakati, Bhaswati (2013) Water quality and phytoplankton variety were researched in Gopeswar sanctuary lake of Assam, India. Out and out 45 species of phytoplankton were recorded addressing Chlorophyceae (16), Cyanophyceae (10), Bacillariophyceae (14), Euglenophyceae (3), Chrysophyceae (1) and Dinophyceae (1). Phytoplankton tops were seen in summer and rainstorm periods. Connections of phytoplankton thickness with various water quality boundaries were assessed and the water body was observed to be modestly dirtied. Presence of Microcystis aeruginosa alongside Navicula cryptocephala over time likewise demonstrated its social eutrophication and consequently, needs the executive's intercession.

S.S. Sharma, et al (2012) - Because biological communities incorporate the environmental effects of water quality, bio-monitoring is required to study the ecological quality of various ecosystems. Water samples were collected for two years, and data on seasonal studies of water chemistry and phytoplanktonic variation in and around the Keladevi wildlife sanctuary, district Karauli, Rajasthan (India) were recorded. Despite the fact that the results show seasonal variations in the various physicochemical properties of water, the values of all parameters, except dissolved oxygen, are higher in the summer. A total of 36 algal genera and 60 species from four classes have been identified from three river sites. A small number of these were recorded throughout the year, while others were distributed primarily in the summer and winter seasons. Chlorophyceae (17 species) and Cyanophyceae (15 species) were the most dominant groups during the summer season. During the winter, however, the Bacillariophyceae (12 species) were the most dominant. Throughout the investigation, algae such as Chlorogonium euchlorm, Chlorella vulgaris, Gonium compactum, Scendesmus opoliensis, Merismopdia sp., Oscillatoriatrichoides, Euglena acus, and Naviculaminusa were found.

Sayeswara, Anantha and Goudar (2011) the physico-chemical boundaries and planktonic organization of Hosahalli lake were read for a time of a year from January to December 2010. The assessed water quality boundaries were contrasted and standard qualities endorsed by the Bereau of Indian norm (BIS) and World Health Organization (WHO). The consequences of physico-chemical examination uncovered that water is contaminated as it have high BOD, free CO2 and phosphate. Decisively these boundaries alongside other physico-chemical qualities were observed to be influenced by surface run-off and other exorbitant human exercises. Sums of 60 species having a place with 43 genera of phytoplankton were recorded, of which chlorophycean and diatoms were observed to be prevailing among four classes. Eleven zooplankton were indentified.

3. RESEARCH METHODOLOGY

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3.1 Study Area

Karauli locale is situated in the eastern piece of Rajasthan. It is limited in the north by Dausa and Bharatpur locale, in the east by Dhaulpur area, south by province of Madhya Pradesh and SawaiMadhopur region in the west. It extends between 26° 01' 27.02" to 27° 00' 11.61" north scope and 76° 28' 34.98" to 77° 24' 12.00" east longitude covering a space of 4,985 sqkms. This locale is essential for four stream bowls in particular 'Gambhir River Basin', 'Banas River Basin', 'Chambal River Basin' and 'Parbati River Basin'.

Karauli area is authoritatively isolated into five blocks. The accompanying table sums up the fundamental insights of the locale at block level.Sapotra block is the biggest in region possessing around 1955 sqkms though the littlest block is Todabhim spread over around 544 sqkms while populace astute, Hindaun block has the most noteworthy populace and Nadoti has least populace.

The environment of the region is described by subtropical, dry with unmistakable winter, summer and storm. Most elevated temperature during May-June has been recorded as 49 °C and least temperature in January recorded as 5 °C. The greater part of the precipitation is gotten during the rainstorm season, which reaches out from July to September. Normal precipitation of the locale is 577.11 mm.

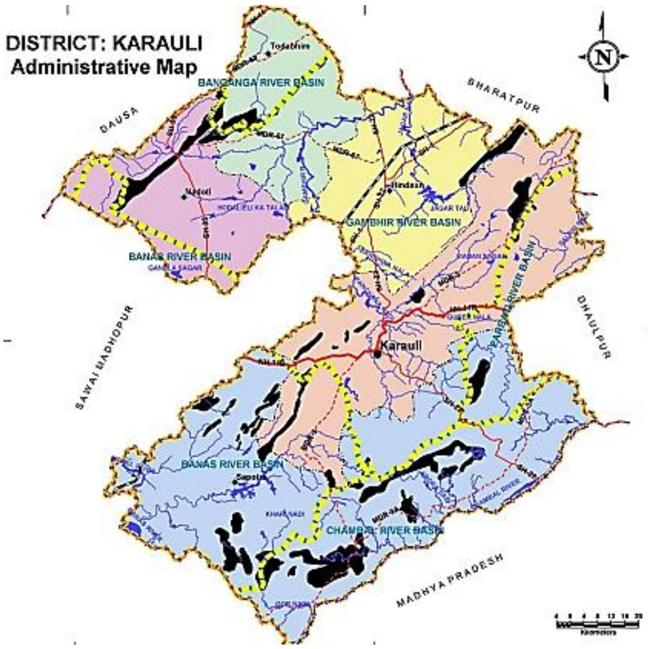

Figure 1: Map of Karuli, Rajasthan

3.2 Sample collection

Freshwater samples were collected from November 2017 to October 2019 to record the physicochemical and phytoplankton characteristics of Fresh Water Body of Karauli District, Rajasthan. On a monthly basis, surface water samples were manually

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collected in clean sampling bottles (plastic, one litre capacity). Every water sample was collected in the morning (between 9 and 10 a.m.) during the first week of each month, and photography was taken to see the actual view of the pond. Every month, samples were collected from the sampling site, which was approximately 6-8 feet away from the pond's bank, using a bamboo stick. At the site, physical factors such as water temperature and pH were recorded. The water samples were taken to a laboratory to be estimated of certain physicochemical parameters using standard methods. The phytoplankton-net samples for algal forms were collected and stored in separate bottles. As previously reported, algal samples were also brought to the laboratory for microscopic examinations. The majority of the algal samples were analysed as soon as possible, while some were preserved in 4 percent formalin for further study. Various forms of algae were observed using a Japan-made mirror type microscope and Camera Lucida, and were drawn with an HB pencil. The taxonomic identification of phytoplankton species was carried out using standard monographs and books.

4. DATA ANALYSIS AND RESULT

The current study was conducted over two years, from October 2014 to November 2016. The surface water samples of Fresh Water Body of Karauli District, Rajasthan, were sampled monthly for certain physicochemical parameters and possible phytoplankton populations (Rajasthan). Seasonally, the data from both study years were analysed (summer, rainy and winter). Table 1 contains the recorded data on physiochemical parameters, Table 2 contains the data on seasonal diversity of phytoplankton, and Figure Plates 2 and 3 contain the Camera Lucida diagrams of various forms of phytoplankton observed in the current study.

4.1 Analysis on Characteristics regarding Physicochemical

Temperature, pH, Chemical oxygen demand (COD), Biological oxygen demand (BOD), Dissolved oxygen (DO), Chloride, Calcium, Fluoride, Total alkalinity, Total hardness, Total dissolved solids (TDS), Nitrate, and Phosphate were all measured in water. The results show fluctuations in the values of physicochemical parameters across seasons in both sampling years, which could be attributed to climatic variation. The mean value of most parameters was found to be higher in the summer season (March to June), with the exception of pH (7.93) and DO (7.75 mg/l), which were found to be slightly higher in the winter season (November to February). The higher DO values in winter may be due to the higher solubility of oxygen at lower temperatures, as well as the circulation and mixing of water caused by surface runoff during the monsoon. Fluoride and total alkalinity levels were found to be higher during the rainy season (July to October), with the highest alkalinity levels in both years. TDS, nitrate, and phosphate levels were highest during the summer season (Table 1). The temperature ranges of the water were varied, with a minimum (160 C) in the winter season and a maximum (29.750 C) in the summer, which could be due to seasonal variations in sunshine and rain. As described, the high temperature resulted in a decrease in water level, a rapid rate of organic decomposition, and massive growth of hydrophytes. The temperature in India is quite high during the

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dry pre-monsoon season, but with the arrival of the southwest monsoon, the water temperature drops to its lowest value in August. Temperature was discovered to be one of the most important physicochemical parameters of water in determining the diversity, productivity, and periodicity of the algal flora. The concentration of various nitrate ranges in water provides a useful indication of pollution and thus has the ability to support phytoplankton growth. The pH values indicate that the water is slightly alkaline. pH is one of the most important and single factors influencing aquatic organism production. Except for the phosphate and DO values, the limits of the majority of the analysed parameters were found to be almost within the range of required and permissible limits as prescribed by Indian standards. The summer season had higher phosphate levels (2.33 mg/l) and lower DO levels (3.05 mg/l). Low DO is associated with organic pollution, but it is also caused by inorganic reductions and other waste materials. The hardness values show that pond water is moderate-hard to hard in all seasons. In general, water hardness can be temporary or permanent, depending on the amount of phosphate present.

4.2 Analysis on Phytoplankton diversity

In Karauli District water samples, a total of 25 genera and 38 species of phytoplankton belonging to four algal classes were identified, including 15 species of Chlorophyceae, 14 species of Cyanophyceae, 4 species of Euglenophyceae, and 5 species of Bacillariophyceae (Table 2). Seasonal variation in the presence of different phytoplankton species has been observed. The majority of phytoplankton communities and visible water blooms were found to be abundant during the summer season (March to June), when values of most physicochemical factors were also higher, as observed by several workers1. In the summer, higher Ca concentrations (36.75 and 38.75 mg/l) (Table 1) have been shown to promote the growth of all genera of green algae and the majority of bluegreen algae. Water blooms were found to be more abundant in the summer months and continued to proliferate until the first month of the rainy season, when oxygen levels were low in comparison to the winter season. Members of the Chlorophyceae and Cyanophyceae were most abundant in the summer and then declined in the rainy and winter seasons. As previously observed, all Euglenophyceae and Bacillariophyceae species develop the most during the winter months and the least during the rainy season. During the summer, the water level drops, whereas during the rainy season, the water level rises and becomes turbid. Several previous studies have also shown that the winter months are more favourable for maximum diatom development. Diatom species thrive in environments with high pH, high DO, low phosphate levels, and low temperatures. The presence and massive growth of phytoplankton in bodies of water is determined not only by physical factors (light, temperature, and pH), but also by chemical load, which influences species composition10. Certain algal species, including Closteriumvenus, Scenedesmusobliquus, and Hydrodictyonindicum of Chlorophyceae, Merismopediaglauca and Nostocpunctiforme of Cyanophyceae, Euglena polymorpha and E. acus of Euglenophyceae, and Synedra ulna of Bacillariophyceae, were observed throughout the study period and regardless

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of season (Table 2). As a result, these algal species have been identified as a good indicator of water pollution.

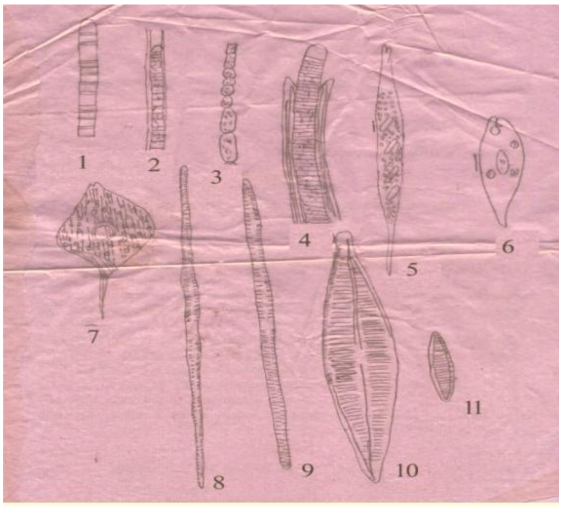

Figure 2. Camera Lucida of different forms of phytoplankton

Scale denotes to 10 µm

- Phormidiumretzii (Ag.) Gomont
- PhormidiumpachydermaticumFremy
- CylindrospermummajusKutz
- LyngbyaaestuariiLiebm. Ex Gomont
- Euglena acusEhr.
- Euglena polymorphaDangeard
- Phacustortus (Lemm)
- SynedraacusKutz
- Syndra ulna (Nitzsch) Ehr.
- NaviculacuspidataKutz
- NitzschiaamphibiaGrun

Table 1 Physicochemical parameters of water samples of Fresh Water Body of Karauli District, Rajasthan

S. No.	Parameters	Summer (Mean±SD)		Rainy (Mean±SD)		Winter (Mean±SD)	
		(2017-2018)	(2018-2019)	(2017-2018)	(2018-2019)	(2017-2018)	(2018-2019)
1	Temperatur	29.75±4.79	29±4.76	28.75±4.79	29±3.16	15.63±3 .90	16±3.56

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2	pH	7.48±0.34	7.58±0.39	7.40±0.22	7.65±0.31	7.93±0.60	7.75±0.46
3	COD	200.50±13.70	147.50±10.41	185.25±14.73	111±13.32	148.75±21.75	142.75±4.57
4	BOD	32±2.16	28±2.94	27.15±3.53	23.75±3.50	24±2.94	17.25±4.57
5	DO	1.88±0.30	3.05±0.10	5.08±1.16	5.18±0.90	5.78±0.85	7.75±0.65
6	Chloride	58.75±8.54	72.50±5.26	35±12.91	40.50±12.79	24.75±2 .50	34±8.64
7	Calcium	36.75±5.06	38.75±2.99	32.75±2.75	30±11.89	28.30±2 .41	26.25±8.54
8	Fluoride	0.53±0.22	0.73±0.30	0.88±0.22	2.03±0.41	0.13±0.05	2.02±1.06
9	Total Alkalinity	166.75±19.72	145.5±17.08	221.5±23.57	244±19.25	155.75±44.84	142.75±51.82
10	Total Hardness	162.75±19.52	175.75±8.42	106.75±16.09	131.50±35.87	115.25±14.86	133.75±32.44
11	TDS	384±48.41	446.25±13.87	266±72.79	320±18.26	198.75±53.06	282.50±60.07
12	Nitrate	11.88±0.56	8.93±1.68	6.50±3.24	4.38±0.67	7.70±0.67	6.55±1.03
13	Phosphate	1.85±1.12	2.33±0.70	0.38±0.43	0.63±0.67	0.18±0.05	0.33±0.26

Summer (March-June), Rainy (July-October), Winter (November-February); values are mean ± SD (n=4) COD-Chemical oxygen demand, BOD-Biological oxygen demand, DO-Dissolved oxygen, TDS-Total dissolved solids All values of physicochemical parameters are expressed in mg/l except the Temperature (in °C) and pH

Table2Phytoplanktontaxain Fresh Water Body of Karauli District, Rajasthan

AlgalClass	No.	Genus	Species	Summer	Rainy	Winter
Chlorophyceae	1	*Closterium*	*ehrenbergii*	+	+	-
	2	*C.*	*venus*	+	+	±
	3	*Scenedesmus*	*obliquus*	+	+	±
	4	*S.*	*dimorphus*	+	-	+
	5	*Oedogonium*	*curtum*	+	+	-
	6	*O.*	*paratens*	+	+	-
	7	*Hydrodictyon*	*indicum*	+	+	+
	8	*H.*	*reticulatum*	+	-	-
	9	*Ankistrodesmus*	*spiralis*	+	+	-
	10	*Pediastrum*	*simplex*	+	-	+
	11	*Cosmarium*	*granatum*	+	±	-
	12	*Straurastrum*	*bieneanum*	+	-	-
	13	*S.*	*cuspidatum*	+	-	+
	14	*S.*	*hexacerum*	+	-	±
	15	*Spirogyra*	*jungalis*	+	+	-
Cyanophyceae	1	*Gleocapsa*	*gelatinosa*	+	+	-

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	2	*Gleotrichia*	*pilgeri*	+	-	+
	3	*Aphanothece*	*pallida*	+	-	-
	4	*Merismopedia*	*glauca*	+	+	+
	5	*M.*	*punctata*	+	+	-
	6	*Cylindrospermum*	*majus*	+	±	-
	7	*Dactylococcopsis*	*raphidiodes*	+	+	-
	8	*Phormidium*	*retzii*	+	-	+
	9	*P.*	*pachydermaticum*	-	-	+
	10	*Oscillatoria*	*proboscida*	+	-	+
	11	*O.*	*subbrevis*	+	-	-
	12	*O.*	*pernornata*	+	-	-
	13	*Nostoc*	*punctiforme*	+	+	±
	14	*Lyngbya*	*aestuarii*	+	±	-
Euglenophyceae	1	*Euglena*	*polymorpha*	+	±	+
	2	*E.*	*acus*	+	+	+
	3	*E.*	*spirogyra*	+	-	+
	4	*Phacus*	*tortus*	-	+	+
Bacillariophyceae	1	*Synedra*	*acus*	-	+	+
	2	*S.*	*ulna*	+	+	+
	3	*Navicula*	*cuspidata*	-	+	+
	4	*Nitzschia*	*amphibia*	-	-	+
	5	*Fragilaria*	*pinnata*	+	-	+

Summer (March-June), Rainy (July-October), Winter (November-February); Present (+), Absent (-), Rare (±)

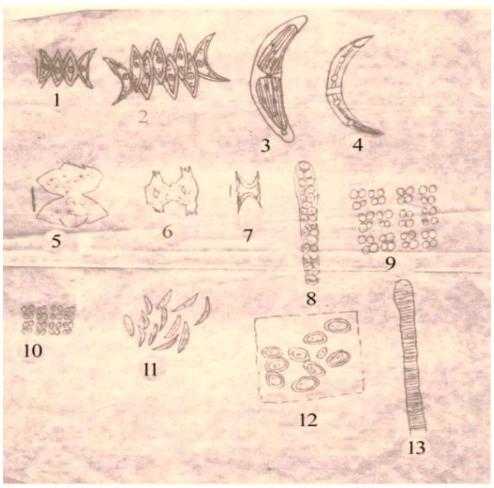

Figure 3. Camera Lucida diagrams of different forms of phytoplankton

Scale denotes to 10 µm

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- Scenedesmusobliquus (Turnip) Kuetzing
- Scenedesmusdimorphis (Turnip) Kuetzing
- ClosteriumehrenbergiiMeneghini ex. Ralfs
- ClosteriumvenusKutz
- StaurastrumbieneanumRabenh.
- Staurastrumhexacerum (Ehr.) Wittr
- StaurastrumcuspidatumBreb.exRalfs forma Kriegera
- NostocpunctiformeKutz
- MerismopediapunctataMeyen
- Merismopediaglauca (Ehrenb.) Nag.
- DactylococcopsisraphidiodesHansg.
- AphanothecepallidaKutz. Rabenh.
- OscillatoriasubbrevisSchmidle

5. CONCLUSION

The recorded values of thirteen physicochemical parameters of water show seasonal fluctuations, but the values of most of the parameters were found to be higher in the summer season, with the exception of the pH and DO values, which were found to be slightly higher in the winter season. The findings also show variation across both sampling years. Fluoride and total alkalinity levels were found to be higher during the rainy season. Except for phosphate (higher) and DO levels (low) in summer, the limits of the analysed parameters were found to be almost within the range of required and permissible limits of Indian standards. The hardness values indicate that the water is moderate-hard to hard. Seasonal variation in the presence of different phytoplankton species was observed in both study years. The majority of phytoplankton taxa were found to be abundant during the summer season, when most physicochemical factors were also elevated. Summer and rainy months were more favourable for the proliferation of water blooms, with Chlorophyceae and Cyanophyceae members predominating. Members of the Euglenophyceae and Bacillariophyceae, on the other hand, were abundant during the winter season. Phytoplankton species from the Chlorophyceae (Closteriumvenus, Scenedesmusobliquus, and Hydrodictyoindicum), Cyanophyceae (Merismopediaglauca and Nostocpunctiforme), Euglenophyceae (Euglena polymorpha and E. acus), and Bacillariophyceae (Synedra ulna) were collected in each Because these species are highly sensitive to pollution, they have been identified as a good indicator of water pollution. The Fresh Water Body of KarauliDistricthad a moderate level of pollution in this situation. We conclude that adequate knowledge of phytoplankton is required for proper water resource utilisation.

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NOTE:

1. Some red mark may be saw mistake check it.
2. Photographs doesn’t like perfect

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