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STUDIES ON ALGAL DIVERSITY WITH SPECIFIC REFERENCE TO PHYSICO-CHEMICAL PARAMETERS IN GLEN STREAM NEAR SUMMER HILL REGION OF HIMACHAL PRADESH

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ABSTRACT

The present research paper deals with the composition and diversity of algae from Glen Stream near Summer Hill region of Shimla district of Himachal Pradesh. 4 genera under Bacillariophyceae represented by *Cymbella*, *Cocconema*, *Gomphonema* and *Navicula* and 6 genera under Chlorophyceae represented by *Cladophora*, *Cosmarium*, *Oedogonium*, *Spirogyra*, *Ulothrix* and *Zygnema* and 1 genus each under Cyanophyceae and Xanthophyceae represented by *Anabaena* and *Tribonema* respectively were reported from this stream. This is the first record of algae from Glen Stream. The impact of selected physico-chemical parameters on algal composition has also been assessed.

Keywords: Assessment, Composition, Diversity, Parameters, Physico-chemical

INTRODUCTION

Among all living things, algae are one of the most diverse groupings. Algae are mostly aquatic and can be found in fresh and saline water [1]. They can be found in various habitats, including lakes, ponds, rivers, and the ocean [2]. Algae are crucial to maintaining aquatic ecosystems and make

up the base of the food web or food chain [3]. Reservoirs with high levels of human sewage combined with phosphate and other pollutants lead to algal blooms that include species of *Oscillatoria*, *Chlorella*, *Microcystis*, *Closterium*, and Diatoms, as well as other planktonic algae that give off a

dusty water odour [4]. Algae participate in the photosynthesis process, which results in significant oxygen and organic carbon production enormously that's of the world's primary productivity [5]. Compared to terrestrial habitats, aquatic areas are seeing a faster decline in biodiversity, and streams and rivers are particularly affected by this issue [6]. Physical and chemical characteristics determine the quality of the water [7]. Water pollution is believed to occur when organic and inorganic materials are dumped into bodies of water, affecting the water's natural chemistry and causing changes in the physicochemical parameters. Certain climatic and environmental conditions might also cause it. An indication of human-made pollution is the fluctuation of life in aquatic biological complexes [8]. The season has an impact on the distribution and amount of algae [9]. Seasonal variations have an impact on the physicochemical factors, which affect the number and diversity of algae [10]. Wastes from human activities (such as agricultural runoff) are continuously introduced into the environment, which may have an impact on the physico-chemical variables from season to season [11]. Environmental factors, including temperature, pH, EC, and TDS, have a significant impact on how dense the algae are [12]. A perusal of the literature has revealed that very little information is available on the algal flora of the Shimla

district of Himachal Pradesh. The present research paper is the first attempt to describe algal flora from the Glen Stream.

MATERIALS AND METHOD:

Study area

Himachal Pradesh is a hilly state in the northernmost part of India. It is situated between latitude 32°5'3.1416" North and longitude 77°34'16.2012" East. The altitude ranges from 350 metres to 6975 metres above mean sea level. The state is located in the Himalayan region of India. It covers an area of 55,673 square kilometres which is about 1.69% of India's total area and has 12 districts.

Shimla is known as the Queen of hills for its beauty. The city is situated between the Himalayan foothills. The city is well known for its temperate climate as well as the large number of Shimla residents who live there. Shimla is situated between 31° 6' 16.5780" North and 77° 10' 24.3264" East.

Shimla, in the northern Indian state of Himachal Pradesh, has a woodland region called Glen between Annadale, Summer Hill, Chaura Maidan, and Boileuganj. Glen is famous for its pristine scenery and natural trails. Glen Stream is situated between 31.112067° N and 77.147424° E.

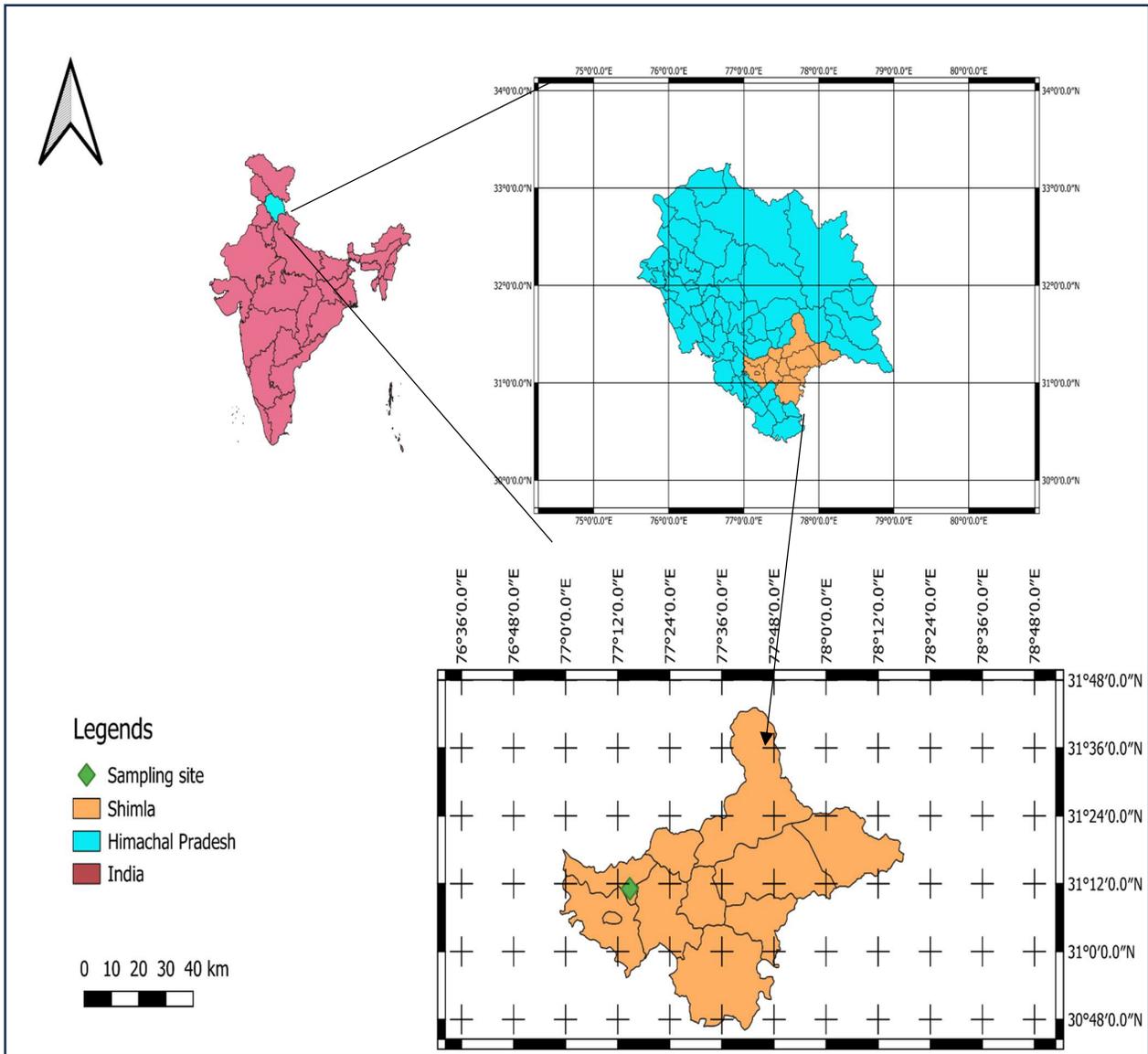


Figure 1: Map showing the area of study



Figure 2



Figure 3

Figure 2 & 3: Collection site



Figure 4



Figure 5

Figure 4 & 5: Collection of Algal Samples

Collection of algal samples: Algal samples were collected from the Glen stream of Summer Hill in Shimla district. Samples were collected using forceps and needles. All algal samples were preserved in plastic bottles with a 4% formalin solution to avoid contamination. To minimise the risk of contamination, fresh samples were used. Fresh samples of algae were taken and placed in petri plates after being carried to the lab. Put one to two drops of glycerol on a glass slide then with the help of a forceps and needle put a small amount of sample on that glycerol and then cover it with the help of a coverslip. The samples were examined and identified under a microscope using standard references.

Water sample analysis: For physico-chemical analysis, water samples were taken from the Glen stream. Temperature, pH, TDS, and electrical conductivity were monitored on the spot by using a water testing meter [13]. The total hardness,

hardness resulting from Ca^{2+} , and hardness resulting from Mg^{2+} of the samples were measured by titration as per [APHA] [14].

RESULT AND DISCUSSION

The findings are shown in **Tables 1-2** and **Figure 6-7**, respectively.

Algal diversity: A total of 12 genera (**Table 1**) of algae were observed belonging to 4 families. Class Chlorophyceae is dominant in the study area. Six genera, including *Cladophora*, *Cosmarium*, *Oedogonium*, *Spirogyra*, *Ulothrix*, and *Zygnema*, are found within the Chlorophyceae class. *Cymbella*, *Cocconema*, *Gomphonema*, and *Navicula* are four genera observed in the class Bacillariophyceae. *Anabaena* is the representative of one of the genera found within the class Cyanophyceae. *Tribonema* is one of the genera identified in the Xanthophyceae class. During the study, it was found that Chlorophyceae algal growth is dominated over Cyanophyceae, Bacillariophyceae and Xanthophyceae.

Physico-chemical parameters:

Temperature has a direct effect on the growth of algae. The temperature noted at the collection site is 14 °C (Table 1). Temperature affects the abundance of algae; diatoms and green algal bloom at low temperatures, according to [15]. Small groups of various ecological niches are formed along the stream by a low-temperature gradient, which also has a change in the mineral composition [16]. The measured pH value of the water is 8.9, indicating that in summer, water is neutral [17]. During the summer, the pH value is higher due to the low water level and increased concentration of nutrients in the water. Similar results were found by Shinde [18] [19]. This suggests that this is a perfect medium for the growth of microorganisms [20]. High pH levels encourage the growth of algae and cause a significant algal bloom. The electrical conductivity is measured at 285.3 $\mu\text{m}/\text{cm}$ at the collection site. Other

workers obtained similar results [21] [22]. The presence of salt in the water and the current that is created by it are what cause EC in the water [21]. The ion concentration, nutritional status, and fluctuation in soluble solid content all affect the conductivity of water [23]. The majority of the inorganic salts in the water, such as calcium, magnesium, potassium ions, sodium, calcium carbonate, chloride, sulphate, etc., and the minor quantity of organic salts are what cause the total dissolved solids in water [24]. The maximum value of TDS was noted at collection site is 142.7 in ppm. In the summer, the highest measured total hardness of the water in the study was 182.8 mg/L. Comparable outcomes were discovered [25]. The total hardness of the water indicates the Ca^{2+} and Mg^{2+} amounts of the water. More than 200 mg/L of total hardness is unfit for household use, including drinking and cleaning [26].

Table 1: Distribution of classes Bacillariophyceae, Chlorophyceae, Cyanophyceae and Xanthophyceae

Class	Bacillariophyceae	Chlorophyceae	Cyanophyceae	Xanthophyceae
1.	<i>Cymbella spp.</i>	<i>Cloadophora spp.</i>	<i>Anabaena spp.</i>	<i>Tribonema spp.</i>
2.	<i>Cocconema spp.</i>	<i>Cosmarium spp.</i>	-	-
3.	<i>Gomphonema spp.</i>	<i>Oedogonium spp.</i>	-	-
4.	<i>Navicula spp.</i>	<i>Spirogyra spp.</i>	-	-
5.	-	<i>Ulothrix spp.</i>	-	-
6.	-	<i>Zygnema spp.</i>	-	-

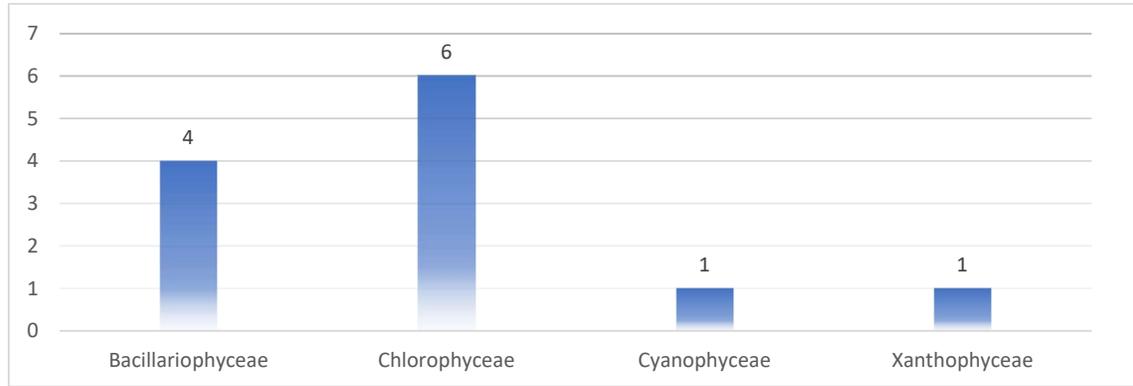


Figure 6: Total number of Algal genera of different classes at the collection site

Table 2: Physico-chemical analysis of Glen stream

Parameters	Values
Temperature (°C)	14°C
pH	8.9
TDS (ppm)	142.7
EC (µm/cm)	285.3
Total hardness (mg/l)	182.8
Hardness due to Ca ²⁺ (mg/l)	142.8
Mg ²⁺ Hardness (mg/l)	40

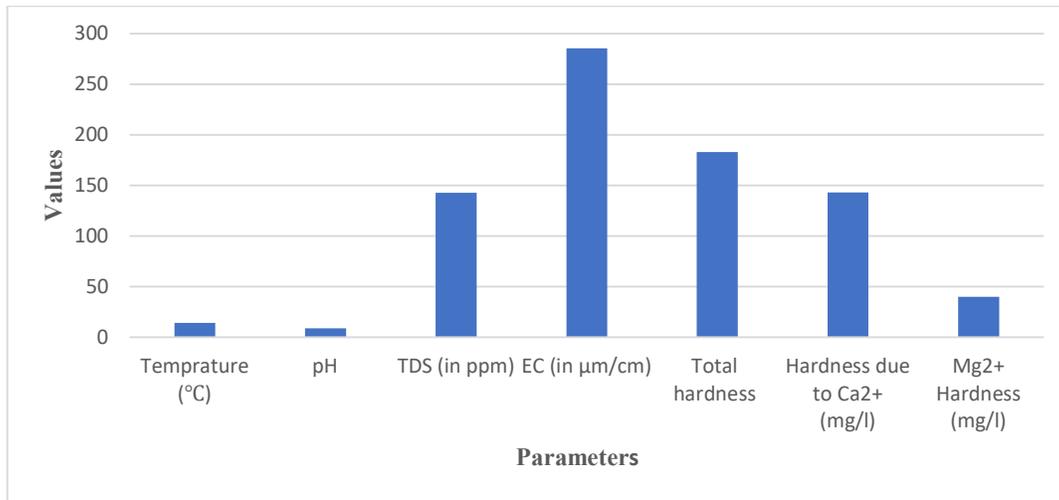


Figure 7: Physico-chemical parameter values



Figure 8: Cladophora



Figure 9: Oedogonium

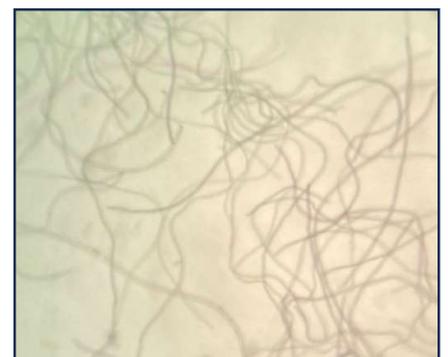


Figure 10: Zygnema

CONCLUSION

Present research work can be concluded that however fair diversity of algae furthermore physico-chemical analysis of stream water has shown that this stream has got the favourable value of pH, EC, TDS, temperature and total hardness which supplement algal diversity and growth in this stream. Algae are found to be an integral component of the food chain ecosystem. Because vertebrates such as frogs are found to be dependent on algae. Hence maintenance of critical water levels is essential for the sustenance of algal diversity. In this stream, this is the first attempt to describe algal diversity.

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