Limnological Study of Algae from Twinma Lake, Kani Township, Sagaing Region

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Abstract

Limnological study of algae was carried out by selecting area of Twinma Lake, Kani Township, Sagaing Region in the present investigation. Algae and water collected from two stations of Twinma Lake. In present investigation an attempt was made, to find out the relationship of algal communities and physico-chemical parameters of Twinma Lake. According to water analysis results, values of pH were 14 as both stations which give an alkaline taste. Total hardness was ranging from 24 mgl^{-1} to 60 mgl^{-1} which gives rise to slightly hard condition of water. Total dissolved solids (TDS) were found to exceed the range of WHO Guideline value (2000). The range and average population are two groups of algae which were Cyanophyceae and Bacillariophyceae from two stations of studied area. As in Cyanophyceae group, *Spirulina* and *Anabaena* were mostly occurred and other Cyanophyceae genera were not be found in this studied area.

Keywords: Limnology, Physico-chemical parameters, Algae

Introduction

Limnology is the study of inland aquatic ecosystems. The study of limnology included aspects of the biological, chemical physical and geological characteristics and functions of inland waters. This includes the study of lakes, reservoirs, ponds, rivers, springs, streams, wetlands and groundwater. The distribution of several groups of algae exhibited interesting relationships to the physico-chemical complex of the ponds, and throws much light on the algal distribution in freshwater lakes (Wikipidia, 2005).

Algae are widely present in the freshwater environments, such as lakes and rivers, where they are typically present as microorganisms-visible only with the aid of a light microscope. Although relatively inconspicuous, they have a major important in the freshwater environment, both in terms of fundamental ecology and in relation to human use of natural resources. Even blue green algae have beneficial uses. Particularly, *Spirulina* (*Arthrospira*) is still use by the people around lake as a dietary supplement.

Aquatic biology can be divided into two major displines-limnology (water bodies within contimental boundaries) and oceanography (dealing with oceans and seas, occurring between contiments). Water is typically fresh (non-saline) and where water bodies are of two main types; standing (lentic) water- particularly lake and wetlands and running (lotic) waters-including streams and rivers. Although the differences between standing and running waters is not absolute, it is an important distinction in relation to life algae present, since lentic systems are typically dominated by planktonic algae and lotic systems by bentic organisms. Freshwater algae can be grouped into ten phyla in relation to microscopical appearance; Cyanophyta, Euglenophyta, Xanthophyta, Dinophyta, Cryptophyta, Crysophyta, Bacillariophyta, Rhodophyta, Phaeophyta and Chlorophyta (Bellinger, 2015).

Twinma lake is located beside the Monywa-Yagyi- Kalewa road near the Laeshay village in kani Township, Sagaing Region. Twinma lake is situated between 22°43′ N and 99°12′ E on the west bank of Chindwin river. These lakes of water have high pH level about 14 which is alkaline lake type. Natural *Spirulina* is available from Twinma and Taungpauk but their combined yield was a lot less than yield of Twintaung of Butalin Township. Twinma lake is packed with local visitors this peak season, according to residents. Yekharr Lake between Sagaing Hill and Min

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Wun Hill produces natural *Spirulina* as in Twintaung of Butalin Township and Twinma and Taungpauk of Kani Township in Sagaing Region.

The aims of this study are: to record the algae and related water qualitly, to know about the algal flora in high pH water and to give information of algal flora and water quality of this study area.

Materials and Methods

Study Area

Water samples containing algae were collected from the upper surface of two sites in Twim-ma Lake, Kani Township, Sagaing Region during March to November 2019. The location map of two stations in study area was shown in Figure 1 and sampling sites of Twinma Lake, Kani Township, Sagaing Region were shown in Figure 2.

Collection of algae and water samples

Algae and water samples were collected from upper surface of two sites in Twinma Lake, Kani Township, Sagaing Region. The positions of all sampling sites were measured by Global Position System (GPS), temperature of water was measured by thermometer and pH of water was measured by pH meter. The collected algal specimens were examined by using compound microscope (Olympus) in laboratory, Department of Botany, Monywa University. The measurements of algae were taken by using micrometer and the images were recorded by digital camera.

Classification and identification of samples

The samples were identified on the thallus shape, size, colour, chloroplast, pyrenoids and sinus structure. Some collected specimens had been listed by the classification system of John *et al*. (2002). The first step in identifying an unknown sample is to determine to which family it belongs. The second step in identifying the unknown sample is to decide to which genus it belongs, and lastly to identify species, The taxonomic description of algae have been done by the references, Komarek & Anagnastis (1985-1989), and John *et al*. (2002).Physico-chemical report of water were analyzed at the Water Laboratory; Water and Sanitation Department Committee, Public Health Laboratory, Mandalay.
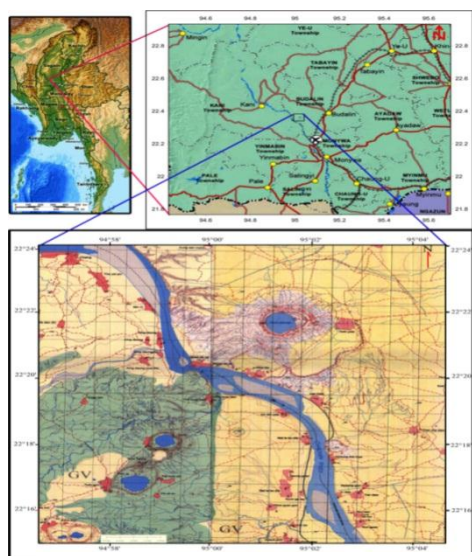
Figure 1. Location Map (Source: Department of Geology, Monywa University)

Figure 2. (A) Site 1

(B) Site 2

Results

Algae specimens were collected from two sampling sites of Twim-ma Lake, Kani Township, Sagaing Region during the periods of March to November 2019. The total 18 algal species were found in this study area. Among them 3 species, 3 genera, 2 families, belonging to 1 order of Cyanophyceae; 15 species, 15 genera, 5 families belonging to 1 order of Bacillariophyceae had been identified, described and recorded with photomicrographs (Figure 3-4). The classification of algae was mentioned in Table 1. The water quality was analyzed and recorded (Figure 5-6).

Table 1. Classification of some species found in Twinma Lake, Kani Township, Sagaing Region

| Division	Class	Order	Family	Genus	Species
Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	*Arthrospira*	1. *Arthrospira platensis* (Gomont) Geitler
			Phomidiaceae	*Spirulina*	2. *Spirulina subsalsa* Oerst.ex. Gomont
				Anabaena	3 *Anabaena oryzae* Fritsch
Chrysophyta	Bacillariophyceae	Pennales	Cymbellaceae	*Amphora*	4. *Amphora ovalis* Kutzing
				Cymbella	5. *Cymbella aspera* Ehrenberg
				Epithemia	6. *Epithemia argus* Ehrenberg
				Rhopalodia	7. *Rhopalodia gibba* (Ehrenberg) Kutzing
			Eunotiaceae	*Eunotia*	8. *Eunotia serpentine* Hust.
			Fragilariaceae	*Fragilaria*	9. *Fragilaria islandica* Grunow
				Synedra	10. *Synedra ulna* Nitzsch
			Gomphonemataceae	*Gomphoneis*	11. *Gomphoneis herculeana* Ehrenenberg
				Gomphonema	12. *Gomphonema seminatum* Ehrenberg
			Nitzschiceae	*Nitzschia*	13. *Nitzschia sigmoidea* Ehrenberg
				Pinnularia	14. *Pinnularia gentilis* Dank.
				Anomoeneis	15. *Anomoeneis spharophora* Kutzing
				Caloneis	16. *Caloneis amphibaena* Bory
				Dimerogramma	17. *Dimerogramma fulvum* Ralfs.
				Frustulia	18. *Frustulia romboides* Ehrenberg
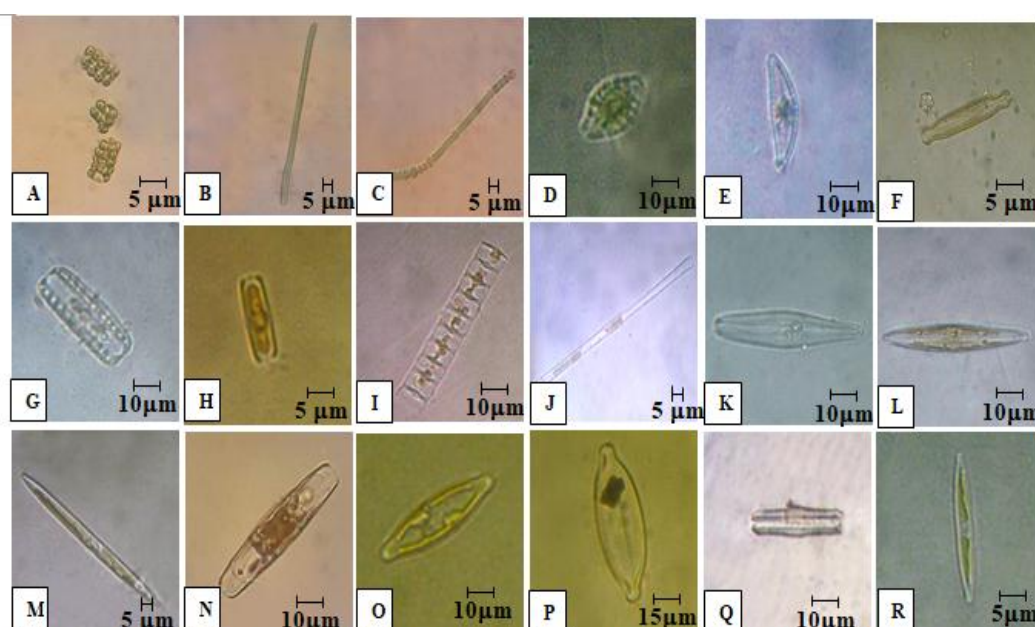
Figure 3. A. *Arthrospira platensis* (Gomont) Geitler,   B. *Spirulina subsalsa* Oerst.ex. Gomont,   C. *Anabaena oryzae* Fritsch
D. *Amphora ovalis* Kutzing   E. *Cymbella aspera* Ehrenberg   F. *Epithemia argus* Ehrenberg
G. *Rhopalodia gibba* (Ehrenberg) Kutzing   H. *Eunotia serpentine* Hust.   I. *Fragilaria islandica* Grunow
G. *Synedra ulna* Nitzsch   K. *Gomphoneis herculeana* Ehrenenberg   L. *Gomphonema seminatum* Ehrenberg
M. *Nitzschia sigmoidea* Ehrenberg   N. *Pinnularia gentilis* Dank.   O. *Anomoeneis spharophora* Kutzing
P. *Caloneis amphibaena* Bory   Q. *Dimerogramma fulvum* Ralfs.   R. *Frustulia romboides* Ehrenberg
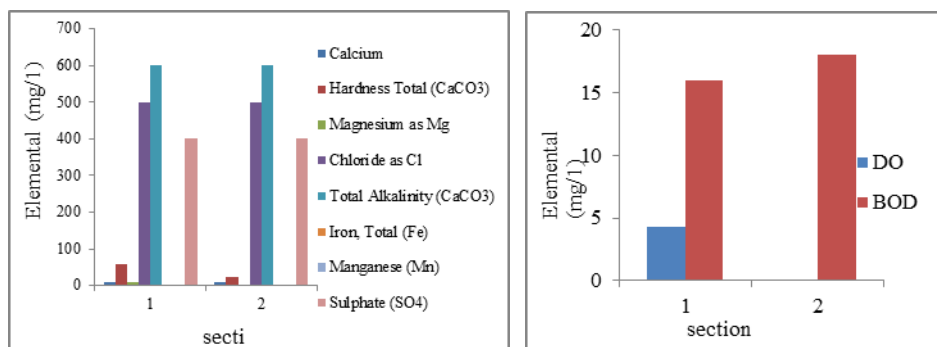
Figure 5.

Physico-chemical Characteristic
of Twinma Lake

Figure 6. Distribution of Do and BOD
of Twinma Lake

Discussion and Conclusion

In the present investigation, two sites at Twinma lake, Kani Township, Sagaing Region were selected to study of physico-chemical parameters and algal flora. Water samples and algal specimens were collected from November 2018 to April 2019.

According to the result of physico-chemical parameters of water, the values of pH were 14 in both sites in study area which gives an alkaline taste. The pH value of water above 8.5-10 was alkaline lake (Goel 1997). So, this study area is the type of alkaline lake. According to Joshi (2014), *Spirulina* is reported mainly to be found in natural alkaline lakes having pH value between 8-10. In this study, *Spirulina* (*Arthrospira*) was abundantly found. So, this finding was agreed with Joshi (2014).

Temperature is also fundamental climatic factor influencing the growth rate of *Spirulina*. Most of *Spirulina* species optimally grow in the range of 30-35°C (Jourdan 2001) and above 35°C is dangerous. In this study, temperature was ranging from 28°C to 30°C which were not dangerous for algae growth. In most freshwater nearly all the hardness is imparted by the calcium and magnesium ions which are in combinations with bicarbonates and carbonates apart from sulphates, chlorides and nitrates (Adoni *et al* 1985). In the present work, total hardness were ranging from 24 mgl^{-1} to 60 mgl^{-1} which give rise to slightly hard condition. Adoni *et al.*(1985) also reported that chlorides are usually present in low concentration in natural waters. The content of chloride in water samples was found not more than 500 mgl^{-1}.

Alkalinity is defined as the ability of water to resists a change in pH (Adoni *et al* 1985). In this study, the amount of total alkalinity in water samples of two sites were occurred not more than 600 mgl^{-1}. Dissolved Oxygen (DO) is necessary for the life of fish and other aquatic organisms. In this work, the contents of DO were recorded 0.14 in East side (Site B) and 4.29 in center (Site A).

The Biochemical Oxygen Demand (BOD) depends on the temperature of the environment and on the particular kinds of micro- organisms and nutrient present. The consequences of high BOD are the same as those of low DO; aquatic organisms become stressed and die (Spellman 2008). The BOD content in water samples was finding 18 mgl^{-1}.

In present investigation an attempt was made, to find out the relationship of algal community and physico-chemical parameters of water. Cyanobacteria species such as *Arthrospira platensis* (*Spirulina platensis*) and *Anabaena* were reported as dominant species in the considered sampling sites of Twinma Lake. A soda lake or

alkaline lake is a lake on the strongly alkaline side of neutrality apically with a pH value between 9 and 12 (Hammer 1983).

Major environmental parameters such as light, temperature, salinity, CO_2 condition and pH etc. have been studied and influence the growth, chemical composition and productivity of microalgae including *Spirulina* (Goksan 2007). *Spirulina* has been harvested as a food source by Mexicans from soda (alkaline) lakes of Mexico from historical records of the 16th centuary (Cifierri 1983). *Spirulina* can be sold in local markets to be used as a source of protein by the consumers. *Spirulina* was established as "wonderful future food source" in 1967 for its exceptionally high quality protein (70% dry weight) content (Bleakley & Hayes, 2017).

According to the result of collected specimens, Bacillariophyceae group were commonly found especially *Amphora, Cymbella, Epithemia, Eunotia, Fragillaria, Gomphoneis, Nitzschia, Pinnularia, Anemoneis* and *Caloneis*. It was displayed that average population of Cyanophyceae comprised 11.11% and Bacillariophyceae 88.88% but *Arthrospira platensis* was dominantly occurred which was indicated of alkaline lake.

Nowadays *Spirulina* was used as a nutrient source for both human food and animal feeds, it can also applicable to food colorant industry, cosmetics, medicine, energy production and wastewater remediation. *Spirulina* can also be used as a source of bio-fertilizers as it has high nitrogen and phosphorous content (FAO, 2008).

According to the results of present investigations, it can be concluded that dominant algal populations were found especially *Spirulina* and *Anabaena* followed by the commonly distribution such as fifteen species of Bacillariophyceae. Thus, the appearance of *Spirulina* was found increase in numbers in this study. The data also revealed that there was recorded the variation in the abundance and distribution of algal population especially *Spirulina* with the variations of physico-chemical factors in water samples of studied sites.

Acknowledgements

References

Belay, R 2013. Handbook of Microalgal culture Applied .Phycology and Biotechnoligy, 2nd Edition, Richmond, A. (ad), John Wiley and sens 235-358 pp.

Cifierri, O.1983. *Spirulina,* the edible microorganisms.Microbiological Reviews.P.551- 578.

Komarek*, et al*. 2014. Taxonomic classification of Cyanoprokaryotes (Cyanobacterialgenera), using polyphasic approach 86, 295-331.

Gomont, M.1892. Monographic des *Oscillatoria* (NostoceaeHomocystaes) Lyngbyeae Annales des Sciences Naturelles, Botampue, series 7, 16, 91-264.

Bleakley, S. and Hayes, M. 2017.Algal protein, Extraction.Applications and Challenges Concerning Production. Foods (5), 1-34.

FAO, 2008. A reviews on ed cultures production and use of *Spirulina*as food for humans and feeds for domestic animal and fish. FAO.Fisheries and Aquaculture circular No 1034, 41.pp.

John, D.M; Whitton, B.A & Brook, A.J. 2002. The Freshwater Algal Flora of the British Isles.United States of America by Cambridge University Press, New York.

Josh, M. Kaur, K. Mishra, T. and Singh, S. 2014.To evaluate lab scale Cultivation of *Spirulina*by using different substrates and to evaluate its chlorophyll and protein content. Research Journal of Biological Sciences 3 (1), 22-30.

Hammer,U.T., Shamess, j. &Hanynes, R.C. 1983. The distribution and abundance of algae in saline lake of Saskatchwa, Canada, Hydribiologia. 105, 1-26.

Lavens, P. &Sorgeloos, P. 1996. Manual on the production and use of live food for Aquaculture.FAO. Rome. United Nation.