TAXONOMIC STUDY ON SOME MEMBERS OF CHLOROPHYTA IN YENWE VILLAGE, TAUNGGYI TOWNSHIP

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Abstract

The present study deals with some algae belonging to Chlorophyta in Yenwe village. It is located in Taunggyi Township and is famous for its warm water stream. The specimens were collected from two selected locations. Water temperature of Location I is approximately between 39˚C and 40˚C, and that of Location II is between 25˚C and 29˚C. Algal specimens were collected during June 2009 to February 2010. In this study, 24 species belonging to the 15 genera of Chlorophyta were identified, described and recorded. Keys were constructed according to their morphological characters. Green algal genera such as *Ulothrix*, *Microspora*, *Cladophora*, *Pithophora*, and *Spirogyra* were abundantly seen in Location II. *Microspora crassior* and *Microspora stagnorum* were found in Location I. *Spirogyra rhizobrachialis* was found only in Location I. *Cosmarium pachyderma* and *Cosmarium rectosporum* were found in Location I.

Keywords: Chlorophyta, Yenwe village, morphological characters, hot spring.

Introduction

Earth is often called the "watery planet" because its surface is covered by water. Only 29% of the Earth's surface is made up of land and 71% is covered by water (Manson, 1989). Billions of tiny living creatures drift like a pale mist in the waters of the world. This drifting mass of life is called plankton. Phytoplanktons are the autotrophic component of the plankton community (Thurman, 1997). Phytoplankton prouces 80% of the atmosphere's oxygen through photosynthesis. They vary seasonally in amount, increasing in spring and fall with favourable light, temperature and minerals (Emiliani, 1991). Microscopic algae and dinoflagellates are the smallest plankton organisms. Algae are ubiquitous and multitude of species

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ranging from microscopic unicells to multicells. They occur on shores and coasts, attached to the bottom (benthic species) or live suspended in the water (plankton species) (Hoek, 1998). Aquatic freshwater algae are called pond scums or, when present in great abundance, water blooms (Harold, 1957).

Chlorophyta are commonly known as green algae. This is the most diverse group of algae, with over 7,000 species. Among the oldest of all organisms, the first green algae appeared more than 2 billion years ago in the fossil recording, they are believed to be the most immediate relatives of the green plants (Peter & George, 1990). Green algae may be unicellular, multicellular, colonial or coenocytic (Pandy & Trivedi, 1996). They may occur as free living, attached, epiphytes or parasites. They may be aquatic, amphibious, terrestrial or subaerial. They can adapt to shallow water, and live in both freshwater and marine habitats. Ninety percent of Chlorophyta are freshwater species (Peter & George, 1990).

Today algae are used by humans in many ways: - fertilizers, soil conditioners, livestock feed, food, bakery, cosmetics, pharmaceuticals, leather, textile industries and so on. Algae are nutritious because of their high protein content and high concentrations of minerals, trace elements and vitamins. They have been used for centuries especially in Asian countries. Algae tolerate a wide range of temperature. They can be found growing in hot springs, on snow banks, and also grow on the sea bed, beneath a thick blanket of Arctic or Antarctic sea ice and in the driest deserts (Pandy & Trivedi, 1996).

In Myanmar, the hot springs can be found in some places and Yenwe Village is one of these places. The present study is expected to explore the various algae which are adaptable to not very high temperatures. The research study concerning with this area have not been explored.

Materials and Methods

Study Areas and Sample Collection

Specimens were collected from two selected locations in Yenwe Village during the year 2009 – 2010. It is located in Taunggyi Township, Southern Shan State (N 20˚45′ 22″, E 96˚ 54′ 48″). Its area is 581.559 acres. Water samples were taken from the upper surface and shallow area of the pond and streams. Some were from moist soils. The algal samples were placed under good aeration and favourable light conditions. Water temperatures were measured by thermometer.

Preparation of the Samples for Identification

Fresh and pure specimens were placed on the glass slides and covered with cover slits Measurements were done by using ocular micrometers. The morphological description, classification, and nomenclature were conducted according to the literatures: Tiffany (1937), Presscott (1962), Shirota (1966), Han Maosen Shu Yunfang (1995) & Dillard (1989 – 2000).

Results

In this study, 24 species belonging to 15 genera of Chlorophyta has been identified, described and recorded. Artificial keys: - order keys, genera keys and species keys were made primarily.

Class Chlorophyceae

Key to the Order:

1. The wall is two sections which adjoin at the midregion, constriction or sinus present between the two cell halves (semicells); the walls are often ornamented with spines, teeth, granules, verrucae, sacrobiculations, ---------- Desmidiales

1. The walls not as above ---------- 2

2. Filamentous occurring as coenotypes without cross walls, except where reproductive structures are cut off ---------- Siphonales

2. Plants not as above ---------- 3

3. Filament composed of cells adjoined end to end in definite series, sometimes interrupted ---------- 4

3. Plants filamentous, composed of cells arranged to form filaments; unicellular or colonial, cells varies in shape, spherical, pyramidal, or polygonal, incapable of division in the vegetative state ---------- Chlorococcales

4. Filament unbranched; attached or free – floating ---------- 5

4. Filament with branches, the branches sometimes closely appressed, forming pseudoparenchymatous masses ---------- 7

5. Chloroplast 1 to several, large in the form of spiral band, stellate masses, or plate; pyrenoids conspicuous; reproduce by conjugation ---------- Zygnematales

5. Chloroplast parietal, plate – like, net – like, or small or ovate; reproduce by iso – or heterogametes ---------- 6

6. Cells with a single, parietal, plate – like or broadly discoid chloroplast; cells cylindrical; filaments uniseriate or multiseriate; one or more pyrenoids; isogametes and zoospores are produced in unspecialized cells ---------- Ulotrichales

6. Cells with net – like or sheet – like chloroplast which usually cover both the end and lateral walls; wall composed of two sections which overlap in the midregion, forming H – pieces upon fragmentation; pyrenoids lacking; sexual reproduction unknown ---------- Microsporales

7. Filament composed of cylindrical or rectangular, uninucleate cells; branches which usually are not distinctly bulbous at the base ---------- Chaetophorales

7. Filament composed of cylindrical, multinucleate cells; branches which may become attenuated towards their apices ---------- Cladophorales

Order – Ulotrichales

Family – Ulotrichaceae

Key to the Genera:

1. Filaments often show basal differentiation ---------- 2

1. Filaments not usually show basal differentiation ---------- 3

   2. Chloroplast a parietal band with nearly encircling the cell, protoplast unspecialized cells ---------- *Ulothrix*

   2. Chloroplast a laminate forming a band in the midregion of the cell, protoplast in pairs ---------- *Binuclearia*

3. Cells cylindrical, undifferentiated ---------- *Hormidium*

3. Cells spheroidal broadly ovoid, usually separated from each other ---------- *Geminella*

Ulothrix Kuetzing

Key to the Species:

1. Filaments curved, cells elongate – cylindric, 11.0 – 12.5 µm in diameter 2¼ times longer than wide ---------- *Ulothrix cylindricum*

1. Filaments slender, cells cylindrical, 4.5 – 6.0 µm in diameter & up to 15 µm long ---------- *U. variabilis*

***Ulothrix cylindricum* Prescott.** (Fig. 1) – Filaments long, curved, and lightly entangled. Cells elongate – cylindric, 11.0 – 12.5 µm in diameter, 2¼ times longer than wide; the wall thin and not constricted at the joints. Chloroplast a broad band, nearly equal to the cell in length and folded around ¾ of the circumference; pyrenoids 2.0 – 5.0 µm.

***U. variabilis* Kuetzing** (Fig. 2) – Filaments long, slender, and entangled, forming cottony masses. Cells cylindrical, without constrictions at the cross walls. Chloroplast a folded,parietal plate, ½ to ⅔ the length of the cell, with 1 pyrenoid. Cells 4.5 – 6.0 µm in diameter & up to 15.0 µm long.

Hormidium Kuetzing

***Hormidium subtile* (Kuetz.) Heer.** (Fig. 3) – Long unbranched filaments with no basal – distal differentiation. Cells small, no constricted at the cross walls, chloroplast covering only a small portion of the cell wall. Cells 5.0 – 7.0 µm long 1.5 - 3.0 µm wide.

Geminella Turpin

***Geminella crenulatocollis* Prescott** (Fig. 4) – Uniseriate filaments, oblong cells inclosed by a broad gelatinous sheath and usually separated from each other. Chloroplasts folded parietal plate. Cells 12.0 – 15.0 µm in diameter, 18.0 – 24.0 µm long.

Binuclearia Wittrock

***Binuclearia tatrana* Wittrock** (Fig. 5) – Filaments of long cylindrical cells. Protoplasts oblong with rounded apices; not filling the cells, in pairs. Cells 7.0 – 10.0 µm in diameter, the length sometimes 6 times the width.

Order Microsporales

Family Microsporaceae

Microspora Thuret

Key to the Species:

1. Cell walls thick, the sections evident, 26.0 – 28.0 – (33.0) µm in diameter, 28.0 – 38.0 µm long ---------- *Microspora crassior*

1. Cell walls thin, sections not evident ---------- 2

2.Cells slightly swollen, 14.0 – 17.0 µm in diameter, 22.0 – 29.0 (35.0) µm long; chloroplast usually reticulate ---------- *M. floccose*

2. Cells slightly constricted at the cross walls, 9.0 µm wide, 10.0 – 225.0 (27.0) µm long; chloroplast a granular sheet ---------- *M. stagnorum*

***Microspora crassior* (Hansg.) Hazen** (Fig. 6) – Cell walls thick, the sections evident at the juncture in the mid – region of the cell. Cells cylindrical or

slightly swollen, very slightly constricted at the cross walls, 26.0 – 28.0 – (33.0) µm in diameter, 28.0 – 38.0 µm long. Chloroplast densely granular and covering the entire cell wall.

***M. floccosa* (Vauch.) Thuret** (Fig. 7) – Walls relatively thin, sections not always evident in the mid – region of the cell. Cells cylindrical or slightly swollen; 14.0 – 17.0 µm in diameter, 22.0 – 29.0 (35.0) µm long. Chloroplast usually reticulate.

***M. stagnorum* (Kuetz.) Lagerheim** (Fig. 8) – Walls thin, the two sections not evident. Cells cylindrical or slightly constricted at the cross walls, as much as 3 times their diameter in length; 9.0 µm wide, 10.0 – 225.0 (27.0) µm long. Chloroplast a granular sheet, incompletely covering the wall.

Order Chaetophorales

Family Chaetophoraceae

Key to the Genera:

1. Parenchymatous prostrate system, chloroplast transversely zonate with several pyrenoids ---------- *Stigeoclonium*

1. Pseudoparenchymatous disc of horizontally growing filaments, chloroplast a parietal disc with one pyrenoid ---------- *Protoderma*

Stigeoclonium Kuetzing

***Stigeoclonium longipilum* Kuetzing** (Fig. 9) – Filaments elongate, some branches dichotomous but mostly opposite, arising from node – like zones where a series of 2 or more swollen cells in the main axis develops pairs of branches; branches long and tapering to form slender. Cells short, 1.0 – 3.0 (5.0) µm in diameter, 11.0 – 15.0 (19.0) µm long.

Protoderma Kuetzing

***Protoderma viride* Kuetzing** (Fig. 10) – Thallus an attached disc, irregular in outline, made up of branched filaments which are compact and parenchymatous internally but semi – radiate and spreading at the margin;

terminal cells slightly narrowed. Cells quadrate or cylindrical with thin walls; 3.0 – 6.0 µm in diameter, 10.0 – 15.0 µm in length.

Order Cladophorales

Family Cladophoraceae

Key to the Genera:

1. Filaments repeatedly branched, show distinct basal – distal differentiation, akinetes lacking ---------- *Cladophora*

1. Filaments not repeatedly branched, not clearly show basal – distal differentiation, akinetes cells frequent ---------- *Pithophora*

Cladophora Kuetzing

Key to the Species:

1. Plants free – floating, branches not crowded in the upper limits ---------- 2

1. Plants attached, branches usually crowded in the upper limits ------ *Cladophora glomerata*

   2. Filaments successively branched, cells cylindrical ---------- *C. crispata*

   2. Filaments irregularly branched, cells irregularly swollen ---------- ----- *C. fracta*

***Cladophora crispata* (Roth) Kuetzing** (Fig. 11) – Free – floating except when young, forming rather delicate thalli of successively branched filaments with long, cylindrical cells, gradually attenuated in the branched to slightly narrowed but rounded apices. Main axis 40.0 – 75.0 µm in diameter; branches 20.0 – 35.0 µm in diameter. Cells up to 20 times their diameter in length. Cell walls relatively thin.

***C. fracta* (Dillw.) Kuetzing** (Fig. 12) – Floating, irregularly branched filaments, 60.0 – 120.0 µm in diameter in the main axis, 1 – 3 times their diameter in length; 20.0 – 40.0 µm in diameter in the ultimate branches, 3 – 6 times their diameter in length.

***C. glomerata* (L.) Kuetzing (**Fig. 13) – Thallus successively branched filaments with long, cylindrical cells, gradually attenuated in the branches to slightly narrowed but rounded apices. Main axis 50.0 – 60.0 µm in diameter, branches 20.0 – 25.0 µm in diameter.

Pithophora Wittrock

***Pithophora oedogonia* (Mont.) Wittrock** (Fig. 14) – Filaments slender, 45.0 – 70.0 µm in diameter; branching mostly solitary, rarely opposite. Cells long and cylindrical; as much as 20 times their diameter in length. Akinetes cylindrical, or slightly swollen to cask – shaped, conical, or more often acuminate, when terminal, 57.0 – 144.0 µm in diameter, 95.0 – 380.0 µm long.

Family Hydrodictyaceae

Hydrodictyon Roth

***Hydrodictyon reticulatum* (L.) Lagerheim** (Fig. 15) – Thallus macroscopic with cylindrical cells. Chloroplasts much diffused reticulum, light yellow – green color in the plant mass, meshes pentagonal or hexagonal. Cells up to 200 µm in diameter and up to 1 cm long.

Order Chlorococcales

Family Oocystaceae

Ankistrodesmus Corda

***Ankistrodesmus falcatus* (Corda) Ralfs** (Fig. 16) – Cells needle – like to somewhat spindle – shaped, or narrowly fusiform; solitary or clustered in fascicles, sometimes straight, usually curved, often twisted about one another; without gelatinous envelope. Chloroplast a thin parietal plate covering most of the cell wall; pyrenoid present or absent.

Order Siphonales

Family Vaucheriaceae

Dichotomosiphon Ernst

***Dichotomosiphon tuberosus* (A. Braun) Ernst** (Fig. 17) – Dichotomously branched, chloroplast numerous, without pyrenoids. Filaments dark – green color, 40.0 – 110.0 µm in diameter and up to 10 cm in length.

Order Zygnematales

Family Zygnemataceae

***Spirogyra* Link**

Key to the Species:

1. Filaments less than 90 µm in diameter ---------- 2

1. Filaments more than 90 µm in diameter ---------- *Spirogyra jugalis*

   2. Cells 70.0 – 77.0 µm in diameter, chloroplast 4 ---------- *S. cylindrospora*

   2. Cells 40.0 – 45.0 µm in diameter, chloroplast 3 ---------- *S. rhizobrachialis*

***Spirogyra cylindrospora* W. & G.S. West** (Fig. 18) – Vegetative cells cylindrical, 70.0 – 77.0 µm in diameter, 100.0 – 300.0 µm long, with plane end walls; chloroplasts 4, making 1 – 3 turns, with crenate margins.

***S. rhizobrachialis* Jao** (Fig. 19) – Vegetative cells cylindrical, 40.0 – 45.0 µm in diameter, 115.0 – 240.0 µm long, with plane end walls; chloroplasts 3, making 1.5 – 2.5 turns, with crenate margins.

***S. jugalis* (Fl. Dan.) Kuetzing** (Fig. 20) – Vegetative cells cylindrical, 90.0 – 100.0 µm in diameter, 1 - 1½ times the diameter in length; chloroplasts 3 – 4, making 1 – 2 turns, wall layers smooth.

Order Desmidiales

Family Desmidiaceae

Key to the Genera:

1. Cells without a median constriction, attenuated from the midregion to narrow ---------- *Closterium*

1. Cells with an obvious median constriction, always without extended processes ---------- *Cosmarium*

Closterium Nitzsch

Key to the Species:

1. Cells nearly straight, 80.0 – 100.0 µm wide, 950.0 – 970.0 µm long ---------- *Closterium acerosum*

1. Cells slightly curved, 25.0 – 40.0 µm wide, 280.0 – 320.0 µm long ---------- *C. balliyanum*

***Closterium acerosum* (Schrank) Ehrenberg** (Fig. 21) – The cell is straight, narrowly fusiform, 80.0 – 100.0 µm wide, 950.0 – 970.0 µm long, gradually tapering to the apices; chloroplast with longitudinal ridges and scattered pyrenoids.

***C. balliyanum* Brebisson** (Fig. 22) – The cell nearly straight, slightly curved, 25.0 – 40.0 µm wide, 280.0 – 320.0 µm long, slightly attenuated to the broadly truncate apices; chloroplast with 5 – 8 pyrenoids in series.

Cosmarium Cordaex Ralfs

Key to the Species:

1. Cells truncate pyramidal in shape, 15.0 – 20.0 µm wide, 18.0 – 26.0 µm long ---------- *Cosmarium rectosporum*

1. Cells reniform in shape, 50.0 – 87.0 µm wide, 72.0 – 117.0 µm long ----- *C. pachyderma*

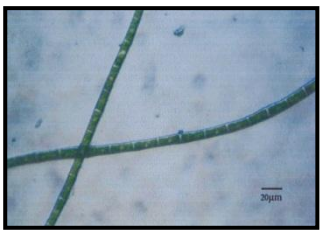
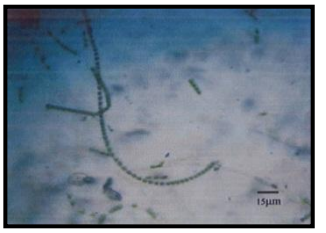
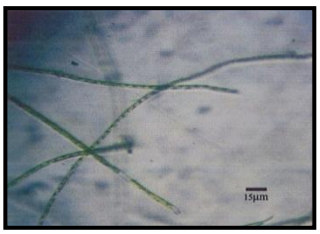
***Cosmarium pachyderma* Lund** (Fig. 23) – Semicells reniform in shape, cell wall smooth, median constriction deep; cells 50.0 – 87.0 µm wide, 72.0 – 117.0 µm long; 1 pyrenoid in each semicell.

***C. rectosporum* Turner** (Fig. 24) – Semicells reniform or truncate pyramidal in shape, lateral margins and apical angles slightly rounded, apex narrow and flat, sinus closed; cells 15.0 – 20.0 µm wide, 18.0 – 26.0 µm long; 1 pyrenoid in each semicell.

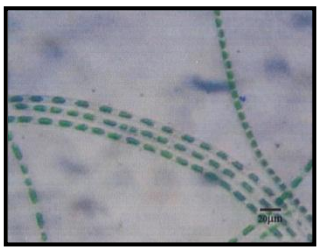
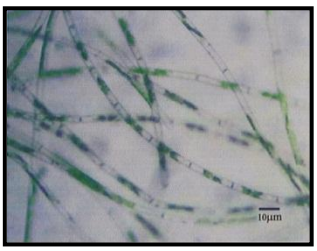
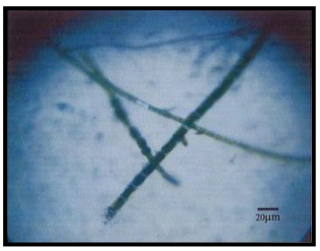
The identified specimens in Chlorophyta were expressed in Table 1.

Table 1. Classification of Chlorophyta found in Yenwe Village

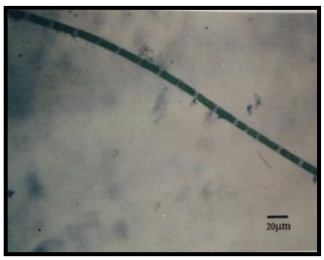
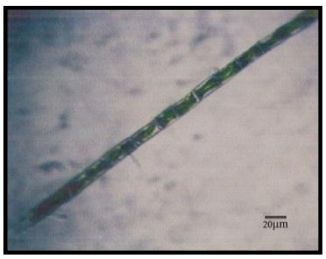
Class	Order	Family	Genus	Species
Chlorophyceae	Ulotricales	Ulotricaceae	*Ulothrix*	*U. cylindricum*
				U. variabilis
			Hormidium	*H. subtile*
			Geminella	*G. crenulatocollis*
			Binuclearia	*B. tatrana*
	Microsporales	Microsporaceae	Microspora	*M. crassior*
				M. floccosa
				M. stagnorum
	Chaetophorales	Chaetophoraceae	*Stigeoclonium*	*S. longipilum*
			Protoderma	*P. varide*
	Cladophorales	Cladophoraceeae	*Cladophora*	*C. crispata*
				C. fracta
				C. glomerata
			Pithophora	*P. oedogonia*
		Hydrodictyaceae	*Hydrodictyon*	*H. reticulatum*
	Chlorococcales	Oocystaceae	*Ankistridesmus*	*A. falcatus*
	Siphonales	Vaucheriaceae	*Dichotomosiphon*	*D. tuberosus*
	Zygnematales	Zygnemataceae	*Spirogyra*	*S. cylindrospora*
				S. rhizobrachiats
				S. jugalis
	Desmidiales	Desmidiaceae	*Closterium*	*C. acerosum*
				C. baillyanum
			Cosmarium	*C. pachyderma*
				C. rectosporum

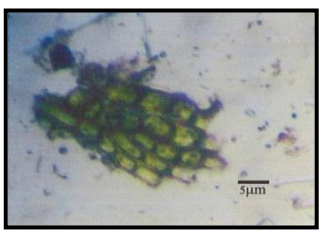
1. *Ulothrix cylindricum* Prescott 2. *Ulothrix variabilis* Kuetzing 3. *Hormidium subtile* Heer

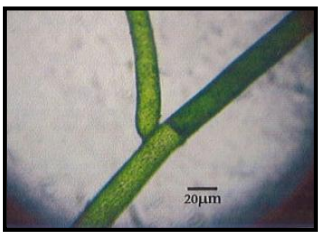




4.*Geminella crenulatocollis* Prescott 5.*Binuclearia tatrana* Wittrock 6. *Microspora rassior*Hazen


7.*Microspora floccose* Thuret 8. *Microspora stagnorum* Lag. 9.*Stigeoclonium longipilum*

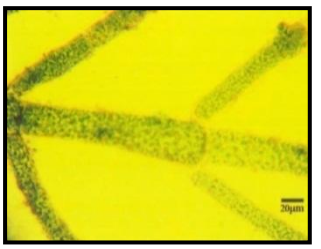
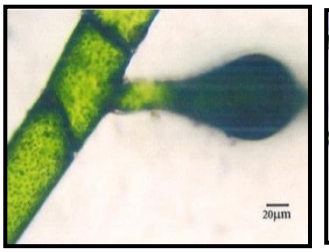
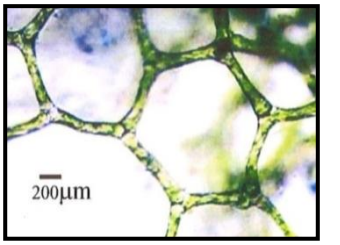




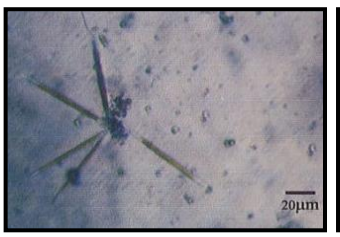
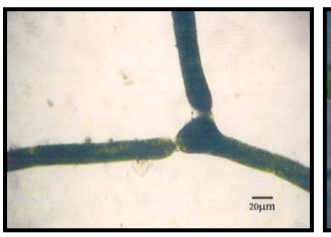
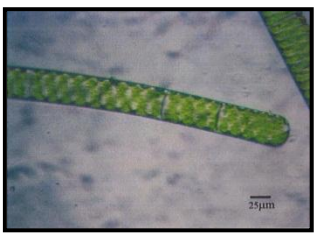
Kuetz.

10. *Protoderma viride* Kuetz. 11.*Cladophora crispate* Kuetz. 12. *Cladophora fracta*

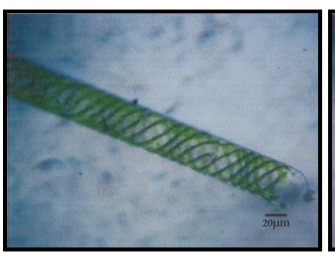
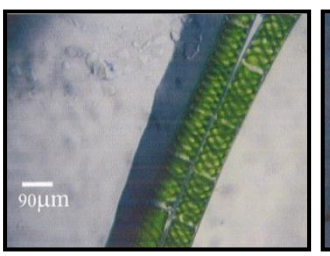
Kuetz.

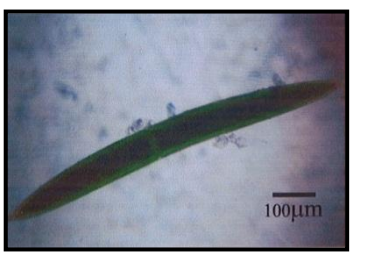




13. *C.glomerata* Kuetz. 14.*Pithophora oedogonia* Witt. 15.*Hydrodictyon eticulatum* La.

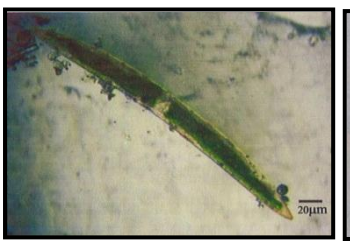
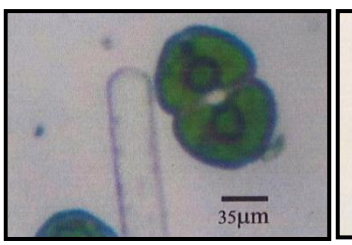




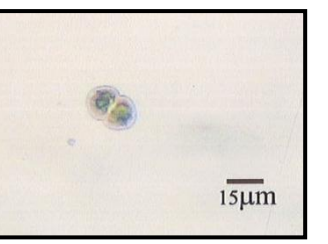
16.*Ankistrodesmus falcatus*Ra. 17.*Dichotomosiphon tuberosus*Er. 18.*Spirogyra cylindrospora*W.



19.*Spirogyra rhizobrachialis* J. 20.*Spirogyra jugalis* Kuetz. 21.*Closterium acerosum* Ehren.



22.*Closterium baillyanum*Bre. 23.*Cosmarium pachyderma* Lu.24.*Cosmarium rectosporum* Tur.

Discussion and Conclusion

Yenwe Village is situated in Taunggyi Township. Many ponds, rice fields and hot springs are found in this village. Because of their presence, different kinds of algae were found abundantly. In the present study, 15 genera and 24 species were collected and identified from two selected locations. The algae represented in Chlorophyta. This study was conducted from June 2009 to February 2010.

German phycologist Skuji (1949) published Flora Burmas in which 83 genera of Chlorophyta were described. Setchell (1903) made observations in Yellowstone Park and reported that the temperature where the algae visible was 75˚C to 77˚C. Khin Cho (2005) made observations in hot springs of Paung Township and reported that the temperature where algae visible was 40˚C to 50˚C. Khin Cho recorded the genera such as *Chrococcus, Gloeocapsa, Synechococcus, Scytonema, Tolypothrix, Calothrix, Radiofilum, Chaetomorpha, Euastrum, Botrydiopsis, Scoliopleura, Tribonema, Cyclotella, Fragilaria, Synedra* and *Cacooneis*. The observations of the present study were not agreed with those mentioned by Khin Cho. This was due to the difference between the temperatures of the study areas.

The present study reported that the temperature where algae visible was 25˚C to 40˚C. Green algae such as *Ulothrix, Microspora, Cladophora, Pithophora,* and *Spirogyra* could abundantly be seen in Location II where the temperature was between 25˚C to 29˚C. In Location I (39˚C to 40˚C), *Microspora, Spirogyra, Closterium* and *Cosmarium* were observed (Table. 2). It can be concluded that the habitats of green algae were strongly dependent on the temperature.

Guiry (2009) stated that green algae were extremely important as a source of food for other aquatic organisms and made a major contribution to

the world's oxygen supply. One of the green algae, *Chlorella* was now grown and sold as a health supplement and *Dunaliella* was as a source of β-carotene. Unfortunately, green algae had negative effects, as when large populations produced an unpleasant taste and odor in drinking water or clog filteration equipment. Algal bloom drastically decreased the oxygen supply available to other life forms in freshwater lakes and ponds.

Johnston, (1996) explained that hot springs were considered to be therapeutic in nature. The hot springs emerged from the earth's crust full of minerals and elements from within. The mineral composition of a hot spring was quite high, and their high temperature facilitated the entry of them into the human body. It can therefore be concluded that green algae found in Yenwe Village had minerals and elements. This can be beneficial and applicable to humans, and their environments.

Table 2. Some Species of Chlorophyta in Two Selected Locations.

No.	Collected Algae in Chlorophyta	Location I	Location II
1.	*Ulothrix cylindricum* Prescott.	-	✓
2.	*Ulothrix variabilis* Kuetzing	-	✓
3.	*Hormidium subtile* (Kuetz.) Heer.	-	✓
4.	*Geminella crenulatocollis* Prescott	-	✓
5.	*Binuclearia tatrana* Wittrock	-	✓
6.	*Microspora crassior* (Hansg.) Hazen	✓	✓
7.	*Microspora floccosa* (Vauch.) Thuret	-	✓
8.	*Microspora stagnorum* (Kuetz.) Lagerheim	✓	✓
9.	*Stigeoclonium longipilum* Kuetzing	-	✓
10	*Protoderma viride* Kuetzing	-	✓
11.	*Cladophora crispata* (Roth) Kuetzing	-	✓
12.	*Cladophora fracta* (Dillw.) Kuetzing	-	✓
13.	*Cladophora glomerata* (L.) Kuetzing	-	✓
14.	*Pithophora oedogonia* (Mont.) Wittrock	-	✓
15.	*Hydrodictyon reticulatum* (L.) Lagerheim	-	✓
16.	*Ankistrodesmus falcatus* (Corda) Ralfs	-	✓
17.	*Dichotomosiphon tuberosus* (A. Braun) Ernst	-	✓

18.	*Spirogyra cylindrospora* W. & G.S. West	-	✓
19.	*Spirogyra rhizobrachialis* Jao	✓	-
20.	*Spirogyra jugalis* (Fl. Dan.) Kuetzing	-	✓
21.	*Closterium acerosum* (Schrank) Ehrenberg	-	✓
No.	**Collected Algae in Chlorophyta**	**Location I**	**Location II**
22.	*Closterium balliyanum* Brebisson	✓	-
23.	*Cosmarium pachyderma* Lund	✓	-
24.	*Cosmarium rectosporum* Turner	✓	-

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