STUDY ON ALGAE OF AQUATIC ECOSYSTEMS IN DUYA INN

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Abstract

This research was carried out during a period from May 2018 to May 2019. Algae specimens and phytoplankton of water samples were collected from the upper layers and the lower layers from the seasonal interval of two stations (Duya and Nat Kone) near Duya Inn. All collected living algae were identified. In the present study, algae species and phytoplankton from water samples were examined by using a microscope. This study described algae morphology and analysed each algae type. In this paper, 20 species of microalgae were presented with morphology illustration with photomicrograph. The present study observed 11 families, 13 genera and 20 species.

Key words: algal flora, water samples, Duya Inn area.

INTRODUCTION

Algae are aquatic organisms for understanding ecosystem process. Green algae have significant roles in various ecosystems and particularly in the plankton (Maya P. Stoyneva, 2007).

Algae may be used to treat polluted water. Water is polluted because there are next nutrients in the water but algae are like nutrients so they can be removed from the water (Andrew *et al.*, 2007).

Algae are photosynthetic eukaryotic organisms. Most are unicellular but some multicellular. They are autotrophic and do not have true roots, stems nor leaves, form gametes, most have flagella. Cell walls are spherical, rod shaped, club shaped, spindle shaped, branched or unbranched thin and rigid. Algae can be used to capture fertilizers to run off from farm. (Website, 1)

The amount of phytoplankton produced by the body of freshwater is equal to being other things, in some inverse ratio proportion to the amount of its gross aquatic vegetation of various types of algae have been proved to be sources of compounds with antibiotic and antineoplastic (anticancer) activities. (Graham & Wilcox, 2000)

The present study deals with the algae flora. Algae were collected from the surface layer and bottom layer of water at two stations (Duya and Nat Kone) of Duya Inn. Its position is between Latitude N 17° 32′ 30′′ and Latitude N 17° 34′ 30′′ and Longitude E 95° 29′ 0′′ and Longitude E 95° 30′ 30′′. Water body of the Inn has approximately 10.1 square km. Duya Inn is situated beside the main road between South East of Hinthada Township and North of Zalun Township in Ayayarwaddy Division. This paper observed the families, Desmidiaceae, Euglenaceae, Gomphonemataceae, Hydrodictyaceae, Mesotaeniaceae, Nitzschiaceae, Oscillatoriaceae, Oocystaceae, Nostocaceae, Scenedesmaceae, and Zygnemataceae.

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The aim of this study is to observe the phytoplankton of water bodies, to estimate the algal species of two stations of Duya Inn, Hinthada District, and to provide the information for those who are interested in managing and monitoring ecosystems and application of algae for human beings.

MATERIALS AND METHODS

Algae specimens and phytoplankton of water samples were collected from Duya Inn, from May 2018 to May 2019. The location map of the study area was shown in Figure 1 and 2 and the samples were collected from two stations of Duya Inn. The study areas are two stations of Duya and Nat Kone villages as shown in Figures 3, 4 and 5. Samples were used as sources of screening of algae which were collected from the upper and lower layers with bottles of water samples at two stations of Duya Inn. The algae and phytoplankton samples were collected by using water samples and then transferred into plastic bottles and analysed at laboratory, Botany Department, Hinthada University. The collected water samples were kept under aeration and favorable light condition until correct identification of the specimens was determined. Fresh specimens of water mounted on a glass slide and covered with cover slip were examined under a microscope (Olympus). After that the photomicrographs of these specimens were taken by a digital camera. The algae specimens were observed with references to Round (1965), West & West (1907), Bronmark (2004), Prescott (1962), Manoylon *et al*. (2014), and Proschold & Leliaert (2007).

Fig. 1 Google Location Map of Study Area in Hinthada District

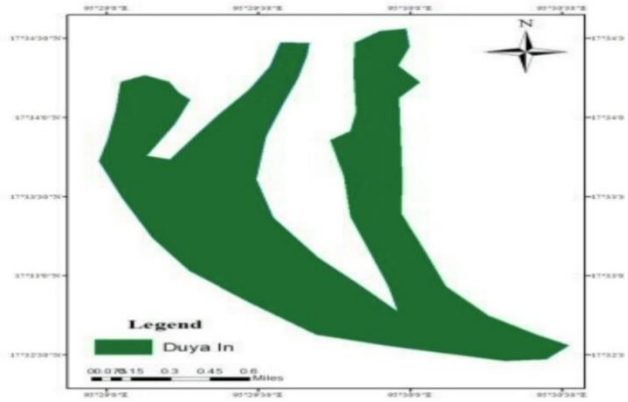

Fig. 2 Google Map of Study Area

Fig. 3 Algae sample collections (Duya village)

Fig. 4 Algae sample collections (Natkone village)

Fig. 5 Water samples with bottle collected from bottom layer

RESULTS

The collected specimens of fresh water phytoplankton were examined under a microscope and identified based on their morphological characters to classify into families levels, genus to species. They are found to be of 11 families, 13 genera and 20 species. The morphological characters of collected species were described as follows:

Table 1. Classification of algae species of Duya and Nat Kone villages in Duya Inn

No	Family	Geneus	Species
1	Desmidiaceae	*Cosmarium*	*Cosmarium spp.*
			Cosmarium subdanicum West *var.bigranulatum Foerster*
		Staurastrum	*Staurastrum tohopekaligense*Woll
			Pleurotaenium trabecula (Ehrenberg) Naegel
2	Euglenaceae	*Euglena*	*Phacus denisii* Allorge et Lefevre
3	Gomphonemataceae	*Gomphonies*	*Gomphonies* spp.
4	Hydrodictyaceae	*Pediastrum*	*Pediastrum duplex* var.*Reticulatum* Lager Hein Hansjgirg
			Pediastrum integrum var. tetradon (Corda) Hansging
5	Mesotaeniaceae	*Netrium*	*Netrium digitus* Ehrenberg.
6	Nitzschiaceae	*Denticula*	*Denticula pelatica Husted*
7	Nostocaceae	*Nostoc*	*Anabaena affinis* Lammermann
			Pseudonabaena biceps Bocher
8	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria willei* Gardnei
9	Oocystaceae	*Ankistrodesmas*	*Ankistrodesmas spp.*
			Ankistrodesmas falcatus var. Mirabilis
		Tetraedron	*Tetraedron trilobulatum* Renisch
			Spirulina tenerrima Kutzing ex.Gomont
10	Scenedesmaceae	*Scenedesmus*	*Scenedesmus quandricauda Brebisson*
			Scenedesmus flavescenes Chodat
11	Zygnemataceae	Zygnema	*Zygnema pectinatum* (Voucher) Agardh

Table 2. Phytoplankton and algae species from upper layer of Duya and Nat Kone villages

No.	Algal Species	Summer	Rainy	Winter
1.	*Anabaena affinis* Lammermann	_	++	+++
2.	*Ankistrodesmas* spp.	_	++	+++
3.	*Ankistrodesmas falcatus* var. Mirabilis.	_	+	+++
4.	*Cosmarium* spp.	+	++	+++
5.	*Cosmarium subdanicum* West var.bigranulatum Foerster	+	++	+++
6.	*Netrium digitus* Ehrenberg.	_	++	+++
7.	*Oscillatoria willei* Gardenei	_	++	+++
8.	*Pseudonabaena biceps* Bocher	_	++	++
9.	*Pediastrum duplex var.* Reticulatum Lager Hein Hansjgirg	_	++	++
10.	*Pediastrum integrum var tetradon* (Corda)Hansging	_	+	++
11.	*Phacus densii* Allorge et.Lefevre	_	+	+
12.	*Spirulina tenerrima* Kutzing ex.Gomont	_	++	++
13.	*Staurastrum tohopekaligense* Wolle	_	++	++
14.	*Scenedesmus quandricauda* Brebisson	_	++	++
15.	*Scenedesmus flavescenes* Chodat.	_	++	++
16.	*Tetraedron trilobulatum* Renisch	+	++	++
17.	*Zygnema pectinatum* (Voucher) Agardh	_	++	+

Table 3. Phytoplankton and algae species from bottom layer of Duya and Nat Kone villages

No.	Algal Species	Summer	Rainy	Winter
1.	*Anabaena affinis* Lammermann	-	-	+++
2.	*Gomphonies spp*	-	+	++
3.	*Netrium digitus* Ehrenberg	+	++	+
4.	*Oscillatoria willei* Gardenei	+	++	++
5.	*Pseudonabaena biceps* Bocher	_	++	++
6.	*Pleurotaenium trabecula* (Ehrenberg) Naegeli	_	++	++
7.	*Staurastrum tohopekaligense* Wolle	_	++	++
8.	*Scenedesmus flavescenes* Chodat	_	++	+
9.	*Zygnema pectinatum* (Voucher) Agardh	_	++	++

Morphology of algae species

1. *Anabaena affinis* Lammermann.

Trichome straight, cell globose, akinete globose to ovate, angular to optical section, not adjoining heterocysts. (Fig. 6)

2. *Ankistrodesmas spp.*

Cell solitary and lunate shaped, without pyrenoid; apices gradually tapering to fine point. (Fig. 7)

3. *Ankistrodesmas falcatus* var. Mirabilis

Cell solitary, nearly straight, slightly curved at the apex; apices gradually tapering to fine point. (Fig. 8)

4. *Cosmarium spp.*

Cell solitary, median constriction deep, sinus linear opened; semicells subretangular, lateral margin undulate , truncate apex with crenate. (Fig. 9)

5. *Cosmarium subdanicum* West var.bigranulatum Foerster

Cell about as wide as long, at isthmus; median constriction deep, sinus closed; semicells sub rectangular to truncate, pyramidal, basal angles and upper angles rounded, lateral margins undulate, apical margin four undulate. (Fig. 10)

6. *Denticula pelatica* Husted.

Cells single, in short loose chains or in gelatinous masses. Valves elongate, symmetrical, linear; raphe with small central and polar nodules. Girdle view with somewhat convex sides and truncate poles. (Fig. 11)

7. *Gomphonies spp.*

Frustule capsule shaped, cells arranged in filaments, frustules with spine like extensions at the poles which aid in adjoining cells. (Fig.12)

8. *Netrium digitus* Ehrenberg

Cell oblong, elliptical to broadly spindle shaped apices turncate, wall smooth and green; chloroplast axile, each with six longitudinal ridges with deeply notched free. (Fig. 13)

9. *Oscillatoria willei* Gardnei

Trichome pale blue green to grey blue green, bent at the ends or screw lile, unconstrictions at the cross walls; not capitates; without thickened membrane. (Fig. 14)

10. *Pseudonabaena biceps* Bocher

Trichomes short, solitary or slightly curved, intensely constricted at cross walls, cells cylindrical to barrel-shaped, isodiametic, apical cell, rounded pointed at the ends. (Fig. 15)

11. *Pediastrum duplex var. Reticulatum* Lager Hein Hansjgirg

Colonies sixteen celled, cells more or less Hshaped with sides of marginal cells nearly parallel, intercellular space large and oval. (Fig. 16)

12. *Pediastrum integrum* var.*tetradon* (Corda) Hansging

Colonies eight cells, interior cells sperical to nearly rectangular with the edges rounded and with small intercellular spaces, pherical cells sperical, joined to each other at the base; cells long. (Fig.17)

13. *Pleurotaenium trabecula* (Ehrenberg) Naegeli

Cells at apex , at isthmus, slightly attenuate to truncate apices; semicells with slightly basal swelling, with 2 distal undulations, cell wall punca. (Fig.18)

14. *Phacus denisii* Allorge et Lefevre

Cells orbicular, anterior ends abruptly; a short straight caudus, paramylon body one; cells long. (Fig.19)

15. *Spirulina tenerrima* Kutzing ex. Gomont

Trichome solitary, pale to bright blue green, regularly densely spirally coiled, not constricted at the cross walls, apical cells rounded. (Fig. 20)

16. *Staurastrum tohopekaligense* Wolle

Cell excluding process, at isthmus; median constriction deep, sinus v shaped notch; semicells oval to elliptic, bearing along, smooth process with bifurcate at the apex. (Fig. 21)

17. *Scenedesmus quandricauda* Brebisson

Cells in a single linear series, colony four celled, oblong cylindrical, outer cells with long, curved spine at each pole; inner cells without spines cells. (Fig. 22)

18. *Scenedesmus flavescenes* Chodat

Cells arranged in linear series, colony four celled, cyclindrical to ovoid, marginal cells sometimes with parallel sides, main spines which are stright and almost equal to cell length, tapering to rounded apices; cells long. (Fig. 23)

19. *Tetraedron trilobulatum* Renisch

Cell triangular, each coner extends into very short rounded processes. (Fig. 24)

20. *Zygnema pectinatum* (Voucher) Agardh

Filaments pale green, cotton mass; usually enclosed by a soft mucilagenous sheath; zygospore formed, median wall pitted and brown. (Fig. 25)

Fig. (6) *Anabaena affinis* Lammerman

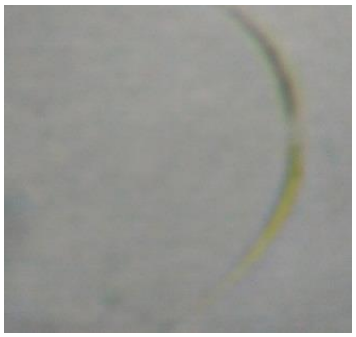

Fig. (7) *Ankistrodesmas* spp.

Fig. (8) *Ankistrodesmas falcatus* var. Mirabilis

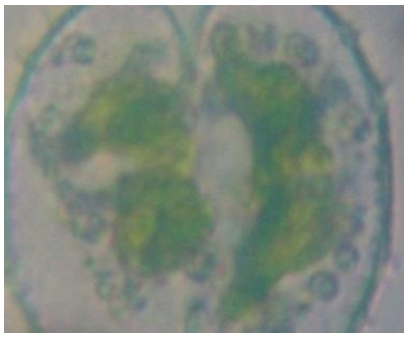

Fig. (9) *Cosmarium* spp.

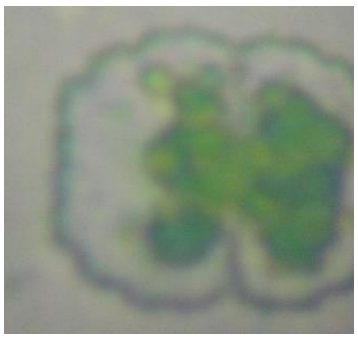

Fig. (10) *Cosmarium subdanicum*Westvar

Fig. (11) *Denticula pelatica* Husted

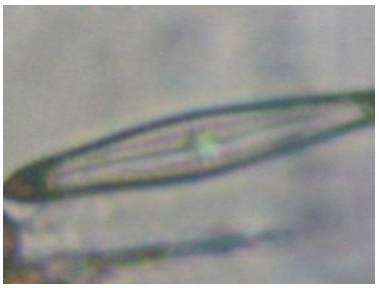

Fig. (12) *Gomphonies* spp.

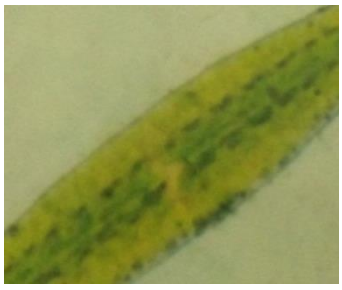

Fig. (13) *Netrium digitus* Ehrenber

Fig. (14) *Oscillatoria willei* Gardnei

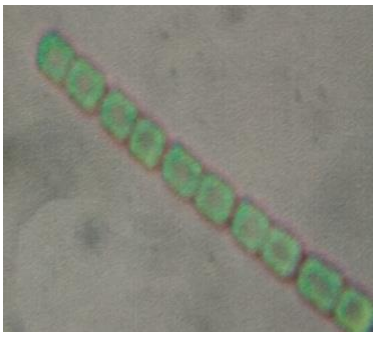

Fig. (15) *Pseudonabaena biceps* Bocher

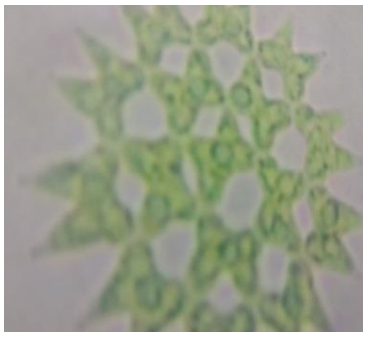

Fig. (16) *Pediastrum duplex var.* Reticulatum

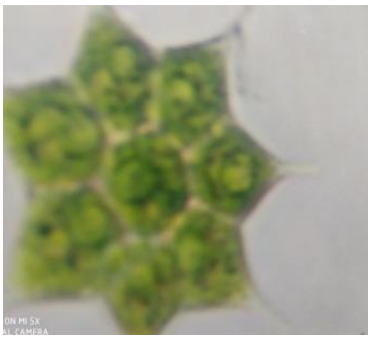

Fig. (17) *Pediastrum integrum* var. *tetradon*

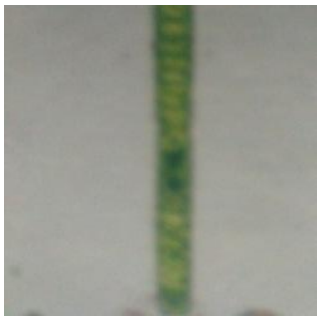

Fig. (18) *Pleurotaenium trabecula*

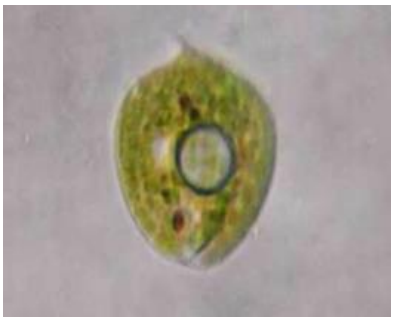

Fig. (19) *Phacus denisii* Allorge

Fig. (20) *Spirulina tenerrima* Kutzing

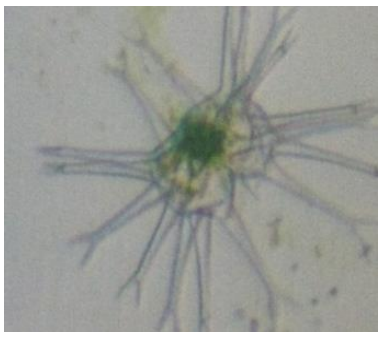

Fig. (21) *Staurastrum tohopekaligense* Wolle

Fig. (22) *Scenedesmus quandricauda* Brebisson

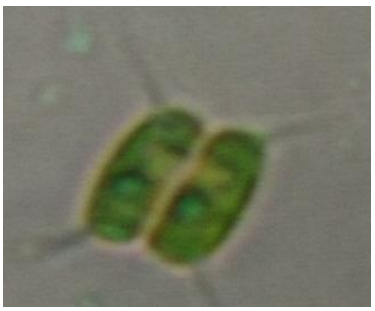

Fig. (23) *Scenedesmus flavescenes* Chodat

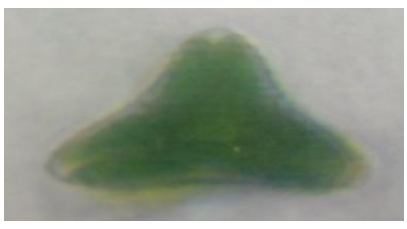

Fig. (24) *Tetraedron trilobulatum* Renisch

Fig. (25) *Zygnema pectinatum* (Voucher) Agardh

DISCUSSION AND CONCLUSION

In the present study, the algae specimens were collected from two stations of Duya Inn, Hinthada Township from May 2018 to May 2019. Collected specimens of algae and phytoplanktons were identified into 20 species, 13 genera and 11 families. Among them, 17 species were recorded from the upper layer and 10 species were from the lower layer, *Gomphonies, Pleurotaenium* which were only observed from the bottom layer. Other species were found from both two layers.

Anabaena, Ankistrodesmus, Cosmarium, Nerium, Oscillatoria, with abundant growth were observed in winter season and *Pseudonabaena, Pediastrum, Spirulina, Staurastrum, Scenedesmus, Tetraedron* were moderately observed and *Zygnema, Phacus* were rarely found in winter season from the upper layer.

Ankistrodesmus, Pediastrum, Phacus species were rarely found and the rest of the fourteen species moderately occurred in the rainy season. *Cosmarium* and *Tetraedron* were found in summer but the remaining species did not occur in summer at the upper layer.

Anabaena species only occur in winter, not in other two seasons and two species of *Nerium, Scenedesmus* were rare and *Gomphonies, Oscillatoria, Pseudonabaena, Pleurotaenium, Staurastrum, Zygnema* were moderately found in winter season of the bottom layer. And then *Gomphonies* rarely occurred, but the rest of the seven species were moderately found in the rainy season at the bottom layer. Besides *Nerium, Oscillatoria species* occurred a little and the remaining species were not observed in summer at the bottom layer.

Among them, 17 species were recorded from the upper layer and 9 species were from the lower layer. *Gomphonies* and *Pleurotaenium* were only reported in the bottom layer. Other species were found in two layers. The above-mentioned data suggest that uneven distribution and abundance of algae species were present at the two stations.

Algae are microscopic, free floating plants and they play important roles in aquatic ecosystems and have a direct effect on the health of these systems. Through their photosynthetic process, algae use carbon dioxide, converting it organic matter and oxygen. (Maya P. Stoyneva *et al.*, 2007) Nitrogen fixing blue green algae like *Anabaena* is being developed as a natural bio-fertilizer, but these algae are not always safe to eat (Henerikson, 1989).

It has been stated that some members of algae can be used as a food supply in many parts of the world. The benefits of *Spirulina* also include losing weight, increasing energy, and stimulation of the immune system. It is loaded with various nutrients and antioxidants that benefit your body and brain. (Website 2 & 3)

This study contributes to the knowledge of the phytoplankton of this Inn to provide the support for the future limnological studies and biomonitoring.

In conclusion, this study contributes towards an increase of knowledge of the phytoplankton in this region. Nowadays, algae are widely used all over the world for many purposes such as medicine, functional food, cosmetics, bio-fertilizer and biofuel. Fresh water algae are very important for human beings. Therefore, algae from Duya Inn can be used to apply for the domestic and drinking purposes and various kinds of fish and other aquatic organisms are also useful for local people.

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