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Research Article

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First report on phytoplankton communities of Barishal City, Bangladesh

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ABSTRACT

Phytoplanktons, also called microalgae, are microscopic photosynthetic living organisms that generally found in aquatic environments. Although they are considered as the most important primary producers and bioindicators of aquatic ecosystems, there was no previous report found for Barishal City about these tiny organisms. Consequently, the present study selected 10 freshwater reservoirs from the city to investigate phytoplankton communities and listed 110 taxa under 4 phyla, 7 classes, 18 orders, 24 families and 49 genera. The distribution of Chlorophytes was abundant relatively in terms of species number (45 taxa) followed by Euglenophytes, Chlorophytes and Cyanophytes in this area. Only Euglenaceae possessed one-third of the total species of this report. Among all stations, the highest number of taxa was recorded from station 2 and according to nine biodiversity indices, the station 2 and 9 showed comparatively good results. All of the recorded taxa were previously mentioned by different authors from Bangladesh.

KEYWORDS: Phytoplankton, Microalgae, *Scenedesmus abundans*, Barishal and Bangladesh

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INTRODUCTION

Algae are considered as sole primary producers in oceans [1] and one of the most important primary producers in freshwater ecosystems. The term 'phytoplankton' also called microalgae is generally referred to mean microscopic algae to cyanobacteria, and they provide a major share of oxygen in an aquatic ecosystem. Besides, they serve as foods, fertilizers and considered as an effective bio-indicator for fishing as well as assessing water quality. Furthermore, several bioactive compounds have been extracted from phytoplankton, which have the properties of antioxidant, anti-inflammatory, anticancer, and antiviral medicines [2]. Thus, phytoplanktons have been considered as an alternate of synthetic dietary supplements for treatments of many human diseases [3]. And for their high lipid content per cell, rapid growth rate, biodegradable, renewable and environment-friendly natures, they have been regarded as a prospective source of biofuel to reduce the use of terrestrial food crops for biofuel production in future [4].

Barishal is one of the oldest beautiful municipal with a large number of freshwater reservoirs and the second largest river ports of Bangladesh. The City is located in the southern part of this country and lies on the bank of Kirtankhola River. The area of the City is 24.91 km^2 located in between 22°38' and 22°45' north latitudes as well as 90°18' and 90°23' east longitudes [5]. As the City is expanding, several industries are operating already near to many ponds or lakes and thus the water is being polluted by waste dispersal and leakages. To assess the water quality of the area, phytoplankton would be the most important bio-indicators and sometimes they would be far better than other parameters. Moreover, to measure biodiversity of any region phytoplankton must be included as a large group of aquatic microorganisms. Some previous investigations were done on the phytoplankton communities from Barishal divisional region, such as Pirojpur district [6] and Bakerganj upazila of Barishal district [7]. But there were no available reports found on phytoplankton communities of Barishal City.

Diversity of freshwater phytoplanktons is highly complex in an aquatic environment because diversity consists of two components, the variety and the relative abundance of species. Even ecologists set many indices to measure diversity and it is obviously an important tool for measuring the species status of an area. Therefore, the main goal of this work was recording phytoplankton species of Barishal City with their distribution and diversity. Moreover, outcome of the study would be helpful

to analyze the water quality, environment pollutions, and biodiversity of this region.

MATERIALS AND METHODS

Study Area

The survey was carried out between September 2019 and January 2020 from 10 stations (St.) of Barishal City (Figure 1). The stations were Rupatali Pond (1), Rupatali Lake (2), DC Office Pond (3), DC Lake (4), Gol Pukur (5). Kalushah Sarak Pond (6), Kawnia Road Pond (7), Notun Bazar Pond (8), College Road Pond (9) and Nazrul Islam Sarak Pond (10).

Samples Collection

Samples (1L water) were collected between 7 to 10 am from each station. They were collected from the surface layer of 10 to 50cm depth with Ruttner water sampler and fixed with 4% neutral formalin before transferring to graduated cylinders (1L capacity). Then added a few drops of Lugol's solution and left for 48 hours to sediment. The supernatant water was then siphoned until the sample was concentrated to 100 ml. Finally, the sediment was examined under a light microscope (100x magnification) equipped with digital camera for photographing, recording and measuring.

Taxonomy & Identification

Identification and enumeration were done by a binocular microscope. And as literatures, Bellinger and Sigee [8], Ahmed et al. [9], Islam and Alfasane [10], Islam and Moniruzzaman [11], and Smith [12] were followed to confirm identification. Moreover, the presented taxonomic arrangements and classifications were prepared based on Robert Edward Lee [13], but in some special cases Komárek and Fott [14], and Bold and Wynne [15] were consulted.

Distribution & Diversity Measurement

The frequency was counted by using heamocytometer based on the percent occurrence of an individual species to refer species distribution. The rare and the dominant species were indicated following the resulted frequency. The phytoplanktons were expressed as organisms per ml for the purpose of calculating diversity indices and the data were subjected to a software program PAST which generates nine diversity indices (Dominance index, Shannon index, Simpson index, Pielou's index, Menchinick's index, Margalef's index, Equitability index, Fisher alpha index and Berger-Parker's Dominance Index).

RESULTS

A total of 110 taxa including 16 prokaryotic and 94 eukaryotic phytoplanktons were recorded from the City. They were found belonging to the four major phyla Cyanophyta, Chlorophyta, Heterokontophyta and Euglenophyta within 49 genera, 24 families, 18 orders and 7 classes. The Chlorophytes were found dominantly in terms of the percentage of taxa present in the study (41%), while the Cyanophytes and Heterokontophytes were less dominant comparatively (Figure 2). All taxa of the survey were listed in the table 1 with their brief description and distribution. Then the taxonomic classifications were presented in the table 2. The classifications were arranged following alphabetic orders and all prokaryotes were presented first following the eukaryotes. The habits found in the study were colonial, filamentous, aggregated, coenobial and solitary. The listed phytoplanktons were spherical, oval, square, round, conical, disk, curved, crescent, spindle, elliptical, leaf, triangular, drum, boat, needle, horn, linear, and fusiform shaped. And, their cell size ranges from 1.5×2 to 21×95 µm.

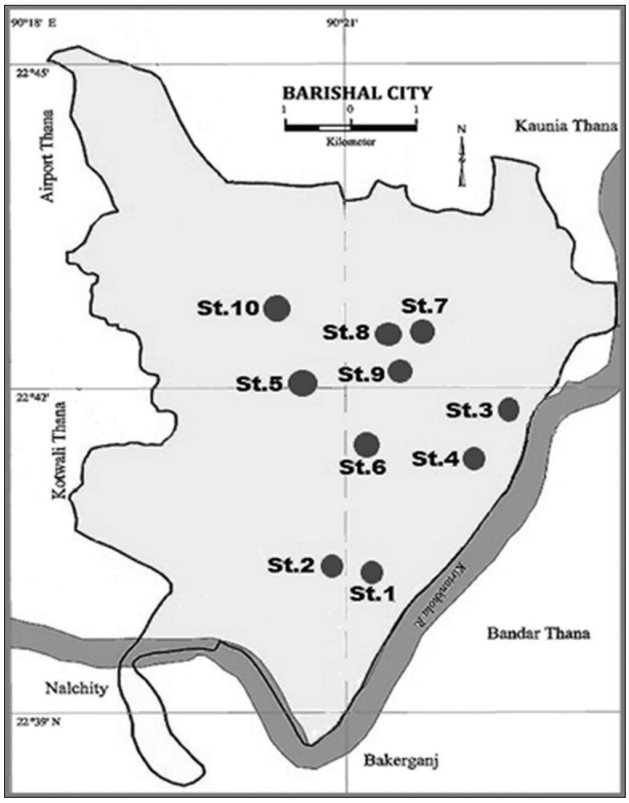

Figure 1: Barishal City map showing all sampling stations

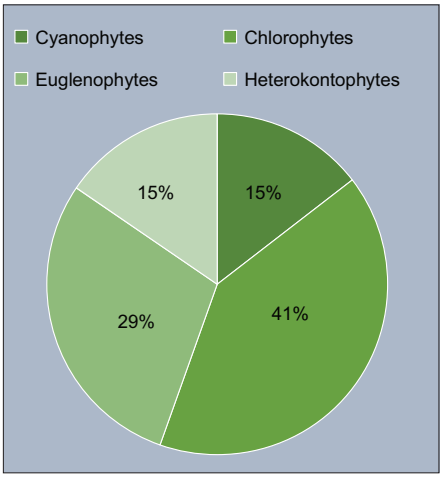

Figure 2: Relative distributions of phytoplanktons under four phyla

Table 1: List of phytoplanktons found in the 10 stations of Barishal City with their brief description and distribution

No.	Name	Habit (Cell)	Shape (Cell)	Size (μm)	Distribution (Frequency)									
					St.1	St.2	St.3	St.4	St.5	St.6	St.7	St.8	St.9	St.10
1	*Chroococcus dispersus*	Colonial	Spherical	3×4.5	1	0	0	0	0	1	0	0	2	0
2	*Chroococcus minor*	Colonial	Spherical	3.5×4	0	0	0	2	1	0	0	0	0	15
3	*Gloeothece rupestris*	Colonial	Oval	4×5.5	2	2	0	0	0	13	1	3	0	11
4	*Merismopedia angularis*	Colonial	Square	5×5.5	0	0	1	0	0	17	0	0	0	1
5	*Merismopedia glauca*	Colonial	Square	2×3.5	0	0	0	0	0	10	12	0	0	0
6	*Merismopedia punctata*	Colonial	Square	3×3.5	0	2	0	8	8	0	1	10	0	0
7	*Merismopedia trolleri*	Colonial	Square	4×5.5	2	0	0	0	9	0	2	1	0	9
8	*Microcystis aeruginosa*	Colonial	Round	2.5×3	8	7	8	0	0	1	0	0	2	2
9	*Microcystis densa*	Colonial	Round	2.5×3	2	0	0	2	0	11	16	0	0	3
10	*Microcystis flosaquae*	Colonial	Oval	2.5×3	0	2	2	1	8	0	2	9	0	7
11	*Synechocystis aquatilis*	Solitary	Oval	3.5×5	7	0	0	0	0	0	0	0	0	0
12	*Anabaena raciborskii*	Filament	Conical	6×10	0	0	12	2	0	0	0	0	0	0
13	*Anabaena volzii*	Filament	Round	6×9.5	0	0	8	1	0	0	0	0	0	0
14	*Calothrix scytonemicola*	Filament	Spherical	6.5×8	0	0	13	15	0	0	0	0	0	1
15	*Oscillatoria formosa*	Filament	Round	3.5×4	6	6	9	18	0	0	0	2	2	0
16	*Spirulina major*	Filament	Disk	6×8.5	0	0	2	0	0	2	0	0	0	0
17	*Characium limneticum*	Solitary	Oval	7.5×9	0	1	0	1	0	8	8	7	0	0
18	*Characium rostratum*	Solitary	Spindle	8.5×12	0	0	0	0	0	0	0	1	0	3
19	*Closterium dianae*	Solitary	Curved	16×90	0	7	0	0	0	0	7	0	0	6
20	*Closterium incurvum*	Solitary	Crescent	18×85	0	0	0	0	1	0	0	0	0	1
21	*Closterium kuetzingii*	Solitary	Curved	20×90	2	0	0	0	0	0	2	0	0	0
22	*Closterium nematodes*	Aggregated	Crescent	13×95	0	5	0	0	6	0	0	0	0	0
23	*Closterium setaceum*	Solitary	Curved	12×90	0	1	0	0	0	1	11	9	1	0
24	*Closterium subulatum*	Solitary	Crescent	21×95	1	0	0	0	0	0	0	1	0	0
25	*Actinotaenium turgidum*	Solitary	Fusiform	14×20	0	0	0	0	0	0	0	2	2	1
26	*Cosmarium moniliforme*	Solitary	Oval	17×19	0	0	0	2	0	0	0	0	0	2
27	*Cosmarium portianum*	Filament	Round	20×22	0	0	1	1	0	0	0	7	0	7
28	*Cosmarium tumidum*	Solitary	Round	17×19	9	0	2	1	0	0	0	0	0	8
29	*Euastrum elegans*	Solitary	Round	3×4.5	0	7	0	0	0	0	0	0	0	0
30	*Teilingia exigua*	Solitary	Elliptical	1.5×2	0	0	2	0	0	0	0	0	0	0
31	*Chaetopeltis orbicularis*	Aggregated	Oval	10×13	0	0	0	7	1	0	6	1	0	0
32	*Chlorella vulgaris*	Solitary	Elliptical	2×2.5	0	0	0	0	0	0	0	0	0	13
33	*Chlorococcum infusionum*	Solitary	Elliptical	9.0×40	1	0	0	0	5	5	0	0	0	0
34	*Hyaloraphidium contortum*	Solitary	Curved	3×5.5	0	2	0	0	0	0	0	0	0	2
35	*Schroederia setigera*	Solitary	Spindle	12.5×5	1	0	0	0	0	0	0	0	0	8
36	*Tetraedron minimum*	Solitary	Triangular	9.5×12	0	0	2	1	0	0	0	0	5	0
37	*Closteriopsis longissima*	Solitary	Crescent	7.5×75	0	0	0	0	0	6	3	0	0	0
38	*Oocystis lacustris*	Coenobial	Oval	9×9.5	1	1	0	0	4	0	0	0	0	0
39	*Oocystis submarina*	Solitary	Fusiform	11×17	1	2	0	0	0	0	0	0	0	0
40	*Planktosphaeria gelatinosa*	Solitary	Oval	4×4.5	0	0	0	0	3	0	0	0	0	0
41	*Pediastrum duplex*	Coenobial	Horn	8.0×30	0	0	0	3	0	0	5	0	0	0
42	*Actinastrum hantzschii*	Coenobial	Linear	2.5×7	0	1	0	0	0	0	0	0	1	5
43	*Scenedesmus abundans*	Coenobial	Round	4×8.5	0	0	0	0	0	11	13	3	0	2
44	*Crucigenia crucifera*	Coenobial	Oval	5.5×16	0	5	1	1	0	0	0	0	0	0
45	*Crucigenia tetrapedia*	Coenobial	Crescent	6.5×15	0	0	5	5	0	2	0	0	0	0
46	*Coelastrum microporum*	Coenobial	Spherical	8.0×12	4	1	4	0	0	0	0	1	0	1
47	*Kirchneriella contorta*	Coenobial	Linear	1.5×12	4	1	5	4	0	0	0	1	1	0
48	*Scenedesmus longispina*	Coenobial	Fusiform	6×7.5	0	0	0	0	0	0	0	0	1	2
49	*Scenedesmus quadricauda*	Coenobial	Spherical	8.5×12	5	6	0	0	0	1	0	0	1	1
50	*Scenedesmus regularis*	Coenobial	Elliptical	6.5×12	0	7	2	0	0	0	9	0	1	0
51	*Scenedesmus acuminatus*	Colonial	Needle	2.5×11	0	0	0	0	0	0	2	0	0	0
52	*Pandorina morum*	Colonial	Crescent	3.5×12	5	0	0	0	0	0	0	0	0	0
53	*Korshikoviella limnetica*	Solitary	Linear	2×8.0	0	0	0	4	0	0	0	0	0	0
54	*Asterococcus limneticus*	Colonial	Oval	7.5×8	0	0	0	0	0	1	1	0	0	4
55	*Gloeocystis vesiculosa*	Aggregated	Round	6.5×8	0	5	0	0	0	2	0	0	0	2
56	*Chlamydomonas acidophila*	Solitary	Fusiform	7×9.5	0	0	2	0	3	0	0	0	0	1
57	*Chlamydomonas angulosa*	Solitary	Spherical	6×8.5	0	0	0	0	1	4	4	0	0	0
58	*Chlamydomonas botryopara*	Solitary	Spherical	7.0×10	0	0	1	2	0	0	0	0	0	0
59	*Chlamydomonas globosa*	Solitary	Oval	4×6.5	5	0	1	1	0	0	6	0	0	0
60	*Eudorina elegans*	Colonial	Spherical	8.5×10	0	0	0	0	1	0	0	0	1	4
61	*Kirchneriella irregularis*	Colonial	Oval	4×6.5	1	1	0	0	0	0	0	0	0	0
62	*Euglena acus*	Solitary	Spindle	5.5×17	2	0	0	0	1	0	0	0	0	0
63	*Euglena chlamydophora*	Solitary	Spindle	5.5×17	1	0	1	0	0	0	0	2	0	1
64	*Euglena clavata*	Solitary	Spindle	5.0×16	0	0	2	2	0	0	0	0	0	0
65	*Euglena flava*	Solitary	Spindle	4.5×14	18	0	0	0	0	0	0	14	0	0

(*Contd...*)

Table 1: (*Continued*)

No.	Name	Habit (Cell)	Shape (Cell)	Size (μm)	Distribution (Frequency)									
					St.1	St.2	St.3	St.4	St.5	St.6	St.7	St.8	St.9	St.10
66	*Euglena geniculata*	Solitary	Spindle	4.0×15	0	11	0	0	2	10	0	3	0	0
67	*Euglena granulata*	Solitary	Spindle	4.0×14	0	0	0	0	0	0	0	0	2	0
68	*Euglena pisciformis*	Solitary	Spindle	4.5×65	0	0	0	0	0	0	0	3	1	0
69	*Euglena polymorpha*	Solitary	Spindle	8.5×75	0	1	1	2	0	0	6	0	0	0
70	*Euglena proxima*	Solitary	Curved	11×55	5	5	0	1	1	0	0	0	0	0
71	*Euglena sociabilis*	Solitary	Spindle	7.0×75	1	0	0	0	0	1	1	0	0	7
72	*Euglena spirogyra*	Solitary	Curved	12×70	0	1	4	5	0	0	0	1	0	0
73	*Euglena tripteris*	Solitary	Spindle	11×65	0	0	0	0	0	0	6	0	2	2
74	*Euglena variabilis*	Solitary	Oval	21×77	0	1	2	1	0	0	0	2	0	0
75	*Lepocinclis acuta*	Solitary	Oval	8×9.5	0	4	1	0	0	0	0	0	1	0
76	*Lepocinclis ovum*	Solitary	Spherical	14×19	0	0	0	0	8	0	0	0	1	0
77	*Lepocinclis playfairiana*	Solitary	Spherical	15×19	0	0	0	2	0	0	0	0	0	3
78	*Lepocinclis sphagnophila*	Solitary	Spindle	7×8.5	0	0	0	0	0	3	0	0	0	0
79	*Lepocinclis teres*	Solitary	Oval	7.5×9	1	1	0	5	0	0	0	0	0	4
80	*Lepocinclis texta*	Solitary	Oval	14×35	0	0	1	1	0	0	0	0	0	4
81	*Phacus acuminatus*	Solitary	Leaf	30×40	0	0	4	0	0	0	0	0	0	0
82	*Phacus caudatus*	Solitary	Leaf	11×25	0	0	0	0	1	0	0	1	2	0
83	*Phacus curvicauda*	Solitary	Leaf	35×65	0	2	0	0	2	1	0	0	0	0
84	*Phacus denisii*	Solitary	Leaf	30×40	0	0	0	0	1	2	0	0	0	0
85	*Phacus hamatus*	Solitary	Oval	9.0×15	0	0	4	5	0	0	0	0	0	1
86	*Phacus pseudonordstedii*	Solitary	Oval	11×19	0	2	0	0	1	0	0	2	0	0
87	*Strombomonas gibberosa*	Solitary	Oval	15×19	1	0	0	0	4	1	0	0	0	0
88	*Trachelomonas granulosa*	Solitary	Spherical	11×18	0	0	0	0	5	0	3	0	0	1
89	*Trachelomonas hispida*	Solitary	Spherical	18×28	0	0	0	0	4	0	0	0	0	0
90	*Trachelomonas oblonga*	Solitary	Elliptical	7.5×16	0	3	0	0	1	0	0	0	0	0
91	*Trachelomonas pulcherrima*	Solitary	Spherical	10×20	0	0	0	0	1	2	0	0	0	6
92	*Trachelomonas pusilla*	Solitary	Elliptical	11×14	0	0	1	2	0	1	0	0	0	0
93	*Trachelomonas robusta*	Solitary	Spherical	21×29	0	1	0	1	0	0	0	0	0	0
94	*Melosira granulata*	Colonial	Spherical	8.0×14	0	8	5	0	0	0	0	0	0	0
95	*Melosira varians*	Colonial	Spherical	10×21	3	0	0	0	0	3	0	0	0	0
96	*Gomphonema lanceolatum*	Solitary	Leaf	13×45	0	0	1	1	0	4	0	0	0	0
97	*Gomphonema subtile*	Solitary	Leaf	13×37	1	0	0	0	0	4	4	0	1	1
98	*Nitzschia acicularis*	Solitary	Needle	5.0×40	0	5	0	0	5	0	0	0	0	0
99	*Nitzschia longissima*	Solitary	Needle	4.5×30	0	0	0	3	0	0	0	3	0	0
100	*Navicula cuspidata*	Solitary	Boat	21×60	0	0	0	0	0	0	2	0	0	0
101	*Navicula exigua*	Solitary	Elliptical	7.5×21	0	3	0	0	0	0	0	0	2	0
102	*Navicula menisculus*	Solitary	Boat	6.5×26	0	0	0	0	0	0	0	0	9	0
103	*Pinnularia acrosphaeria*	Solitary	Boat	11×82	6	0	6	0	0	2	0	0	1	0
104	*Pinnularia acuminata*	Solitary	Elliptical	23×95	0	0	5	4	0	0	0	0	0	0
105	*Pinnularia tabellaria*	Solitary	Elliptical	16×85	0	0	0	1	0	0	0	0	3	0
106	*Cyclotella comensis*	Solitary	Round	8.5×11	0	5	0	0	0	0	0	0	0	0
107	*Cyclotella comta*	Solitary	Drum	10×18	0	4	0	0	0	0	1	0	0	0
108	*Cyclotella stelligera*	Colonial	Round	8.0×12	0	0	1	0	0	0	2	0	0	0
109	*Gonyostomum semen*	Solitary	Oval	28×48	3	0	0	0	0	0	0	0	1	0
110	*Synura uvella*	Solitary	Spherical	7×8.5	0	0	4	0	1	1	0	0	0	0

Table 3 showed the nine diversity indices of phytoplankton found in the 10 stations of Barishal City. In case of dominance index, the highest value was found in Station 8 and 9 (0.08) and the least in Station 2 (0.04). In terms of Simpson index, it was ranges from 0.92 to 0.96 among the all stations. Station 2 showed highest value by Shannon index and Equitability index, while Shannon index was lowest in Station 8 and equitability index was in Station 4, 6 and 8. Pielou's index is a measure of diversity that quantifies how equal the community is numerically, and the value was highest for the Station 2 and 9 (0.77), while it was lowest in Station 4 (0.65). Menhinick's index was low (2.32) in Station7 and high in Station 9 (3.54). Similarly Margalef's index showed higher value in Station 2 (7.41) and lower value in Station 8 (5.12). Moreover, Fisher's alpha index and Berger- Parker index was highest in Station 9, but lowest in Station 7 and 2 respectively.

DISCUSSION

The Barishal City has numerous freshwater reservoirs but for the survey this experiment selected 10 reservoirs as sampling stations which were relatively old and large. And the stations demonstrated a rich number of phytoplanktons throughout the investigation. In terms of species number and percentage, the occurrence of Chlorophytes was dominant followed by Euglenophytes, Heterokontophytes and Cyanophytes, which indicated this group of green algae was common in this City (Figure 2). On the other hand, among the families the highest richness was represented by Euglenaceae (32 Taxa)

Table 2: Position of each taxon in the taxonomic classification

Domain	Phylum	Class	Order	Family	Taxa
Prokaryotes	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	1-11
			Nostocales	Nostocaceae	12-13
			Oscillatoriales	Rivulariaceae	14
				Oscillatoriaceae	15-16
Eukaryotes	Chlorophyta	Charophyceae	Charales	Characiaceae	17-18
			Desmidiales	Closteriaceae	19-24
			Zygnematales	Zygnemetaceae	25-30
		Chlorophyceae	Chaetopeltidales	Chaetopeltidaceae	31
			Chlorellales	Chlorellaceae	32-36
				Oocystaceae	37-40
			Sphaeropleales	Hydrodictyaceae	41
				Scenedesmaceae	42-50
				Selenastraceae	51-53
			Tetrasporales	Palmellaceae	54-55
			Volvocales	Chlamydomonadaceae	56-59
				Volvocaceae	60-61
	Euglenophyta	Euglenophyceae	Euglenales	Euglenaceae	62-93
	Heterokonto-phyta	Bacillariophyceae	Biddulphiales	Melosiraceae	94-95
			Cymbellales	Gomphonemataceae	96-97
			Pinnales	Bacillariaceae	98-99
				Naviculaceae	100-105
			Thalassiosirales	Stephanodiscaceae	106-108
		Raphidophyceae	Chattonellales	Raphidophyaceae	109
		Synurophyceae	Synurales	Synuraceae	110

Table 3: Diversity indices of phytoplankton of Barishal City during the study period among the 10 stations

Indices	St.1	St.2	St.3	St.4	St.5	St.6	St.7	St.8	St.9	St.10
Taxa_S	31	37	36	36	28	30	27	24	24	37
Individuals	110	129	126	118	89	131	136	89	46	152
Dominance index	0.06	0.04	0.05	0.06	0.06	0.07	0.06	0.08	0.08	0.05
Simpson index	0.94	0.96	0.95	0.94	0.94	0.93	0.94	0.92	0.92	0.95
Shannon index	3.06	3.35	3.25	3.15	3.02	2.99	2.99	2.80	2.91	3.28
Pielou's index	0.69	0.77	0.72	0.65	0.73	0.66	0.74	0.69	0.77	0.72
Menhinick's index	2.96	3.26	3.20	3.31	2.97	2.62	2.32	2.54	3.54	3.00
Margalef's index	6.38	7.41	7.24	7.34	6.02	5.95	5.30	5.12	6.00	7.17
Equitability index	0.89	0.93	0.91	0.88	0.91	0.88	0.91	0.88	0.92	0.91
Fisher's alpha index	14.36	17.35	16.84	17.65	14.05	12.17	10.11	10.79	20.25	15.57
Berger-Parker index	0.16	0.09	0.10	0.15	0.10	0.13	0.12	0.16	0.20	0.10

followed by Chroococcaceae (11 Taxa), Scenedesmaceae (9 Taxa), Zygnemetaceae (6 Taxa), Closteriaceae (6 Taxa) and Chlorellaceae (5 Taxa). Among all taxa, *Scenedesmus* was mostly frequent genus in Chlorophyta, while *Merismopedia* in Cyanophyta, *Euglena* in Euglenophyta, and *Navilcula*, *Pinnularia*, *Cyclotella* were in Heterokontopyta. Furthermore, as a single genus, *Euglena* possessed the highest number of taxa (13) throughout the survey, while the 27 genera reported with only single species.

Diversity measurements have many potential applications in any aquatic ecosystems as part of the ecological study. In this investigation, Station 8 and 9 indicates the more dominancy by species number than the other stations. And, the species abundance was found highest in the Station 2 according to Simpson and Shannon diversity index. As the evenness or Pielou's index means how equal the community is numerically in an ecosystem, Station 2 and 9 showed greater results over the others. According to Menhinick's index, Fisher alpha index and Berger- Parker index, the Station 9 demonstrated the highest richness of species. On the other hand, Station 2 demonstrated the best species richness according to Margalef's index and Equitability index. However, assessing the nine diversity indices, the diversity of the listed phytoplanktons was more prominent in Station 2 and 9, whereas Station 8 earned lowest marks in five indices out of the nine.

In terms of species distribution through the stations, 56 taxa were found common regardless of rare and abundant frequency in several stations. On the other hand, 12 species were found only abundantly and 42 taxa were found rarely in some of the stations. The species *Teilingia exigua*, *Chlorella vulgaris*, *Planktosphaeria gelatinosa*, *Kirchneriella contorta*, *Kirchneriella irregularis*, *Korshikoviella limnetica* and *Euglena granulata* were found rarely only in Station 3, 10, 5, 7, 1, 4 and 9 respectively (Figure 3). On the other hand, the appearance of *Gloeothece rupestris*, *Microcystis aeruginosa*, *Microcystis flosaquae*, *Oscillatoria formosa* and *Scenedesmus acuminatus* were common in maximum stations (Figure 3).

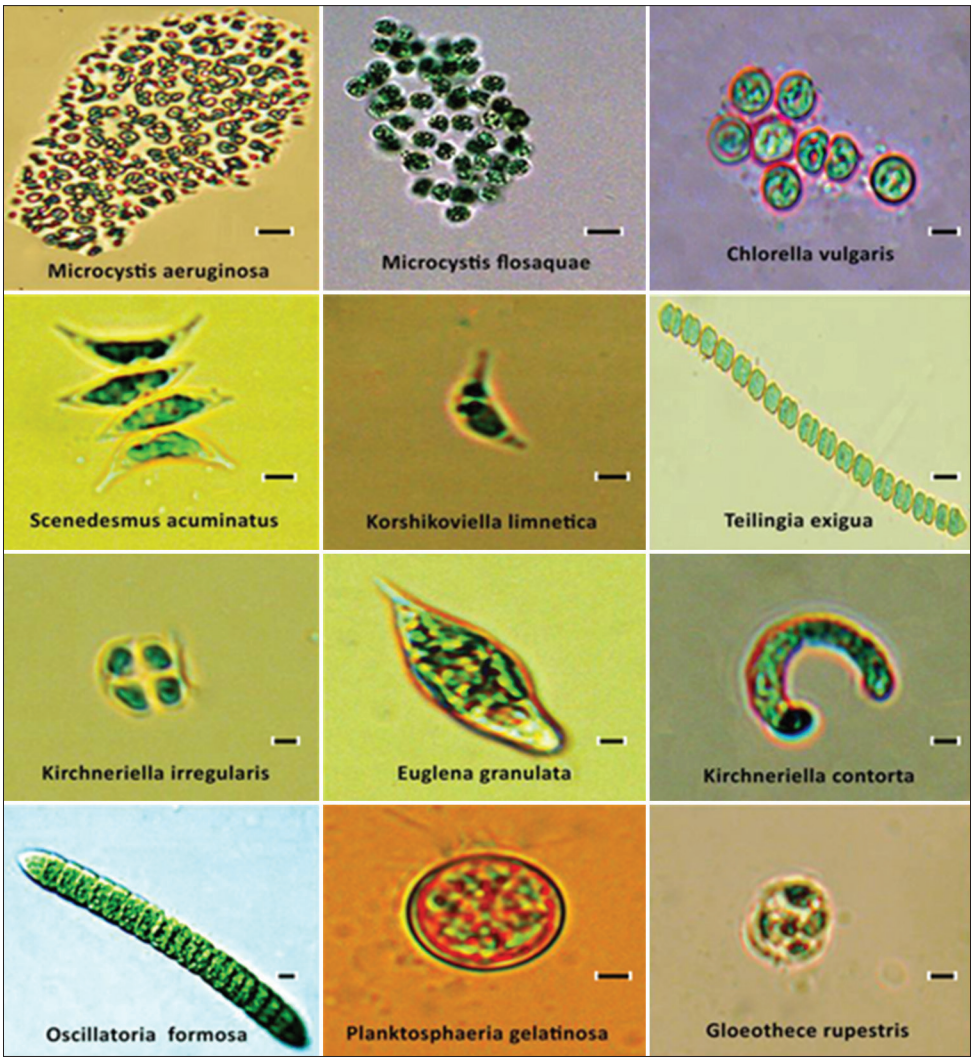

Figure 3: The rarest and the most common phytoplanktons of Barishal City. Bar = 1 μm

CONCLUSIONS

There was no new species report and all listed taxa were reported previously from different locations of Bangladesh by different authors. However, this is the first report on phytoplanktons community from the Barishal City of Bangladesh.

REFERENCES

1. Andersen RA. Algal culturing techniques, Elsevier Academic Press, London. 2005; 83-85.
2. Chiara L, Andersen JH., Espen H, Marte A, Laura E, Francesco E, Kirsti H, Hanssen KØ, Giovanna R, Adrianna I. Bioactivity screening of microalgae for antioxidant, anti-Inflammatory, anticancer, anti-diabetes, and antibacterial activities. Frontiers in Marine Science. 2016; 3: 68.
3. Thajuddin N and Dhanasekaran D. Algae- organisms for imminent biotechnology, London. 2016; 237–76.
4. Ramaraj S et al. Microalgae as an attractive source for biofuel production (Thangavel P and Sridevi G Eds.), Environmental sustainability. New Delhi. 2015; 129.
5. Banglapedia- the national encyclopedia of Bangladesh. http://en.banglapedia.org/index.php?title=Barisal_City_Corporation
6. Khondker M , Bhuiyan R, Yeasmin J., et al. New records of phytoplankton for Bangladesh. 2. Cryptophyceae and Synurophyceae. Bangladesh Journal of Botany. 2007; 36: 53-59.
7. Khondker M, Bhuiyan R, Yeasmin, J, et al. New records of phytoplankton for Bangladesh. 2. Cryptophyceae and Synurophyceae. Bangladesh Journal of Botany. 2006; 35: 53-59.
8. Bellinger EG and Sigee DC. Freshwater algae: identification and use as bioindicators, John Wiley & Sons, USA. 2010; 244.
9. Ahmed ZU, Khondker M, Begum ZNT, et al. Encyclopedia of flora and fauna of Bangladesh, Asiatic Soc. Bangladesh, Dhaka. 2009; 543.
10. Islam AKMN and Alfasane MA. Euglenophyceae from Barisal district, Bangladesh: III. Genus *Trachelomonas* Ehr. Bangladesh Journal of Plant Taxonomy. 2004; 11: 33-37.
11. Islam AKMN and Moniruzzaman K. Contribution to the study on Euglenophyta of Bangladesh. I. Genus *Trachelomonas* Ehr. Internationale Revue der gesamten Hydrobiologie. 1981; 66: 109-125.
12. Smith GM. Freshwater algae of the United States, New York. 1950; 719.
13. Lee RE. Phycology, Cambridge University Press, New York. 2008; 561.
14. Komárek J and Fott B. Chlorococcales (Huber-Pestalozzi, Eds.), Das Phytoplankton des Süsswassers, Systematik u. Biologie, Teil 1, Stuttgart. 1983; 1044.
15. Bold HC and Wynne MJ. Introduction to the Algae, Prentice-Hall, New Jersey. 1985; 706.