



SEASONAL DISTRIBUTION AND ABUNDANCE OF DIATOMS IN SHRIMP PONDS OF KHULNA, BANGLADESH

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Abstract: The paper deals with the diatoms of shrimp Ponds in Khulna. It includes description and illustration of 30 species of diatom belonging to 13 genera namely Amphora, Synedra, Coccones, Cymbella, Fragilaria, Gomphonema, Gyrosigma, Melosira, Navicula, Nitzschia, Pinularia, Surrella and Caloneis based on one year investigation. Taxonomy of unidentified species was not included but they are considered in periodicity and seasonal distribution. Irregular pulses of diatom were recorded in both the ponds and none of the genera were present round the year.

Key words: Diatom, Limnological, phytoplankton

Introduction

Bangladesh is rich in rivers, canals, *beels*, *haors*, ponds, lakes and many low lying areas with rich prospects for fisheries. Thus importance of Limnology of these areas can hardly be over emphasized. The diatoms constitute an important source of food for aquatic animals including fish and whale. They trap and conserve the life-giving nutrients washed from the land into the aquatic bodies and thus keep them in circulation. There are only a handful member of studies on diatoms and phytoplankton in Bangladesh. Limnological studies emphasizing diatom were carried out by Islam and Aziz (1975), Islam and Haroon (1975), Islam and Aziz (1979), Islam and Aziz (1980) and Islam and Morshed (1985). The list of Diatom from diverse habitats of Bangladesh is far from complete. The authors made a year round hydro-biological study in to two shrimp Ponds in Khulna.

Materials and Methods

The two Ponds selected for the study were located in Khulna district at 24°35'N and 24°70' N and 89°10'E and 89°35'E. Pond -1 was more or less rectangular with a surface area of 5.2 acre. It was a fresh water shrimp Pond This Pond is situated at Terokhada thana. The Pond was connected Atarabay river by a cannal. Main source of water was rainfall though sometime water was supplied from cannal. Pond-2 was more or less square in shape with a surface area of 2.69 acre. It was a seasonally saline water shrimp Pond. The Pond is situated at Botiaghata thana. The Pond is connected with Satuari river. Water supplied to the pond by *goya* from river.

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Phytoplankton samples were collected from November 2006 to October 2007 at monthly intervals. The plankton was collected by a plankton net of 20 μ m mesh size. water 75 liters was passed through the plankton net with the help of a plastic pan of 5 litre capacity. The water was passed down the net and the plankton was collected in a glass test tube fixed firmly at the lower end of the plankton net (Welch 1948). After collection, plankton materials were transferred to glass bottles and preserved in Transeau's solution (Transeau, 1951).

The enumeration of the diatoms was carried out with the help of a Sedgwick Rafter counting cell and by drop method (Welch, 1948). The diatoms abundance was expressed as units per liter (units l⁻¹). The figures of diatom members were drawn with the help of camera lucida.

Results

Taxonomic Enumeration

Class- Bacillariophyceae

Order- Centrales

Family- Eunotiaceae

Cocconeis placentula Ehr. (Pl. 1, Fig. 1)

(Germain, 1981, 102, Pl. 38, Fig. 38)

Frustules oval shaped 26.4 μ long and 13.2 μ diam.

Order-Pennales

Family- Fragilariaceae

Fragilaria capucina (Pl. 1, Fig. 2)

(Germain, 1981, 64, Pl.19, Fig. 9)

Frustules 72.6 μ long and 6.2 μ broad.

Synedra ulna Nitzsch (Pl. 1, Figs. 5 & 6)

(Germain, 1981, 76, Pl. 24, Fig. 8)

Frustules very long, symmetrical in both axes; valve broad in the middle; gradually narrowed along the length with slightly inflated ends; striae 9 to 10 μ , absent in the middle of valve, frustules up to 500 μ long.

Family- Naviculaceae

Gyrosigma acuminatum var. *lacustre* Meist (Pl. 1, Fig. 4)

(Islam and Haroon, 1975, 31, Pl. 2, Fig. 37)

Frustules 72.60 μ long and 16.5 μ broad. striae in 10 μ .

G. acuminatum (Kuetz) Rabh. (Pl. 1, Fig. 3)

(Germain, 1981, 132, Pl. 49, Fig. 5.)

Frustules 69.3 μ long and 13.2 μ broad.

Calonis bacillum Mereschkowsky (Pl. 1, Fig. 7)

(Germain, 1981, 237, Pl. 87, Fig. 28)

Frustules 39.6 μ long 6.6 μ broad.

C. ladogensis cl. var. *densistriata* Husted (Pl. 1, Fig. 8)

(Germain, 1981, 240, Pl. 86, Fig. 29)

Frustules 26.4 μ long and 13.2 μ width at the mid region.

Navicula pupula Kuetz (Pl. 1, Fig. 25)

(Germain, 1981, 205, Pl. 78, Fig. 11)

Fruatules 34.65 μ long and 5.25 μ broad.

N. rhynchocephala Kuetz (Pl. 1, Fig. 10)

(Germain, 1981, 82, Pl. 69, Fig. 5)

Frustules 75.9 μ long and 15.75 μ broad.

N. exigua O. muller (Pl. 1, Fig. 17)

(Islam and Haroon, 1975, 31, Pl.2, Fig. 40)

Frustules 25.6 μ long and 8.25 μ broad.

***Pinnularia brebissonii* (Kuetz) Rabk. (Pl. 1, Fig. 23)**

(Germain, 1981, 250, Pl. 90, Fig. 19.)

Frustules 42.9 μ long and 6.6 μ broad.

***P. gibba* Ehr. var. *mesogongyla* (Ehr.) Hust. (Pl. 1, Fig. 15)**

(Islam and Haroon, 1975, 32, Pl. 3, Figs. 55 & 56)

Frustules 44.55 μ long and 9.9 μ broad. 14/15 striae in 10 μ .

***P. gibba* Ehr. var. *mesogongyla* (Ehr.) Hust. (Pl. 1, Fig. 11)**

(Islam and Haroon 1975, 32, Pl. 3, Fig 56)

Frustules 39.6 μ long and 11.55 μ broad. 14/15 striae in 10 μ .

***P. macilenta* Ehr. (Pl. 1, Fig. 22)**

(Germain, 1981, 262, Pl. 96, Fig. 13)

Frustules 80.25 μ long. 10 μ m diam at the mid region; both ends rounded.

***P. tabellaria* Ehr. (Pl. 1, Fig. 14)**

(Islam and Haroon, 1975, 32, Pl. 3, Fig. 57)

Frustules 90-102 μ long, 12-15 μ diam; at the middle, tips slightly inflated, 10.5 μ diam.

Family-Cymbellaceae

***Cymbella angustata* Cl. (Pl. 1, Fig. 30)**

(Germain, 1981, 276, Pl. 100, Fig. 11)

Frustules 39.6 μ long and 10.21 μ broad.

***C. cymbiformis* var. *Heurck*. (Pl. 1, Fig. 9)**

(Germain, 1981, Pl. 103, Fig. 13)

Frustules 36.3 μ long and 8.25 μ broad.

***C. hustedtii* Krasske (Pl. 1, Fig. 16)**

(Islam and Haroon, 1975, 33, Pl. 4, Fig. 79)

Frustules 34.65 μ long and 10.23 μ broad at the middle.

***C. ventricosa* Kuetz (Pl. 1, Fig. 12)**

(Germain, 1981, Pl. 107, Fig. 21)

Frustules 29.7 μ long, 9.9 μ broad.

***Amphora pediculus* Kuetz (Pl. 1, Fig. 13)**

(Germain, 1981, 295, Pl. 108, Fig. 5)

Frustules 16.5 μ long and 10.56 μ broad.

Family-Gomphonemataceae

***Gomphonema angustatum* Rabh. (Pl. 1, Fig. 21)**

(Germain, 1981, 306, Pl. 114, Fig. 7)

Frustules 25.08 μ long and 8.25 μ diam.

***G. augur* Ehr. (Pl. 1, Fig. 28)**

(Islam and Haroon, 1975, 34, Pl. 5, Figs. 90-91)

Frustules 29.7 μ long and 6.6 μ broad.

***G. gracile* Ehr. Var. *naviculacul* W. Smith (Pl. 1, Fig. 26)**

(Islam and Haroon, 1975, 34, Pl. 5, Fig. 87)

Frustules 80.4 μ long and 13.2 μ broad.

***G. lanceolatum* fao. *turris* (Ehr.) Hust. (Pl. 1, Fig. 31)**

(Islam and Haroon, 1975, 35, Pl. 5, Figs. 88-89, 93, 97-98)

Frustules 72.6 μ long and 17.8 μ broad.

***G. olivaceum* (Lyngb). Kuetz. (Pl. 1, Fig. 18)**

(Islam and Haroon, 1975, 34, Pl. 5, Fig. 94)

Frustules 41.25 μ long and 11 μ broad.

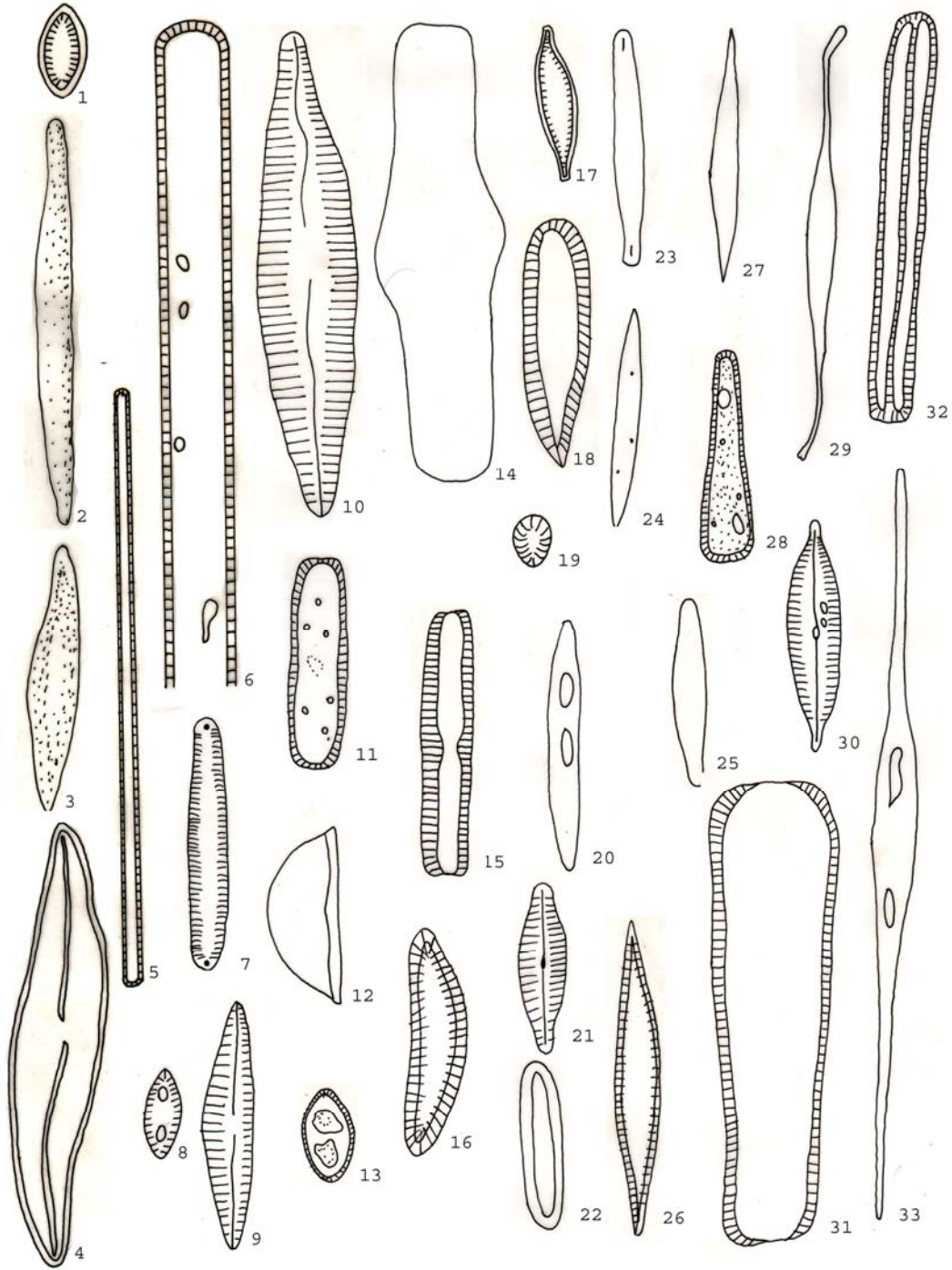


Plate 1

Family-Nitzschiaceae

***Nitzschia acicularis* W. Smith var. *Closterioides* Grun (Pl. 1, Fig. 33)**

(Islam and Aziz, 1979, 113, Pl. 1, Fig. 9)

Cells sigmoid, 133.65 μ long and 6.75 μ diam.

***N. closterium*. W. Smith (Pl. 1, Fig. 29)**

(Germain, 1981, Pl. 137, Fig. 11)

Frustules 67.65 μ long and 4.13 μ broad.

***N. Palea* (Kuetz.) W. Smith (Pl. 1, Fig. 20)**

(Germain, 1981, 350, Pl. 132, Fig. 5)

Frustules 42.9 μ long and 4.62 μ in diam.

***N. Paleacea* Grun. (Pl. 1, Figs. 24 & 27)**

(Germain, 1981, Pl. 132, Fig. 33)

Frustules 36.3-39.6 μ long and 3.75-4 μ broad.

***Diatoma vulgare* Bory var. *lineare* Grun. (Pl. 1, Fig. 32)**

(Islam and Aziz, 1975, 15, pl. 8, Figs. 95-97)

Valve lanceolate, Pseudoraphe preset transverse castae run across the valve. Frustules 92.4 μ long, 9.9 μ diam.

***Surirella ovata* (Pl. 1, Fig. 19)**

(Germain, 1981, 390, Pl. 152, Figs. 1-8)

Frustules oval shaped 10 μ in diam.

Pond-1: Monthly abundance of Bacillariophycean plankton were varied from 928 to 7426 units l⁻¹. There highest abundance was 928 to 7426 units l⁻¹ recorded in January while the lowest in September. The seasonal abundance of Bacillariophyce was 5637 units l⁻¹ in summer, 1857 units l⁻¹ in monsoon, 4640 units l⁻¹ in post monsoon and 3716 units l⁻¹ in winter.

Diatoms were 9.38% of the total phytoplankton population (Table- 1).

Pond-2: Diatom abundance was found to vary from nil to 21347 units l⁻¹. The highest value was in September and the lowest in August. The seasonal abundance was found 4043 units l⁻¹ in summer, 7118 units l⁻¹ in monsoon, 14385 units l⁻¹ in post monsoon and 7465 units l⁻¹ in winter. The Diatoms constituted sp. 32.85% of the total phytoplankton population (Table- 2).

Table- 1: Seasonal distribution and abundance of diatoms in pond-1

Name of the Genus	% of the Genus	Month of occurrence
<i>Amphora</i> sp.	0.62	February & March
<i>Caloneis</i> sp.	0.21	December
<i>Cymbella</i> sp.	1.07	November, December & March
<i>Fragilaria</i> sp.	0.62	December & October
<i>Gomphonema</i> sp.	1.04	December & February
<i>Gyrosigma</i> sp.	0.83	November & June
<i>Navicula</i> sp.	1.45	November, May & June
<i>Nitzschia</i> sp.	1.25	November, January & October
<i>Pinularia</i> sp.	2.29	November, January, March & May

* Pond-1 was dried up in April.

Table- 2: Seasonal distribution and abundance of diatoms in pond-2.

Name of the Genus	% of the Genus	Month of occurrence
<i>Amphora</i> sp.	0.95	September
<i>Synedra</i> sp.	0.48	February
<i>Coccones</i> sp.	0.97	September
<i>Cymbella</i> sp.	1.43	May, August & September
<i>Fragilaria</i> sp.	3.75	April, July, September & October
<i>Gomphonema</i> sp.	3.33	September, October
<i>Gyrosigma</i> sp.	5.21	February, March, May & July to October
<i>Melosira</i> sp.	5.79	July to September
<i>Navicula</i> sp.	1.9	March & September
<i>Nitzschia</i> sp.	6.66	February to May & August to October
<i>Pinularia</i> sp.	0.48	September
<i>Rhopalodia</i> sp.	0.47	September
<i>Surrella</i> sp.	1.43	February

* Pond-2 was dried up from November to January.

Discussion

Diatoms were totally absent in June in Pond -1 and in July and August in Pond -2. During the rest of the period they were present. Monthly abundance was nil to 7428 units l⁻¹ in Pond -1 and nil to 21347 units l⁻¹ in Pond -2. The abundance was highest in January in Pond -1 and September in Pond -2. Bacillariophyta contribute 9.38% in Pond -1 and 32.85% in Pond -2. In Pond -1, diatom member showed an irregular abundance. Pennak (1949, 1955) observed irregular pulses of diatoms in the Colorado lakes. In Pond -2 diatoms were abundant in August, September and October, while Chandler (1940, 42) observed spring and Autumn pulses of diatom. Ecological factors influence the distribution of diatoms in lentic and lotic waters along with the meteorological factors. Nitrate, phosphates, silica, calcium, sodium, oxidizable organic matter and pH of water influence the growth of diatom population in any aquatic body. Zafar (1964) reported high abundance of diatoms in ponds with a high concentration of phosphate and a low concentration of organic matter among them pH of water was more than 7.4 when diatom population was highly abundant. Zafar (1964) reported higher diatom abundance in waters with high pH accompanied by low calcium concentrations. Rice (1938) and Zafar (1964) pointed out that waters with higher concentration of calcium and moderate pH (7.5-8.1) favor the diatoms. Present findings are corroborated by the findings of Zafar (1964) and Rice (1938). Diatom members were totally absent in the shrimp Ponds when pH value was below 7.3. Abundance of diatom was comparatively higher when pH value was above 8. Different type and large number of diatoms were present when calcium and phosphate content were higher and when the concentration was lower then diatom abundance was also lower.

Conclusion

Diatom act as primary producers as well as they are favorite food of fishes and whales. Abundant growth and larger accumulation of diatom creates diatomaceous earth which formed by fossil diatom has great industrial value. Energy of the fuel petroleum arose from the resulting and condensation of fossil diatom. To make a list of plankton diversity and their conservation is very important issue now a day. Many more research work is needed to make a complete list of diatom, their periodicity, seasonal abundance and to know their ecological, biological and economic importance.

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