Studies on biodiversity of Diatoms from Haranbari dam of Baglan Taluka of Nasik District of Maharashtra (India)

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Abstract

Biodiversity of various groups of algae were studied in India, but very few workers have paid attention on diatoms. To fulfill the lacuna in this field, the present investigation was carried out by selecting lotic and lentic habitats of Haranbari dam, from baglan Taluka of Maharashtra. The class Bacillariophyceae (Diatoms) of algae is mainly represented by the species of the genera like Melosira, Cyclotella, Fragilaria, Synedra, Eunotia, Coccone, Achnanthes, Mastogloia, Frustulia, Gyrosigma, Pleurosigma, Colonies, Nitzschia, Diploneis, Staurosina, Navicula, Pinnularia, Amphora, Cymbella, Gomphonema, Hantzschia, Nitzschia, Surirella. Twenty three algal taxa belonging to forty five genera of diatoms were recorded.

Keywords: Biodiversity, Algae, Diatoms.

INTRODUCTION

Diatoms (Division Bacilliarophyta), one of the largest groups of photosynthetic eukaryotic micro-organism. They occur in almost all wet/damp places with a diverse range of habitats across continents. Diatoms grow as single cells, or form simple filaments or colonies. They form the base of aquatic food webs in marine and freshwater habitats. Diatom species are very particular about the physical and chemical parameters of water such as pH, nutrients, salinity, temperature, and water currents in which they live. As a result Diatoms are extensively used in environmental assessment and monitoring across the globe microscopic, unicellular, eukaryotic algae abundant in most aquatic habitats. They are useful proxies for the ecological analysis for the parameters like pH, salinity, temperature, hydrodynamic condition, and nutrient concentration etc. the ubiquitous distribution of diatoms, their high species diversity, and their siliceous frustule all enable the diatoms to function as sound environmental indicators. India the pioneer work on Diatoms was done by Venkatraman (1939 and 1956). He gave a systematic account of south Indian Diatoms. Gonzalves (1947) was probably the first to record the diatoms from Maharashtra. Gonzalves and Gandhi (1952-54) gave a systematic account of the diatoms of Bombay. Gandhi (1955, 1956 and 1960) made the contribution of fresh water diatoms of India. Sarode and Kamat (1984) studied fresh water diatoms of Maharashtra. B. Karthik et al. (2011) gave an account of Community diversity and the abundance of a particular group of species are controlled by immediate environment, inter-community diversity and the interaction, landscape condition historical events and evolutionary processes in western ghats. Bhibishan et al. (2011) also carried out preliminary
survey on Algal biodiversity of Ujani water reservoir (Maharashtra). Nerpagar PB (2011) Algal flora of certain factories effluents, Sandhya Patil (2014) studied Diversity of diatoms from Sulwade barrage of Dhule district. To study the biodiversity and assemblage pattern of freshwater diatoms in Harnabari dam of Baglan (Maharashtra) is the primary objective of this paper.

MATERIALS AND METHODS

Water quality variables such as pH, water temperature (°C), total dissolved solids (mgL⁻¹), Salinity (mgL⁻¹), and nitrates (mgL⁻¹) were recorded at sampling site using EXTECH COMBO electrode and Orion Ion Selective Electrode. Other parameters like chloride, hardness, magnesium, calcium, sodium, potassium, sulphates and phosphates were analyzed in laboratory. All analysis were carried out as per standard methods for the examination of water(APHA, 1998).

Haranbari dam is located at latitude 20° 51' -2° North and longitude 74° 11' -23° East. The algal samples were collected from station I, II and III of Haranbari dam at monthly interval during February 2013 to January 2014. The attached epiphytic and floating form of algae, were collected separately in acid washed glass bottles and preserved in 4% formalin for further study and identification of algae. Line drawings of different forms of algae were made by camera Lucida. For identification of Diatoms were made with the help of monograph and relevant literature.(Gonzalves and Gandhi,1953; Gandhi 1956; 1960 and Sarode and Kamat 1984).

SYSTEMATIC OF BACILLARIOPHYCEAE

1) Melosira granulata (Ehr) Ralfs V.amgustissium 0 muell.(Pl.1,F.1)
Filamentous with narrow and long cells frustules 3.17μ in diameter, cylindrical; semiellipses 13.94μ high end cells with spines, row of areoles 10 in 10 μ in upper semiellipses and 12-14 in 10 μ in lower semiellipses, spirally disposed.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station II, September 2013.

2) Melosira islandica O muell V.helvetica O.muell (Pl.1, F.2)
Frustules 8-10μ in diameters. Cylindrical, united in chains, semiellipses 11.5-14μ high; rows of areoles 13-14μ in 10μ straight.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station I, August -2013

3) Cyclotella meneghiniana kuetz.f.binotata.Grun.( Pl.1, F.3)
Frustules rectangular with undulate wall in girdle view .Valves discoid at 13.94μ in diameter central field radially punctuate having two prominent punctuate, striae 7-9 in 10μ and large.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station III, January- 2014

4) Fragilaria intermedia Grun.(Pl.1,F.4)
Frustules united together to form long bands, linear rectangular in the girdle view. Valves 2.70μ broad and 65-96μ long ends gradually tapering and rounded slightly.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station I, September 2013; Station II, September 2013.

5) Fragilaria ungeriana Grun (Pl. I, F.5)
Frustule in continuous, short chain, Valves 9.7μ board and 72.27μ long linear with shorty tapering, Psendoraphe narrow, enclosing one mucilage Pore, Striae 12-13 in 10μ coarse.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station I. August 2013; Station II – August2013; Station III – August 2013;

6) Syndera minuscula Grun (Pl. I, F. 6)
Valve 18.6 - 27μ long 6-8 μ broad, linear, lanceolate with narrowed, round ends, axial area narrow, linear lanceolate; central area slightly widened; striae 14-15 in 10μ.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. – Station II – July 2013.

7) Syndera ulna (Nitz) Eher. (Pl.1, F. 7)
Valve 6.97μ broad and 93.19 long. Linear, to lanceolate, and tapering at the ends; ends round, striae 9-11 in 10μ coarse.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station II – October2013.

8) Eunotia monodon Eher. (Pl. F. 8)
Hustedt, 1930; P 185, F. 254.
Valve 6.9μ broad and 38.04μ long slightly arcuate. Ventral margin slightly concave; ends slightly constricted on the dorsal side, striae 9 in 10μ in the middle and 12 in 10 μ towards the bends.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station I- November 2013, - Station II-November 2013; - Station III- November 2013,

9) Cocconies placenta Ehr. (pl-1 F. 9)
Valve 19.02 μ broad and 34.87 μ long;elliptical;raphe valve with thin central area small striae 24-26 in10μ, Punctate, marginal rim distinct Pseudoraphe, linear; Wavy hyaline bands.

latitude 20° 51' -2° North and longitude 74° 11' -23° East. Station II- December 2013.
10) Achnanthes coarctata Bred.V.parallela venkat. (pl.2 F. 10)
Valves 42-51.5 µ long, and 9.5-10 µ board. Linear
with board rounded ends. Margins almost Parallel in
the middle. Pseudorapha, striae 10-12 in 10 µ
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - September 2013, - Station II -
October 2013.
11) Achnanthes affinis Grun. (pl.2, F. 11)
Valves 3.80µ board and 18.38µ long linear
lanceolate, slightly humid, in the middle rapha
pseudorapha, striae about 30 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - July 2013, - Station II -
January 2014.
12) Mastogobia baltica Grun. (pl-2, F. 12)
Valve 14.58µ board and 34.87µ long, elliptic,
lanceolate, with produced capitates ends. Rapha
nearly Straight, axial area narrow; central area small
stria 20-21 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - December 2013, - Station II -
January 2014.
13) Frustulia saxonica Rabh. (pl-2, F. 13)
Valves 9.15µ board and 34.23µ long, lanceolate
with constricted produced, rounded ends rapha
between the siliceous ribs. Axial are very narrow.
Polare areas elongated striae about 30-35 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station II - November 2013, - Station III -
November 2013.
14) Gyrosigma khamdeshensis Sarode and Kamat
(pl.2,F.14)
Valve 16.45µ board and 91-65µ long, frustules free
floating, solitary, linear lanceolate with broadly
rounded ends, axial area narrow transverse striae 22-
24 in 10 µ, longitudinal striae 18-20 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station II- July 2013
15) Pleurosigma salinarum Grun. (pl.2,F.15)
Valves 74.5-135µ long, 12.4-14µ board, linear,
lanceolate, sharply rounded at the poles.Sigmoid,
axial area very narrow, central area small elliptical,
transverse striae about 25 in 10µ, oblique seriate
about 30 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
16) Caloneis silicula (Ehr) cleveV. truncatula
(Grun) Mayer. (pl-2, F. 16)
Valve 9.51µ board and 29.79µ long smoothly linear
eelliptical with rounded end. Axial area fairly broad
narrowly lanceolate. Central area small, striae 18.20
in 10 µ crossed by longitudinal marginal line.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - September 2013, Station II -
September 2013, Station III - September 2013,
17) Neridium hercynicum Mayer. (pl.2 F. 17)
Valves 35.5 - 40µ long, 10.2-11.5µ board,
lanceolate to elliptic lanceolate, with obtuse,
broadly rounded ends rapha thin and straight with
central pores, roundish striae 24 – 26 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - January 2014; Station II-
18) Diplone elliptica (kuetz) cleve V.ladogensis
Cleve. (pl. 2, F. 18)
Valve 29.5µ board, and 59.12 µ long, elliptical to
rhombic. Elliptical, axial area very narrow, dilated
in the middle striae 9 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I January 2014, Station II-
January 2014.
19) Staurones phoenicentrum Ehr . F. capitata.
(pl-2, F. 19 )
Valves 19.12 µ board and 81.73 µ long, narrowly
lanceolate and delicate with large rounded, capitates
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
20) Navicula bacillum Ehr. (pl.2 F. 20)
Valves 7.60 µ board and 29.16 µ long with straight
or slightly convex margins and broadly
rounded ends, rapha thin and straight, axial area
wide, central area large, round, striae 21-22 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I- August 2013 and September
2013.
(pl. 3, F. 21)
Valves 5.7µ board and 20.92 µ long lanceolate,
with acutely rounded ends. Axial area narrow, rapha
thin straight. Striae 14-16 in 10 µ.
latitude 20° 51.1′ -21° North and longitude 74° 1.1′ -
23° East. Station I - September 2013.
22) Navicula cuspidata Kuetz, V Major, Meister.
(pl.3, F. 22) Valves 48-69 µ board and 140-85 µ
long elongated and rhombic lanceolate with
produced and rounded ends. Axial area narrow,
linear, central area slight widened transverse striae
14-16 in 10 µ, longitudinal striae 22-24 in 10 µ.
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station I- January 2014.

23) Navicula gastrum Ehr. (Pl.3 F. 23) 
Valves 17.75 µ broad and 51.35 µ long, elliptical, lanceolate, broadly rounded ends, raphe thin and straight, 8-10 µ in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station II – January 2014; Statino III – February 2013.

24) Navicula laterostrata Hustedt. (Pl 3, F. 24) 
Valves 7.6 µ broad and 19-65 µ long elliptical, lanceolate with broadly rounded and more or less capitates ends axial area very narrow, central area large, striate 14-16 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station I – August 2013, September 2013.

Valves 7.60 µ broad and 24.72 µ long elliptic lanceolate with constricted rounded, capitates ends, axial area narrow, central area small. Striae 20-22 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station I June 2013, July 2013. Station II- August 2013.

26) Pinnularia borealis Ehr. (Pl. 3, F. 26) 
Valve 8.2µ broad, and 38.04 µ Long, linear elliptical with broadly rounded ends axial area windened in middle. raphe thread like striae 5-6 in 10µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station I- July 2013; Station II- July 2013.

27) Pinnularia finlandica A. cl. (Pl. 3, F. 27) 
Valve 8.24µ broad and 47.55 µ long, linear with parallel margins and rounded ends axial area wide central area slightly dilated. Striae 10-12 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. Station I-August 2013; Station II – September 2013.

28) Pinnularia molaris Grun. (Pl.3, F. 28) 
Valve 6.95 µ broad and 29.56 µ long, linear lanceolate, rounded ends; axial area quite narrow, central area large striae 14-16 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. station II – January 2014.

29) Pinnularia viridis (Nitz) Ehr. V.fallax cleve. (Pl.3, F. 29) 
Valves 12.04 µ broad and 57.69 µ long, linear, elliptic with rounded ends.Axial area wide central area large.Striae about 9 in 10 µ convergent at the ends.

latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station I – November 2013; Station II – November 2013.

30) Amphora normanii Rabh. (Pl. 3, F. 30) 
Valves 19.65µ broad and 41.21 µ long frustules, elliptic lanceolate, end capitates, raphe thin and linear area narrow, central area with distinct fascia; striae 20-22 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station II – November 2013.

31) Cymbella aspera (Ehr) cleve. (Pl. 4, F. 31) 
Valves 27.82 µ broad and 116.51 µ, slightly convex central side, ends obtusely rounded, axial area moderate, linear,central area slightly formed, striae 8-10 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station I – May 2013, Station II May-2013.

32) Cymbella gracilis (Rabh) cleve. (Pl. 4, F. 32) 
Valves 6.75µ broad, and 27.53 µ. Long asymmetrical, semi lanceolate, ventral margin straight.Raphe thin& straight axial are very narrow. Central area very small striae 10-12 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station I – May 2013, Station II May-2013.

33) Cymbella tumida ( Breb) V. H. (Pl.4, F. 33) 
Valves 15.65 µ and 52.17µ Long, asymmetrical, Ventral margin straight, axial area narrow, central area large, striae 9-10 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. – Station I January 2014, Station II – December 2013.

34) Cymbell turgid (Greg) cleve. (Pl.4, F. 34) 
Valves 8.69 µ.Broad and 36.51 µ. Long ends more or less acute, rounded, axial area moderate, linear; central area small, elliptical, striae 8-9 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station I- August 2013; February – 2013; Station II – March 2013.

35) Cymbella ventricosa Kutz. (Pl. 4, F. 35) 
Valves 9.51 road, and 32-33 µ.Long strongly convex on the dorsal side and straight axial area narrow; central area small striae 10-14 in 10 µ. 
latitude 20° 51' -21 North and longitude 74° 0'11 -23 East. - Station I- August 2013; Station II – January 2014; Station III – September 2013.

36) Gomphonema aeguatoriale Hustted. (Pl. 4, F. 
Valves 12.68 µ.Broad and 51.35 µ.Long clavate in middle, rounded apex, axial area narrow, central area widened;striae 9-10 in 10 µ.in the middle.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. – Station II – May 2013; Station III- March 2013.

37) Gomphonema constrictum (Ehr) V. Indica. Gandhi. (Pl. 4, F. 37)
Valves 11.41 µ.Broad and 45.64 µ.Long, clavate, with slightly constricted, rounded apex, raphe thick and straight.Axial area narrow, central area small striae 10-12 in 10 µ. In the middle and 11-13 in 10 µ.towards the ends.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. – Station II – December 2013.

38) Gomphonema intricatum Kuetz. (Pl 4, F. 38)
Valves 9.51µ. Broad and 31.06 µ. long, sub clavate, axial area narrow, central area unilateral with an isolated. Striae 8 in 10 µ. In the middle and 10 in 10 µ.towards the ends.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. - Station II- May 2013.

39) Gomphonema parvulum (Kutez) Gran. V.exillius.O. Grun. (Pl.4, F. 39.)
Valve 5.70 µ. Broad, and 25.36 µ. Long narrowly lanceolate,withrostrate apex. Axil area narrow, central area unilateral, striae 13-16 in 10 µ.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. - Station II –October 2013; Station III-October 2013.

40) Hantzchia amphioxys (Ehr) Grun. F. capittata. O. muell.(Pl.4, F. 40)
Valve 12.17 µ. Broad and 121.73 µ. Long linear, capitates ends. striae 16-18 in 10 µ.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. - Station II- February – 2013.

41) Nitzschia gracilis Hantzsch. (Pl.5, F. 41)
Valve 3.17 µ. broad and 81.15µ long, elongated with slightly capitates ends striae more than 35 in 10 µ.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. - Station II-September 2013; Station III-September 2013.

42) Nitzschia obtusa W. smith. (Pl.4, F. 42)
Valves 6.97 µ. broad and 72.91 µ. Long linear with obliquely, rounded ends. Keel strongly excentric. Keel punctate. 8-9 in 10 µ. Rounded. Striae about 30 in 10 µ. fine and not clearly visible.
latitude 20° 51′ -2° North and longitude 74° 1′ -23° East. - Station I –March 2013; Station II – March 2013.

43) Surirella ovata Kuetz. (Pl.5, F. 43)
Valves 26.62 µ. broad and 40.57 µ. Long heteropolar, broadly ovate, base Pseudoraphe narrow, linear, striae 16-20 in 10 µ.very distinct coarse.

RESULTS AND DISCUSSION
The present investigation is the outcome of Biodiversity diatoms. Such taxonomical study of diatoms is basically useful to taxonomists and researchers of algae for future research work. Present study also useful for science and society to know what type of diatoms are available from this area. As diatoms are concerned with pollution it certainly helpful to environmental scientists. Authors are agree to some extent of previous works carried out by Nerargar PB (2011), Bhibishan et al. (2011) Sandhya Patil (2014) . Twenty three algal taxa belonging to forty five genera of Diatoms. Melosira(2); Cyclotella(1); Fragilaria(2); Synedra(2); Eunotia(1); Cocconeis(1); Achnanthes(2); Mastogloia(1); Frustulia(1); Gyrosigma(1); Pleurosigma(1); Coloneis(1); Neridium(1); Diploneis s(1); Stauronesis(1); Navicula(6); Pinnularia(4); Amphora(1); Cymbella(4); Gomphonema(4); Hantzschia(1); Nitzschia(2); Surirella (3).was recorded first time from this area.

Acknowledgement
Authors are thankful to University Grants Commission, (WRO), Ganeshkhind, Pune for financial assistance provided to operate this Minor research project. Author’s are also thankful to the Principal, S. G. Patil College, Sakri, GET’S Arts, Commerce and Science College Nagaon and S.S.V.P. Santhu Dhule’s Late S. D. Patil alias Baburao Dada Arts, Commerce and Late Bhausheb M. D. Sisode Science college Shindkheda Dist. Dhule for providing laboratory facilities.
1. Melosira granulate (Her) Ralfs V. angustissium O muell.
4. Fragilaria intermedia Grun.
5. *Fragilaria ungeriana* Grun
7. *Synedra ulna* (Nitz) Eher.
9. *Cocconies placentula* Her

10. *Achnanthes coarctata* Bred.V.parallela venkat.
16. *Caloneis silicula* (Her) cleveV. truncatula (Grun) Mayer.
18. *Diplone elliptica* (kuetz) cleve V.ladogensis Cleve.
20. *Navicula bacillum* Her.

23. *Navicula gastrum* Her.
25. *Navicula wardhensis* Sarode and Kamat.
27. *Pinnularia finlandica* A. cl.
31. *Cymbella aspera* (Ehr) cleve.
32. *Cymbella gracilis* (Rabh) cleve.
33. *Cymbella tumida* (Breh) V. H.
34. *Cymbell turgid* (Greg) cleve.
35. *Cymbella ventricosa* Kutz.
38. *Gomphonema intricatum* Kuetz.
41. *Nitzschia gracilis* Hantzsch.
42. *Nitzschia obtusa* W. smith.
43. *Surirella ovata* Kuetz.
44. *Surirella robusta* Ehr.
45. *Surirella subsalsa* W. smith.

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How to Cite this Article: