Seasonal Variations and Diversity of Marine Diatoms of Jegathapattinam and Kattumavadi, South East Coast of India

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Abstract—The present study entitled on Seasonal variations and diversity of planktonic marine diatoms of Jegathapattinam (Lat. 09° 95 N; Long. 79° 18 E) and Kattumavadi (Lat. 10° 13 N; Long.79° 22 E) South East Coast of India was carried out for a period of one year (from June 2011 to May 2012). The study focuses attention on the survey, systematics of marine diatom diversity and the influence of physico-chemical factors on their seasonal distribution. A total of 52 species belonging to 38 genera of marine diatoms were recorded from both stations. The most common genera were Actinocyclus, Amphora, Bacteriastrum, Biddulphia, Chaetoceros, Coscinodiscus, Cyclotella, Diploneis, Gyrosigma, Licmopedia, Melosira, Navicula, Nitzschia, Pleurosigma and Tropidoneis were present in the two stations. Higher values of diatom population density were found during summer at both stations. The seasonal distribution and abundance are discussed in relation to physico-chemical parameters.

Key words: Diversity, Marine Diatoms, Physico-Chemical parameters, India

I. INTRODUCTION

Diatoms (Division: Bacillariophyta) are one of the largest group of microorganisms. Diatom is among the most successful group of photosynthetic eukaryotes. Microorganisms on earth and are probably well in excess of 100,000 species (Mann 1999.) Ocean represented a habitat of living environment which are continuous with the past. Diatoms, the micro algae that are found in all aquatic and moist environments, first appeared more than 180 million years ago (Bradbury, 2004). Diatom plays a vital role in establishing food chain relationship between different organisms in marine and estuarine ecosystem (Heald and Odum, 1970). These diatoms occur abundantly and fix significant fraction of their organic carbon to support the ecosystem (Admiraal, 1984). Diatoms are an important indicator of environmental changes where individual species respond directly or indirectly and sensitively to changes in chemical, physical parameters. Such as temperature, light, pH, nutrients, silicate, phosphorous, and nitrogen (Stevenson and Pan, 1999). The fact that each diatom species has a specific optimum and tolerance for some environmental parameters including pH, salinity, temperature, nutrients and light availability, makes them particularly useful indicators for biodiversity (Lim et al., 2001). Hence the present work was undertaken to study the seasonal variation and diversity of planktonic diatoms and hydrographical parameters in Jegathapattinam and Kattumavadi of Pudukkotai District, South East Coast of India.

II. MATERIALS AND METHODS

The planktonic marine diatoms were collected by towing plankton net (mouth diameter 0.35m) made of bolting silk cloth (No.35 meshsize 48 m) for 20 minutes., from the surface of water during themonthly intervals for a period of one year (from June 2011 to May 2012) at two stations in Jegathapattinam (Lat. 09° 95 N: Long. 79° 18 E) and Kattumavadi (Lat. 10° 13 N; Long.79° 22 E) Pudukkotai District. The Water samples were preserved in 4 % neutralized formalin and used for nutrient analysis, qualitative analysis of diatoms, the settling method described by Sukhanova (1978); Cleaning of diatom sample by Nitric acid Method (Hendey, 1964). Identification of diatoms by Standard Manuals (Boyce, 1926 ;) Hustedt (1930); Subrahmanyan (1946); Cleve-Euler (1951-1955); Hendey (1964).

III. RESULTS AND DISCUSSION

A. Environmental Parameters and their Influence

For this study monthly variation in meteorological and physico-chemical parameters, rainfall, air, surface water temperature, salinity, pH, dissolved oxygen, reactive silicate, inorganic phosphate, organic phosphate, nitrate and nitrite were recorded for a period of one year from June 2011 to May 2012. The total annual rainfall recorded from the study area(S I and S II ) varied from 1.0 mm to 413.6 mm. Minimum 1.0 mm rainfall was recorded during February 2012 at station I and II. Maximum 413.6 mm rainfall was recorded during November 2012 at station I and II. The Physicochemical parameters are subjected to wide spatial temporal variations. Rainfall is the most important cyclic phenomenon in tropical countries as it brings about important changes in the physical and chemical characteristics of the coastal and estuarine systems.Similar observation was reported by Kaliyaperumal, (1992) and Mathevan (1994).

Temperature is another important factor in the coastal and estuarine environments, which influences the physico-chemical characters. In general, air and water temperatures were recorded during the summer months during the study period varied from 23 to 36°C. The minimum (23°C) was recorded during the month of November 2011 at station II and maximum was recorded (36°C) during the month of May2012 at station I and II. The surface water temperature varied from 23 to 34°C. The minimum surface temperature was recorded (23°C) was recorded during July and November 2011 at station I and maximum was recorded during May 2011 at station II. In general the two stations showed similar monthly changes. Similar observations were reported by Ramalingam Manikannan et al., (2011) from Vedaranyam.
Swamp of the Point Calimere, South-east coast of India, Sushanth and Rajashekhar (2012) from the coastal ecosystem.

Salinity is one of the key factor that determines the distributions of diatoms. In the present study, salinity range varied from 28 to 37ppt. The low value (28ppt) during November 2011 at stations II and high value (37ppt) during the month of July and May2011 and 2012 at station I. This could be due to the continues evaporation of water from the all study area especially during the summer seasons as observed by Palpandi (2011) from Vellar estuary, South east coast of India by many workers. Similar trend in the salinity values were also observed from various parts in southeast coast of India (Seenivasan, 1998; Palanichamy and Rajendran, 2000; Sulochana and Muniyandi, 2005; Prabu etal., 2008; Soundarapandian etal., 2009; Damotharan etal., 2010). In all the above studies the salinity was found fluctuating widely which was mainly due to the influence of rainfall and influx of the freshwater into the study areas.

The hydrogen ion concentration (pH) of water may influence many biological and chemical characteristics of marine waters (Saad, 1978). In general hydrogen ion concentrations fluctuated in all the stations during the study period and the temperature as suggested by several authors attributed to the variations in freshwater inflow and tidal water. Variations throughout the study period at both stations. In all the above studies the salinity was found fluctuating widely which was mainly due to the influence of rainfall and influx of the freshwater into the study areas.

Dissolved oxygen showed a wide range of variations through out the study period at both stations. In general, the maximum values recorded during the monsoon month and minimum during the summer month. This is attributed to the variations in freshwater inflow and tidal ingress (Esvari and RamanaiBai 2002). This was effect by low salinity, air and surface water temperature values. The earlier findings confirmed works that high concentrations of dissolved oxygen in low saline water coupled with low temperature during monsoon. It was noted that in the study area, the standing crop of diatoms were more during summer months (when dissolved oxygen concentrations was low due to cessation of freshwater flow) as reported by Jayachandran (1989) in Pitchavaram mangroves.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of the Diatoms</th>
<th>S. N. O</th>
<th>Name of the Diatoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Actinocyclushehner gii var. ralfsii (W.Smith)</td>
<td>27</td>
<td>Melosira ruminuloides Agardh</td>
</tr>
<tr>
<td>2.</td>
<td>Achnantheshaukianna Grun.</td>
<td>28</td>
<td>NaviculaarabicaGrun</td>
</tr>
<tr>
<td>3.</td>
<td>Amphora coffeaeformis(Ag.)Kutz</td>
<td>29</td>
<td>N. clementisivar. linearis Brander ex Hustedt</td>
</tr>
<tr>
<td>4.</td>
<td>A. marina (W.Sm.)V.H</td>
<td>30</td>
<td>Navicula granulate (Bailey)</td>
</tr>
<tr>
<td>5.</td>
<td>A. ovalis(Kutz) (Kutz)</td>
<td>31</td>
<td>N. lyrHer</td>
</tr>
<tr>
<td>6.</td>
<td>Bacteriastriumfurcatus mShadbolt</td>
<td>32</td>
<td>N. rhychocephalaKützing</td>
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<tr>
<td>7.</td>
<td>Bidulphiambiliosens sBailey</td>
<td>33</td>
<td>N. salinarumGrunow</td>
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<tr>
<td>8.</td>
<td>Caloneispermagna(Bailey) Cleve</td>
<td>34</td>
<td>Nitzschia closterium(Ehr. enberg)W-Smith</td>
</tr>
<tr>
<td>9.</td>
<td>Chaetoceroslorenzian usGrun</td>
<td>35</td>
<td>N.flexaSchumann</td>
</tr>
<tr>
<td>10.</td>
<td>CocconeiscostataGreg</td>
<td>36</td>
<td>N.granulateGrun</td>
</tr>
<tr>
<td>11.</td>
<td>Coscinodiscuscentralti sHer</td>
<td>37</td>
<td>N. insignisGreg</td>
</tr>
<tr>
<td>12.</td>
<td>C. kutzingiiA.Schmidt</td>
<td>38</td>
<td>N. punctate (Wm.Smith) Grun</td>
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<tr>
<td>13.</td>
<td>C. normaniGregory in Greville</td>
<td>39</td>
<td>Pinnulariaviridis(Nitzsch ) Ehrenberg</td>
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<td>14.</td>
<td>Cyclotellastratiata(Kutz ) Grun</td>
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<td>Planktioneisselas (wallich) Schutt</td>
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<td>15.</td>
<td>Diplomenoraccocceni formaA &amp; S Plaze</td>
<td>41</td>
<td>Pleurosigmaeustaurii(De breb.)W.Smith</td>
</tr>
<tr>
<td>16.</td>
<td>Diploneisbombus(Ehr. ) Her</td>
<td>42</td>
<td>Rhabdomarimirificoom wsmith</td>
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<tr>
<td>17.</td>
<td>D. crablo Her</td>
<td>43</td>
<td>RhopalodiagibberulaKutz z</td>
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<td>18.</td>
<td>D. weissflogii(A.Schmidt) Cleve</td>
<td>44</td>
<td>Skeletononmacostatum(Greville) Cleve</td>
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<tr>
<td>19.</td>
<td>Grammatophora marina (Lyngb.) Kutz</td>
<td>45</td>
<td>SurirellaminutaBrèsißos nin Kützing</td>
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<td>20.</td>
<td>Gyrosigmaattenuatum (Kutz.) Rabh</td>
<td>46</td>
<td>SynedrafromosaHantzsch</td>
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<td>21.</td>
<td>G.balticum(Ehr).Clev e</td>
<td>47</td>
<td>Thalassionemanitzschoi desGrunow</td>
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<td>22.</td>
<td>G. distortumvar. parkeri (M.B.Harrison)</td>
<td>48</td>
<td>Thalassiothrixfrauenfeldi iGrunow</td>
</tr>
<tr>
<td>23.</td>
<td>G. scalpoides(Rabh.) Cleve.</td>
<td>49</td>
<td>Thalassiosiradecipiens(Grunow)</td>
</tr>
<tr>
<td>24.</td>
<td>LauderiaannulataClev e</td>
<td>50</td>
<td>TriceratiiumdubiumBrigh twell</td>
</tr>
<tr>
<td>25.</td>
<td>Licmophora abbreviat Agardh</td>
<td>51</td>
<td>TriceratiiumfavusEhrenberg</td>
</tr>
<tr>
<td>26.</td>
<td>Licmophora abbreviat Agardh</td>
<td>52</td>
<td>Tropodoneis Lepidoptera (Gregory) Cleve</td>
</tr>
</tbody>
</table>

Table 1: List of isolated Diatoms
Table 2: Diatom population Density (cell numbers/ ml) during 2011-2012

Table 3: Environmental parameters -2011-2012 (Station I)

Table 4: Environmental parameters -2011-2012 (Station II)
Diatom Population Density

Diatom population density ranged between 3740 and 11138 cells/ml. Minimum population density was observed during the month of November 2011 and maximum was recorded in the month of March 2012 (Table II & Fig.-1-2). In minimum population was reported from station I (3740 cells/ml). Planktonic diatoms totalling 52 species belonging to 38 genera were collected from the both stations in the study area (Table - I & V). In station I 33 species belonging to 26 genera, at station II 26 species 20 genera (Table - V).

Similar observations were made by many workers (Nagasathyaa and Thajuddin, 2008; Ya-hui,Lianget al.,2011).

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