Epipelic Algae Species Composition and Abundance in the Brackish Water Axis of Sombreiro River, Niger Delta, Nigeria

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ABSTRACT

The epipelic alga of Sombreiro River was investigated from April 2012 to March 2014. A total of 53 taxa belonging to 32 genera and 4 classes were identified. The most prominent were the Bacillariophyta represented by 22 species followed by the class Cyanophyta with 14 species, Chlorophyta represented by 13 species and finally Chrysophyta with 4 species all belonging to a single genus. The more common genera were Tabellaria, Nitzchia and Synedra (Bacillariophyta) and Dactyloccopsis, Raphidropsis and Phormidium (Cyanophyta). Baccillariophyta dominated the epipelic algae community with 61.08% of the total number of individuals enumerated, followed by the class Cyanophyta (33.75%) and then by Chlorophya and Chrysophyta which had 3.32% and 1.85% respectively. The most encountered epipelic algae species (of class Baccillariophyta) was Tabellaria fenestrate with 40520 individuals. For class Cyanophyta two species Rhaphidropsis curvata and Dactyloccocopsis irregularis with a combined total of 26,200 individuals represented 90.85% of the entire class. Ankistrodesmus falcatus and Dinobryon bavaricum were the dominant species of Chlorophyta and Chrysophyta respectively, having a total of 1520 and 1360 each representing 52.78% and 85% respectively.

Key words: *Bacillariophyta; Bio-indicator organisms; Diatoms; Sediment; Species composition; Tabellaria*

INTRODUCTION

Epipelic algae are primary producers that dwell on the intertidal or sub- tidal surfaces of estuarine, coastal and marine environments. They live freely on sedimented surfaces, epidsammic algae live attached to grains in sandy sediments. According to Onwugbuta- Enyi (2004) they perform a range of ecosystem functions including bio- stabilization of sediment, regulation of benthic- pelagic nutrient cycling and primary production. The epipelic algae rank amongst the lowest plant forms, which are capable of utilizing low energy materials from the environment such as carbon dioxide and water in the presence of solar energy to produce

complex and high energy food materials (Chindah and Amadi, 1993). These food materials are found in sediments that are temporarily or permanently covered by water in streams, rivers and estuaries.

For the issue of sustainable development to be meaningful and effective, the various aspects of the biotic and abiotic resources (i.e. the total environment) from minute to multicellular forms of diatoms, blue green algae, green algae etc. are properly studied and understood. Epipelic algae consist of many taxonomic groups with a variety of sizes, shapes and forms; ranging from minute to multicellular abundance pattern reflect the nature of water body, nutrient status, and seasonal changes within the environment. Many of the epipelic algal species serve as viable indicators of certain environmental changes especially those due to anthropogenic sources.

Studies on the composition of bio-indicator organisms in the Sombreiro River and indeed in the larger Niger Delta area have been centered mostly on Phytoplankton (Abowei, et al., 2008; Davies, et al., 2009; Ezekiel, et al., 2011b), Zooplankton (Zabbey, 2008; Nkwoji, et al, 2010; Ezekiel, et al., 2011a), Benthic macro-fauna (Umesi and Daka, 2004) and to a lesser extent periphyton (Wokoma, et al., 2010). Information on the composition of the epipelic algae community of most River systems in the Niger Delta have not been reported, particularly that of Sombreiro River. This report is therefore targeted at bridging this gap.

MATERIALS AND METHODS

Description of the study area

The study area- Sombreiro River is located in Rivers State in the Niger Delta region of Nigeria, and lies between Latitude 6^0 30^1 to 7^0 0^1 E and Longitude 4^0 12^1 to 6^0 17^1N (Ezekiel *et al.*,2011b). It is a tidal dominated river, with possible fresh water input. The climate is classified as humid tropical of the semi hot equatorial type. The area experiences heavy rainfall from April to October with a mean rainfall estimated over 2000mm and mean annual temperature of about 29^OC. (UNEP, 2011). Recently heavy rains tend to begin by May, and even in the dry season months of November to March, sporadic heavy downpours are not uncommon. The vegetation of the river is predominantly mangrove with *Rhizophora racemosa*, *Rhizophora mangle* Gaertin and *Rhizophora harosanii* Leechman, as the dominant species (Abowei *et al*., 2008).

In order to obtain samples for this investigation, ten (10) stations were established along the River. The stations as well as their location and global positioning system (GPS) coordinates are in the Table 1.

Table 1: Sampling stations and their GPS Coordinates

S/No	Station No.	Location	GPS Coordinates	
			N	E
1	STN 1	Sikaka Kiri (Fishing settlement)	4˚ 34.692’	6˚ 48.037’
2	STN 2	Bille Boko (Gateway to Bille)	4˚ 36.126’	6˚ 50.418’
3	STN 3	Minjudu-Kiri (Fishing settlement)	4˚ 36.423’	6˚ 50.264’
4	STN 4	Chevron Jokka Well Head 1 & 1D	4˚ 37.145’	6˚ 49.556’
5	TNS 5	Idama Flow Station	4˚ 37.703’	6˚ 48.849’
6	STN 6	Idama Junction	4˚ 38.077’	6˚ 48.498’
7	STN 7	Da- obu Kiri (Fishing Settlement)	4˚ 39.353’	6˚ 48.185’
8	STN 8	Lele Kiri (Fishing Settlement)	4˚ 39.884’	6˚ 46.630’
9	STN 9	Erise Kiri (Fishing Settlement)	4˚ 40.796’	6˚ 46.899’
10	STN 10	Abonnema Urban	4˚ 43.329’	6˚ 46.476’

Field Methods

Epipelic algae (algae growing on the surface of sediment) samples were collected at low tide in each of the ten sampling stations in triplicates by randomly throwing a 2cm by 2cm quadrant on the sediment surface and carefully scrapping off the quadrant area with a scalpel, which was then emptied into a plastic vial, and preserved immediately with 10% formalin solution after proper labeling; To each of the container was then added a few drops of eosin solution to stain the tissues of the organisms and make them visible during microscopic analysis in the laboratory. The samples were then preserved in 10% formalin solution with few drops of eosin before transporting to the laboratory in an ice-chest cooler for identification and enumeration.

Laboratory Methods

In the laboratory samples were allowed to stand for a minimum of 24 hours before decanting the supernatant. The supernatant was removed carefully until a 50ml concentrated sample was achieved. The concentrated sample was then properly shaken and 1ml sub-sample was collected from it and transferred into a Sedgewick Rafter counting chamber using a stampel pipette. Identification and enumeration was carried out under a binocular compound microscope with magnification of 40 x 400. Three replicates of the sub-samples were analyzed. For each sample, each solitary cell was counted as one unit in a cell by cell basis. The result was then expressed in number of organisms per ml of sample.

Identification and characterization of the epipelic algae species was based on the descriptive keys and illustrations of Maosen, (1978) and Durand and Leveque (1980).

RESULTS

A total of 53 species belonging to 32 genera and 4 classes were observed (Table 2). The most prominent were the Bacillariophyta represented by 22 species (accounting for 41.51%) followed by the class Cyanophyta with 14 species (26.41%), Chlorophyta represented by 13 species and contributing 24.53% and finally Chrysophyta with 4 species (7.55%) all belonging to a single genus. The more common genera were Tabellaria, Nitzchia and Synedra (Bacillariophyta) and Dactyloccopsis, Raphidropsis and Phormidium (Cyanophyta).

TABLE 2: CHECKLIST OF EPIPELIC ALGAE FOUND IN THE WATERS OF SOMBREIRO RIVER

S/NO	BACILLARIOPHYTA	CYANOPHYTA	CHLOROPHYTA	CHRYSOPHYTA
1.	*Tabellaria fenestrate*	*Dactyloccopsis irregularis*	*Chlosteridium intermidium*	*Dinobryon bavaricum*
2.	*T. floculossa*	*D. acicularis*	*C. kuetzingii*	*D. cylindricum*
3.	*Nitzchia sigmoidea*	*Phormidium tenue*	*C. Cynthia*	*D. sertularia*
4.	*N. ricta*	*P. mucicola*	*C. strigosum*	*D. sociale*
5.	*Synedra ulna*	*P. valderiae*	*C. pauulum*	
6.	*S. acus*	*Anabaenopsis raciborskii*	*C. dranae*	
7.	*S. affinis*	*A. elenkini*	*Chlorogonium peterhofiense*	
8.	*S. cyclopum*	*Lymgbia linnetica*	*Schroederia*	

			setigera	
9.	*S. capitata*	*Oscillatoria lacustris*	*Ankistrodesmus falcatus*	
10.	*Naviculla anglica*	*Aphanizomenon flos – aquae*	*Phormidium valderiae*	
11.	*N. cryptocephala*	*Microcystis aeruginosa*	*Closteriopsis longissima*	
12.	*N. placentula*	*Rhabdoderma lineare*	*Treubania crassipina*	
13.	*N. viridula*	*Raphidropsis curvata*	*Larteria crucifera*	
14.	*Epithemia zebra*	*Rivularia planctoria*		
15.	*Melosira distans*			
16.	*M. granulate*			
17.	*Fragileria virescens*			
18.	*Eunotia lunaris*			
19.	*Rhizosolenia eriensis*			
20.	*Asterionella Formosa*			
21.	*Gyrosigma attenuatum*			
22.	*Pinnularia viridis*			

In terms of class abundance, Baccillariophyta dominated the epipelic algae community with 61.08% of the total number of individuals enumerated. It was followed by the class Cyanophyta which had 33.75% and then by Chlorophya and Chrysophyta which had 3.32% and 1.85% respectively (Fig. 1).

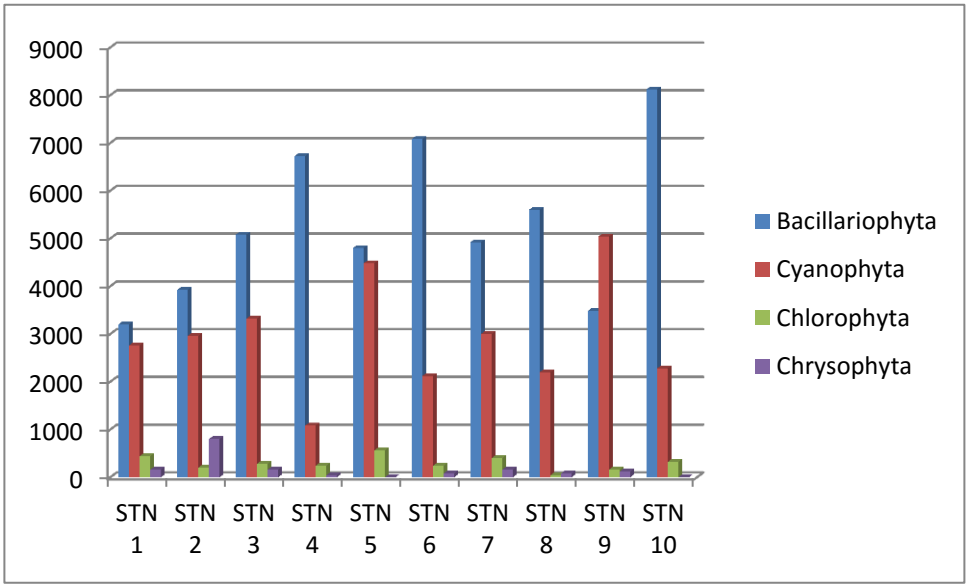

Fig. 1: Spatial distribution of Epipelic Algae Class Density from April, 2012 – March, 2014.

In terms of species abundance, the most encountered epipelic algae species (of class Baccillariophyta) was *Tabellaria fenestrate* which accounted for 76.57% of class Baccillariophyta with 40520 individuals. For class Cyanophyta two species *Rhaphidropsis curvata* and *Dactyloccocopsis irregularis* with a combined total of 26,200 individuals represented 90.85% of the entire class. *Ankistrodesmus falcatus* and *Dinobryon bavaricum* were the dominant species of Chlorophyta and Chrysophyta respectively, having a total of 1520 and 1360 each representing 52.78% and 85% respectively.

DISCUSSION

A total of 53 species of epipelic algae were recorded in this investigation spread across four classes and 32 genera. This is lower than the 112 species recorded by Aykulu (1982), as well as the 85 and 78 species reported by Gonulol *et al*., (2009) in Balik and Uzun lagoons of Turkey respectively. It is however higher than the 39 species recorded by Sahin *et al.*, (2010) but favourably compares with the 61 species of epipelic algae and 55 species of epilithic algae reported by Sahin (2002) in the Yedigoller Lakes – Erzurum-Turkey.

In terms of species composition among the four observed classes, Bacillariophyta was the most dominant with 22 species representing 41.51%, followed by Cyanophyta and Chlorophyta with 14 and 13 species representing 26.41 and 24.53% respectively. Following at the rear is Chrysophyta with only four species representing 7.55% of the total specie occurrence. Similarly, Sahin (2002) also observed four classes of epipelic algae namely, Bacilariophyta, Chlorophyta, Cyanophyta and Euglenophyta in decreasing order of class dominance having 35, 19, 6 and 1 species respectively. The same class dominance pattern was also reported for epilithic algae with Bacilariophyta having the lion share with 28 species, followed by Chlorophyta with 17 species, Cyanophyta with 7 species and finally Euglenophyta with only 3 species. The dominance of Baccilariophyta was also reported by Sahin *et al.*, (2010) in the Balik Lake, Turkey.

The dominance of Baccilariophyta in terms of total abundance as revealed in this investigation is in agreement with the conclusion of Aykulu (1982) and that of Sahin, *et al*., (2010) who both recorded Baccilariophyta as the dominant group in terms of species number and density. Similar dominance pattern was also recorded in previous studies by Sahin, (2008) and Sahin and Aker, (2005). Wokoma, et al., (2010) in their study on periphyton equally recorded Baccilariophyta as the most abundant class followed by Cyanophyta as in this investigation. While Baccilariophyta accounted for 61.08% of the total number of epipelic algae enumerated in this study, but accounted for 79.48% in the report of Sahin *et al.*, (2010).

CONCLUSION

The Epipelic algae community of Sombreiro River is dominated by individuals of class Baccilariophyta both in terms of species richness as well as total abundance, with *Tabelleria fenestrate* as the most dominant species.

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