

Observation of the Algal Flora (Phytoplankton) of the Coral Reef in Iraqi Territorial Waters

*Nida J.M. Al-Mousawi and **Jihad M. Al-Zewar

**Department of Biology, College of Science, University of Basra, Iraq*

***Department of Biological Development, Marine Science Center, University of Basra, Iraq*

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ABSTRACT

Coral reefs in Iraqi territorial waters are important and recent discoveries in the northwest of the Arabian Gulf. Fourteen samples were collected from five sites of these reefs from different levels of water column during the day and night. Exactly (46) taxa documented of phytoplankton suspended in the water column under (32) genus, of which (44) species belong to the Bacillariophyta, and only two species belong to the Dinoflagellate. The most common genera were *Rhizosolenia* and *Cheataceros* four species to both and *Nitzschia* three species. It was found that the species of higher frequency were *Cheatacerosdidymus*, *Coscinodiscus radiates* and *Thalassiothrixnitzschodis*, while species *Achnanthes*, *Amphora*, *Rhopalodia* and *Epithemia* were of fewer frequency.

Key word: *Algal Flora, Phytoplankton, Coral Reef, Iraqi Territorial Waters.*

Introduction

A coral reef is an underwater ecosystem characterized by reef building corals. Reef is formed of colonies of coral polyps held together by calcium carbonate. They are most commonly found at shallow depth in tropical or sub-tropical water, but deep water and cold water they are exist on smaller scales (Lee, 2008). Coral reefs are one of the richest environment in biodiversity (Goreau *et al.*, 1979). The productivity and biodiversity of these complex marine ecosystems can be compared to tropical rain forests in terrestrial environments (Maragos *et al.* 1996). Among these organisms, diatoms were found to be rather divers. Phytoplankton are often used as food supply in the aquaculture industry for grown (Harrison *et al.*, 1990).

Coral reefs are found in the Arabian Gulf in the United Arab Emirates, Saudi Arabia, Bahrain, Qatar, Oman, Kuwait, and Iran, whose coasts are rocky

sandy nature. Soon, no reefs were registered in Iraqi territorial waters because of the muddy nature of their coastlines. But in September 2012, coral reefs were discovered in this area. It is characterized by its environmental conditions such as turbidity and its soft fragile deposits and high currents that are not related to coral reefs in most parts of the world (Pohl *et al.*, 2014).

Taxonomic studies on benthic diatoms algae from coral reef are well dominant for instant Al-Handal, *et al.*, (2016,2018). The first one detailed list of benthic diatoms investigation was made in tropical water and coral reefs of Reunion & Rodriguez Island in Indian Ocean. The list includes 141 taxa. The last work also on benthic diatoms was made in Arabian Gulf which document (96) taxa belonging to 33 genera.

Few publications were available on the phytoplankton of the coral reef, most of which were about benthic diatoms.

The phytoplankton diatoms are well dominant as they play an important role in the ecosystem. Therefore, the present paper is to describe and illustrate the different members of diatoms algae in order to provide back ground data for future research.

Materials and Methods

Collection of Samples

Fourteen Phytoplankton samples were collected from the coral reef area of Iraqi Marine Waters (The coral reef has an area of 28 km² and is located at 29°37'00 N and 048°48'00 E) by using net with 120µm mesh size, at depth range from 1 to 8 m, during day and night in June 2014, Table 1. At bottom, column and surface of water column. The detail information of the coral reef area, location and environmental characteristics is reported by Pohl *et al.* (2014).

Preservation of Samples

The samples were Preserved in formalin 4%.

Diatoms Cleaning

Diatoms samples were cleaned by boiling with 30% hydrogen peroxide for 30 minutes, described in Al-Shaheen, (2016).

The Phytoplankton taxa were identified according to Al-Handal *et al.* (2018, 2016); Bourrelly, (1981); Heurek, (1962); Al-Shaheen, (2016); Lobban and Jordan, (2010); Goreau *et al.*, (1979), and were photographed using axophot imaging light microscope.

Results and Discussion

Total, 46 taxa belonging to 32 genera were identified during the present study, Table 2; in the present investigation (30) genera of diatoms including (44) species and tow genera of Dinoflagellate, with two species have been identified, Table 2 and 3.

The classification of phytoplankton taxa (Table 3) was generally based on Al-Kandari *et al.*, (2009) study, which recognized three classes under the division Bacillariophyta.

We did not notice differences in the presence of species according to the water column Table 1 Which indicates good confusion in the collection sites.

Four species of *Rhizosolenia* and *Chaetoceros* have been reported from the present investigation in water region, Table 3.

Species *Chaetocerosdidymus* and *Coscinodiscus radiates* were widely distributed 92%. Second in importance is *Thalassiothrix nitzschodis* which comprises 85%, while the species *Rhizosolenia alata* comprises 78% Plate 1.

The first station in the number of species has been dominated by 33 species, Table 2, while the third station was the lowest of species. It accounted for only eight species. It could be due to the gathering at night at the third station and day in the first station. The abundance of zooplankton has been observed in the third, fourth and eighth stations, which graze on phytoplankton, which leads to a lack of species.

The widespread occurrence of phytoplankton in coral reefs was attributed to high concentration of

Table 1. Different Locations and Times for Sampling of Marine Algae from coral reef in Iraqi territorial waters

Sample No.	GPS	Water column	Time
1	29° 37'09.9" N 48°48'22.6" E	Bottom	Day
2		Column	Day
3		Bottom	Night
4		Column	Night
5	29°38'244" N 48°49'219" E	Surface	Day
6		Column	Day
7		Bottom	Day
8		Column	Night
9	29° 38'02.8" N 48°49'12.4" E	Surface	Day
10		Bottom	Day
11		Column	Day
12		Bottom	Day
13		Column	Day
14		Bottom	Day

Table 2. Alphabetically the distribution of identified genera and species of phytoplankton from coral reef in Iraqi territorial waters.

Division	Genus or Sp.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Frequency	
Bacillariophyta	<i>Achnanthes (Eucocconeis) Barg</i>	+														1	
	<i>Amphiproraalata Cleve</i>					+							+			3	
	<i>Amphora ovalis Kützing</i>	+														1	
	<i>Asterionellaformosa Hassall</i>	+				+										3	
	<i>Asterionellahussall Hassall</i>	+				+										6	
	<i>Bacillariaparadoxa Gmelin</i>	+															4
	<i>Bacteriastrum sp. Shadbolt</i>																10
	<i>Bacteriastrumvarians Shadbolt</i>	+															10
	<i>Biddulphiairaileyii Gray</i>																5
	<i>Campylodiscus sp. Ehrenberg</i>																1
	<i>Centronellareichetti Kützing</i>																6
	<i>Cheatacerosparadunou Ehrenberg</i>																11
	<i>Cheatacerosarmatum Ehrenberg</i>																13
	<i>Cheatacerosdidymus Ehrenberg</i>																2
	<i>Cheatacerosperuvianum</i>																8
	<i>Cocconis sp. Ehrenberg</i>																10
	<i>Cocconodiscus radiates Ehrenberg</i>																10
	<i>Cyclotella spp. Kützing</i>																5
	<i>Cymatopleurasolenia W. Smith</i>																1
	<i>Cymbella sp. Ayardh</i>																6
	<i>Diploniesinterrupta Ehrenberg</i>																11
	<i>Epithemiaarcus Kützing</i>																13
	<i>Epithemiasorex Kützing</i>																2
	<i>Gyrosigma sp. Hassall</i>																8
	<i>Melosira Herzogii</i>																13
	<i>Nitzschia (Nitzschella) acicularis Hassall</i>																2
	<i>Nitzschialineararia Hassall</i>																1
	<i>Nitzschiaparadoxa Hassall</i>																4
	<i>Neiculamesolepta Kützing</i>																3
	<i>Neiculaserians Kützing</i>																1
	<i>Pleurosigma acuta</i>																4
	<i>Pleurosigma murinum Smith</i>																1
	<i>Rhizosolenia alata Brightwell</i>																11
<i>Rhizosolenia cochlea Brun</i>																7	
<i>Rhizosolenia imbricate Brightwell</i>																4	
<i>Rhizosoleniarobusta Brightwell</i>																2	
<i>Rhopalodia rhopala Kützing</i>																1	
<i>Stephanodiscus niagarae Hokansson & Hickey</i>																1	
<i>Surirellarobusta Ehrenberg</i>																1	
<i>Synedra capitata Kützing</i>																1	

Dinophyta

Table 2. Continued ...

Division	Genus or Sp.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Frequency
	<i>Tabellariafenestrata</i> William & Round		+													2
	<i>Thalassionemagrunt</i> Grunow	+														1
	<i>Thalassiothrixnitischodis</i> Cleven & Grun		+		+	+	+	+	+	+	+	+	+	+	+	2
	<i>Triceratiumconsimih</i> Cleve	+			+	+	+									7
	<i>Ceratiummassilliense</i> Courtt							+								1
	<i>Peridiniumdepressum</i> Bergh	46	33	16	8	13	17	14	23	10	9	10	9	13	12	9

Table 3. Taxonomic List of Marine Algae from coral reef In Iraqi territorial waters.

Division	Class	Order	Family	Genus & Species
Bacillariophyta	Coscinodiscophyceae Round & Crawford	Thalassiosirales Round & Crawford Cosinodiscales Round & Crawford	Stephanodiscaceae Nicolae Cosinodiscaceae Kützing Ehrenberg <i>Melosiraherzogii</i> Triceratiaceae Lemmermann	<i>Cyclotella</i> spp. Kützing <i>Stephanodiscusniagarae</i> Hokanssonf & Hickei <i>Coscinodiscus radiates</i> <i>Triceratiumconsimih</i> Cleve <i>Biddulphiaraileyii</i> Gray <i>Rhizosolenialata</i> Brightwell R. <i>cochilea</i> Brun R. <i>imbricate</i> Brightwell R. <i>robusta</i> Brightwell
	Fragilariophyceae Round	Chaeocerotales Round & Crawford	Rhizosoleniaceae De Toni Chaetocerotaceae Smith Ehrenberg C. <i>paradunou</i> <i>didymus</i> Fragilariaceae Greville	<i>Chaetocerosarmatum</i> Ehrenberg C. Ehrenberg C. <i>peruvianum</i> Ehrenberg C. <i>asterionelliformosa</i> Hassall A. hussall Hassall <i>Bacteriastromvarians</i> Shadbolt B. sp. <i>Centronellaealis</i> Kützing <i>Synedra</i> spp. Ehrenberg <i>Tabellariafenestrata</i> William & Round
	Bacillariophyceae Haeckel	Thalassionematales Round CymbellalesMann AchnanthesSilva NaviculalesBessey	Thalassionemataceae Round Cymbellaceae Greville Achnanthaceae Kützing Cocconeidaceae Kützing Naviculaceae Kützing Pterosigmataceae Mann Epithemiaceae Bessey Sub-family: Pseudoraphidiidae Diploneidaceae Mann Catenulaceae Mereschkowsky Bacillariaceae Ehrenberg	<i>Thalassiothrixnitischodis</i> Cleven & Grun <i>Cymbella</i> sp. Agardh <i>Achnanthes</i> (<i>Eucocconeis</i>) Barg <i>Cocconeis</i> sp. Ehrenberg <i>Naviculamesolepta</i> Kützing <i>Navicularians</i> Kützing <i>Gyrosigma</i> sp. Hassall <i>Pleurosigmaacuta</i> Cleve P. <i>murinum</i> Cleve <i>Epithemia arcus</i> Kützing E. <i>sorex</i> Kützing <i>Rhopalodiarhopala</i> Kützing <i>Thalassionemagrunt</i> Grunow <i>Diplonitesinterrupta</i> Ehrenberg <i>Amphiproronata</i> Cleve A. <i>evalis</i> Ehrenberg <i>Bacillariaparadoxa</i> Gmelin <i>Nitzschia</i> (<i>Nitzschella</i>) <i>acicularis</i> Hassall N. <i>linearia</i> Hassall N. <i>paradoxa</i> Hassall <i>Campylodiscus</i> sp. Ehrenberg <i>Cymatopleurmsolena</i> W. Smith <i>Surirellarobusta</i> Kützing <i>Ceratiummassilliense</i> Courtt <i>Peridiniumdepressum</i> Bergh
Pyrrrophyta	Dinophyceae West & Fritch	Surirellales Mann Gonyaulacales FJR. Taylor Peridimiales Haeckel	Surirellaceae Kützing Ceratiaceae Lindemann Peridimaceae Ehrenberg	

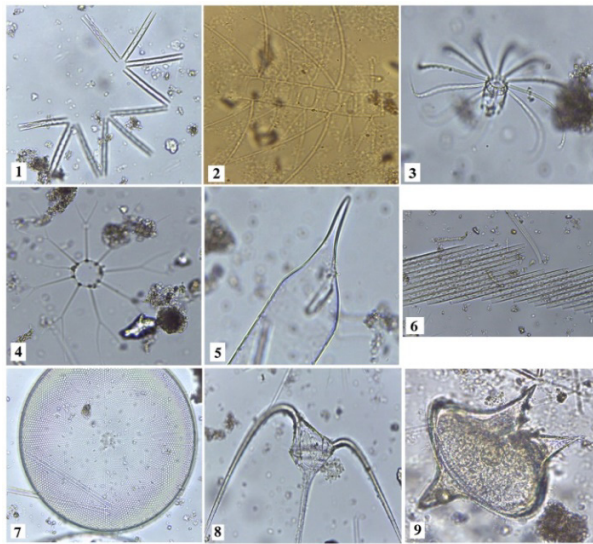


Plate 1. Some commongenera in current study station, (1) *Thalassiothrixnitzschodia* (2) *Cheatocerosdidymus* (3) *Bacteriastrumvarians* (4) *Cheatocerosarmatum* (5) *Rhizosoleniaalata* (6) *Bcillariaparadoxa* (7) *Coscinodiscus radiates* (8) *Ceratium sp.* (9) *Peridinium sp.*

silica, or may be due to the richness of organic matter and calcium and nutrients, Al-Kandari *et al.* (2009).

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