

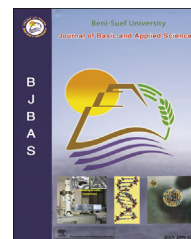
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## Full Length Article

# Contributions to the study of the marine algae inhabiting Umluj Seashore, Red Sea

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## ARTICLE INFO

## Article history:

Received 31 October 2014

Accepted 13 November 2014

Available online 9 December 2014

## Keywords:

Marine algae

Red Sea

Umluj

Saudi Arabia

## ABSTRACT

The marine algal flora of the Umluj city received no attention about the marine macroalgae. In this paper a total of 19 species are reported for the first time as occurring in the Umluj coast of Saudi Arabia. These species related to Chlorophyta (1), Phaeophyceae (6) and Rhodophyceae (12).

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## 1. Introduction

Floristic composition of aquatic algal flora, their distribution and sequence of periodicity can be used in evaluating

ecological changes. This is of special significance as the marine environment was subjected to considerable alteration during the last decades. These changes were intensively monitored (Haroun et al., 1995). The Red Sea has been a region of natural history exploration by European

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Peer review under the responsibility of Beni-Suef University.

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<http://dx.doi.org/10.1016/j.bjbas.2014.11.001>

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Plate 1 – Map showing the study area [Al Harrah, An Nasbah, Al Qars, Ad Dqam, Ash Shaban (N) and Ash Shaban (S)], Umluj, Red Seashore, Saudi Arabia, where samples were collected.

Table 1 – Description and location of collecting sites.

Site number	Site description	Coordinates
1	Al Harrah	25°12'28.24"N 37°12'34.08"E
2	An Nasbah	25°9'51.81"N 37°15'7.00"E
3	Al Qars	25°8'10.81"N 37°15'47.94"E
4	Ad Dqam	25°43'4.59"N 37°14'58.27"E
5	Ash Shaban(N)	24°45'54.20"N 37°12'36.58"E
6	Ash Shaban(S)	24°44'24.14"N 37°13'7.72"E

scientists from about 240 years. The first record of marine algae in the Red Sea was by Strand (a pupil of Linnaeus's), who in his thesis on the flora of Palestine listed three species (Papenfuss, 1968). The first person to collect marine algae from the Saudi Arabian Red Sea Coast, was the Danish botanist and explorer in the 18th century by Forsskal who, in the month of November 1762, made a collection of

Table 2 – Test methods details for the water analysis.

No.	Tests	Method reference
1.	Temperature	–
2.	pH	AOAC-973.41 (2005)
3.	Total Dissolved Solids (TDS)	Standard methods (1985)
4.	Bicarbonates	Standard methods (1985)
5.	Total chloride	Standard methods (1985)
6.	Sulfate	AOAC 925.54 (2005)
7.	Nitrate	Standard methods (1985)
8.	Calcium	AOAC-974.27 (2005)
9.	Magnesium	AOAC-974.27 (2005)
10.	Sodium	AOAC-973.54 (2005)

Table 3 – The recorded macroalgal species collected from the studied area along 52 km during Spring, 2011 on Umluj Seashores.

No. of algal sample	Algal species	Division	Water depth
1	<i>Enteromorpha intestinalis</i>	Chlorophyta	0.5–1 m
2	<i>Padina pavonia</i>	Phaeophyta	0.5–5 m
3	<i>Cystoseira myrica</i>	Phaeophyta	1–1.5 m
4	<i>Cystoseira trinodis</i>	Phaeophyta	1 m
5	<i>Colpomenia sinuosa</i>	Phaeophyta	1–1.5 m
6	<i>Turbinaria ornata</i>	Phaeophyta	1–2 m
7	<i>Sargassum latifolium</i>	Phaeophyta	1–2 m
8	<i>Laurencia majuscula</i>	Rhodophyta	17–44 m
9	<i>Laurencia catarinensis</i>	Rhodophyta	1–10 m
10	<i>Laurencia papillosa</i>	Rhodophyta	1–1.5 m
11	<i>Laurencia</i> sp.	Rhodophyta	20–44 m
12	<i>Laurencia</i> sp.	Rhodophyta	17–42 m
13	<i>Liagora hawaiiiana</i> Butters	Rhodophyta	1–1.5 m
14	<i>Hypnea bryoides</i> Børgesen	Rhodophyta	0.5–1 m
15	<i>Palmaria palmate</i>	Rhodophyta	0.5–1 m
16	<i>Galaxaura rugosa</i>	Rhodophyta	1–1.5 m
17	<i>Gracilaria arcuata</i>	Rhodophyta	0.5–1 m
18	<i>Acanthophora spicifera</i>	Rhodophyta	0.5–1 m
19	<i>Digenia simplex</i>	Rhodophyta	1–1.5 m

seaweeds from the Sea of Jeddah. Forsskal headed a Danish Expedition of 6 scholars to Egypt and Arabia. In the early years of the 19th century a British admiral Viscount Valentia made collections of algae from Red Sea and these were described by Turn in the 17th century (Mohamed et al.,

**Chlorophyta****Plate 2 – *Enteromorpha intestinalis*.****Phaeophyta****Plate 4 – *Cystoseira myrica*.**

2006). The Viscount is commemorated by *Hypnea valentiae* (Turner) Montagne. Several other workers, including medical doctors and amateurs collected marine algae from the Red Sea during the rest of 19th century. We shall only mention those who have collected algae from the Saudi Coast or determined algae collected from the same (Aleem, 1978). Furthermore, collection of algae from the Saudi Red Seashore Mohsen (1972), this writer states that he visited Jeddah and made algal collections in 1965, 1966 and 1967. In concluding this historical account, reference is made to a more recent work by Al-Saif et al. (2014) who recorded ten

marine algal species in Obhor region. The main objectives of this work is to survey, collect and identify the marine macroalgae species which inhabiting Umluj Sea-shores, Jeddah, Saudi Arabia.

**2. Materials and methods****2.1. The study area**

The study area was conducted among 52 km on the north-west coast of the Red Seashore, Kingdom of Saudi Arabia,

**Phaeophyta****Plate 3 – *Padina pavonia*.****Phaeophyta****Plate 5 – *Cystoseira trinodis*.**



**Phaeophyta****Plate 6 – *Colpomenia sinuosa*.**

Specifically, in Umluj city at latitude of 25°2'40.12"N and longitude of 37°15'45.32"E. Umluj city is a coastal town in northwestern Saudi Arabia, situated on the coast of the Red Sea between Al Wajh city (North) and Yanbu city (South). The town is located in the Tabuk Province. Algal samples were collected from six locations as shown in (Plate 1), namely are Al Harrah, An Nasbah, Al Qars, Ad Dqam, Ash

**Phaeophyta****Plate 8 – *Sargassum latifolium*.**

Shaban (N), and Ash Shaban (S) (Table 1; Plate 1). These area has a unique feature which is highly rich in flora and fauna. It was imperative to choose this location for the fact that, it is a fertile Sea shores without any industrial activities, absence of waste drainage materials, and the considerable less population inhabitants.

**2.2. Sampling and sample preparations**

The samples were manually collected from Umluj city throughout 14 days during the Spring season of 2011 from a deep length ranged of 0.5–44 m of the sea surface water. All samples were brought to laboratory in sterilized plastic bags

**Phaeophyta****Plate 7 – *Turbinaria ornata*.****Rhodophyta****Plate 9 – *Laurencia majuscula*.**

**Rhodophyta**Plate 10 – *Laurencia catarinensis*.**Rhodophyta**Plate 12 – *Laurencia sp.*

containing sea water to prevent evaporation. The algae then cleaned from epiphytes and rock debris then given a quick fresh water rinse to remove surface salts. Some of the collected seaweeds were preserved for identification. After cleaning, algae were dried in shade under 70 °C in vacuum oven for 2 days.

### 2.3. Identification of algal species

Algal species were identified according to Aleem, 1978, 1993; Bold, 1978; Lee (2008) and Coppejans et al. (2009).

### 2.4. Physico-chemical analysis of water samples

#### 2.4.1. Sample collection

Samples of water (approx. 2 L) were collected from the studied regions (Plate 1) in a clean, plastic bottles and transferred to the laboratory in cold condition.

#### 2.4.2. Estimation of water sample parameters

Analysis of water was carried out within few hours from the time of collection for determination of total dissolved solids, bicarbonate, total chloride, sulfate, nitrate, calcium,

**Rhodophyta**Plate 11 – *Laurencia papillosa*.**Rhodophyta**Plate 13 – *Laurencia sp.*



**Rhodophyta****Plate 14 – *Liagora hawaiiiana* Butters.**

magnesium and sodium. Moreover, water pH and temperature were recorded in situ (Table 2).

**3. Results and discussion****3.1. Algal collection and identification**

The algal survey for Umluj Seashores along 52 km throughout 14 days is the first attempt to record the algae species which present in the studied area (Plate 1) in our investigation. Table 3, showed that a total of 19 algal species were identified. Out of them, one species belonging to Chlorophyta, 6 to Phaeophyta and 12 species to Rhodophyta. Chlorophyta exhibited at water surface about 0.5–1 m (Plate 2). While Phaeophyta were

**Rhodophyta****Plate 15 – *Hypnea bryoides* Børgesen.****Rhodophyta****Plate 16 – *Palmaria palmate*.**

appeared at 1–2 m (Plates 3,4,5,6,7 and 8). Moreover, Rhodophyta species recorded at different depths (0.5–44 m). Table 3, showed that many species of red algae collected at depths 17,20, 42 and 44 m which called benthic algae (Plates 9–20).

**3.2. Physico-chemical analysis of water samples**

The present study monitored the variation in some physico-chemical parameters of the water sample in Umluj Seashores study area (Table 4). Average water temperature was 25 °C in Spring season. pH value was generally in alkaline side (7.7). The results further revealed high values of chloride ( $23,400 \text{ mg L}^{-1}$ ) and sodium contents ( $11,950 \text{ mg L}^{-1}$ ). Whereas, there was a remarkable increase in sulfate level. On the other hand, calcium, magnesium, nitrate, and bicarbonate recorded a clear fluctuation. Abiotic variations used to describe off shore areas in costal margins in seas, mainly related to

**Rhodophyta****Plate 17 – *Galaxaura rugosa*.**

**Rhodophyta**Plate 18 – *Gracilaria arcuata*.**Rhodophyta**Plate 20 – *Digenia simplex*.

climatic factors and sea water chemistry, led to understand the proper interpretation of the effect of these variables on seashore biology. The analysis of these physicochemical characteristics of water as well as recording of macroalgal species inhabiting Umluj Seashore constituent the major goals of the present survey. It was of prime importance to notice that one of the factors which affected to a great extent the flora composition and density of the species in the surveyed area was the physicochemical characteristics of the sea water. Water temperature is considered as the most important abiotic factor which affects directly or indirectly the distribution and abundance of marine vegetation. It well exhibits the distribution of the recorded algal species at the study seashore. This may be expressed by Van Hoff's law according

**Rhodophyta**Plate 19 – *Acanthophora spicifera*.

**Table 4 – Physico-chemical characters of water sample collected along 52 km on Umluj Seashores. (Data expressed as means of three replicates  $\pm$  SD).**

Water characters	Unit	Average
Temperature	$^{\circ}\text{C}$	$25 \pm 0.1$
pH		$7.7 \pm 0.1$
Total Dis. Solids	mg/L	$41,970 \pm 1.2$
Bicarbonate	mg/L	$146.5 \pm 1.0$
Total chloride	mg/L	$23,400 \pm 1.1$
Sulphate	mg/L	$3244 \pm 1.5$
Nitrate	mg/L	$78.5 \pm 0.1$
Calcium	mg/L	$449.38 \pm 0.1$
Magnesium	mg/L	$1450 \pm 0.2$
Sodium	mg/L	$11,950 \pm 1.0$

to which the rate of biological processes may increase for three times with a rise in temperature to  $10^{\circ}\text{C}$  within the tolerate limits (Clarke, 1954).

**Acknowledgment**

The authors advance thanks and appreciation to the Department of Botany and Microbiology, Collage of Science, KSU on sponsorship to conduct research.

**REFERENCES**

- Aleem AA. Contributions to the study of the marine algae of the Red Sea. III-Marine algae from Obhor, in the vicinity of Jeddah. Saudi Arab Bull Fac Sci 1978;2:99–118.

- Aleem AA. The marine algae of Alexandria. Egypt: Egypt Books House; 1993.
- Al-Saif SSA, Abdel-Raouf N, El-Wazanani HA, Aref IA. Antibacterial substances from marine algae isolated from Jeddah coast of Red sea, Saudi Arabia. *Saudi J Biol Sci* 2014;21:57–64.
- AOAC Official Method 925.54. In: Horwitz W, Latimer Jr GW, editors. Official methods of analysis of AOAC international. Gaithersburg, MD, USA: AOAC International; 2005.
- AOAC Official Method 973.41. In: Horwitz W, Latimer Jr GW, editors. Official methods of analysis of AOAC international. Gaithersburg, MD, USA: AOAC International; 2005.
- AOAC Official Method 973.54. In: Horwitz W, Latimer Jr GW, editors. Official methods of analysis of AOAC international. Gaithersburg, MD, USA: AOAC International; 2005.
- AOAC Official Method 974.27. In: Horwitz W, Latimer Jr GW, editors. Official methods of analysis of AOAC international. Gaithersburg, MD, USA: AOAC International; 2005.
- Bold HC. "Introduction to the algae" structure and reproduction. New-Jersey: Prentice. Hall. Inc.; 1978. p. 07632.
- Clarke GL. Elements of ecology. New York: John Wiley and Sons; 1954. p. 534.
- Coppejans E, Leliaert F, Dargent O, Gunasekara R, De Clerck O. SriLankan seaweeds methodologies and field guide to the dominant species; 2009. ISSN 1784–1283.
- Haroun BM, Sharaf AAM, Ibraheem B. Evaluation of natural productions in some common Egyptian marine algae. *J Union Arab Biol*, Cairo 1995:137–53.
- Lee RE. Phycology. 4th ed. USA: Cambridge University Press. Colorado State University; 2008. ISBN-13 978-0-511-38669-5.
- Mohamed NA, Ibraheem BI, Mohamed SH. Seasonal occurrence and variations in macro-algal populations in Hurghada, Safaga and Qusier coasts of Red sea, Egypt. In: Proc.4th Int. Con. Biol. Sci. (Botany); 2006. p. 189–97.
- Mohsen AFA. Contribution to the marine algal flora of the Red Sea shore bording Jeddah Zone.1. 1972. p. 151–69. Cyanophyta and Rhodophyta. *Bull. Fac. Scie. Riyadh. Univ.* 4, 113-133., 2. Phaeophyta, *ibid* 135-150., 3- Chlorophyta, *ibid*.
- Papenfuss GF. A history, catalogue and bibliography of Red Sea benthic algae. *Isr J Bot* 1968;17:119.
- Standard methods for the examination of water and wastewater. 16th ed. AWWA-WPCF-APHA; 1985.