Ecological and Phytochemical Studies on Brown Algae *Sargassum muticum* from Marsa Alam at Red Sea Coast, Egypt

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ABSTRACT

The present investigation revealed that Red sea stretches along Marsa Alam of Egypt is a habitation of diverse groups of marine macro-algal species recorded along Marsa Hemera shore. Ecological studies (meteorological data, water, soil, aqueous extract analysis of *Sargassum muticum* (Yendo) Fensholt and associated species) reported that, slightly alkaline; low turbidity, moderate temperature and available nutrient content of saline water produced massive growth of *S. muticum* during September (2018). Ecological and Physico-chemical properties of collected water samples showed variations of different parameters of sea water like temperature, salinity, pH, and high dissolved minerals. Heavy metals accumulation inside the investigated seaweeds *S. muticum* was within the corresponding range. The aqueous extract of *S. muticum* contained high amounts of Na, Ca, K and Fe, moderate amounts of Zn, and low in Cu, Cd, Ni and Mn. Lead Pb recorded 0.291 ppm, Ag, Co and Ga were absent in aqueous extract. The associated species to the brown algae *S. muticum* are belonging to 6 families and 7 species as follows: Sargassaceae, Fucaceae, Phaeophyceae, Rhodomelaceae, Caulerpaceae and Hydrocharitaceae. Results showed that *S. muticum* enriched in essential amino acids; micro and macro elements, carbohydrates, protein, lipids, and agar. These algae may be used as bio fertilizers.

Keywords: Seaweeds Ecology; Macro-algae, Red Sea coast, Marsa Alam, Phaeophyta, brown algae.

INTRODUCTION

Red Sea Governorate has an area of 130,000 km2. It includes some plains and highlands (Fig. 1). The weather in the plains is mainly dry and hot. The highlands are not populated. It is colder. In this district, the rainfall is very low and is not considered as water resource. The population growth rate of 2.09% is low compared to Egypt's mean which is 2.24% (Rayan et al 2003). The marine environment in which seaweeds, brown algae exists possesses great taxonomic diversity and synthesis metabolites with interesting biological activities for food materials and in medical applications. The marine macro-algae grow in harsh environments, with variable water currents, a restricted nutrient supply, and high concentrations of salts, sunlight, and oxygen, which may foster the production of natural compounds (Poore, et al., 2013). The growth and chemical composition of marine macro algae are significantly affected by their environmental and habitat conditions. Physico-chemical factors determine the occurrence of particular seaweeds at particular place at a particular season as reported by (Jung, et al., 2013). Hence the study of the physico-chemical characters of marine ecosystem is also very important. Marine organisms, especially algae are rich sources of natural bioactive products. Seaweeds also have come up step by step starting with using them as food, later as raw material for industrial, medicinal, pharmaceutical and cosmetic purposes (Chennubhotla , et al., 2013), associated with their high contents of protein, polysaccharides, minerals, essential fatty acids, carotenoids and vitamins which are related to several environmental factors (Jeeva , et al., 2012; Polat & Ozogul, 2013). The marine algae contain more than 60 trace elements, which are much higher than that in terrestrial plants and so, they have a pharmacological activities (Dhargalkar, 2014).

Seaweeds constitute an important source of natural resources for fertilizers and play an important role in agriculture and horticulture (Fan et al., 2011, Bierman and Rosen, 2013; Cordell and White, 2013, FAO, 2013). Seaweeds are known as sources of plant growth regulators, amino acids, mineral nutrients and vitamin precursors (Spinelli et al., 2010). The nutritional quality of seaweeds protein can be evaluated from amino acid composition and essential amino acids (Wong and

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Cheung, 2001). Their protein contents differ according to the species and seasonal conditions (Jadeja and Tewari, 2008). Agar, carrageenan and alginate are polysaccharides derived from seaweeds (Yang et al., 2011). *Sargassum* is a genus of seaweeds brown algae (order Fucales) macro-algae belonging to family Phaeophyceae, where they generally grow in shallow water and coral reefs. Most species within the Phaeophyceae are predominantly cold water organisms, but the genus *Sargassum* appears to be an exception (*Hogan and Michael 2011*).

Therefore, the present study was undertaken to investigate ecological parameters and phytochemical composition of brown algae seaweed, *Sargassum muticum* collected from Marsa Allam area (Marsa Hamera shores), Red Sea coast of Egypt during September, 2018.

MATERIALS AND METHODS

The resort of Marsa Alam is located on a town in south-eastern Egypt Red Sea (Fig. 1). Located 274 km south of Hurghada and connected to Edfu by 289 km long desert road. After creation of Marsa Alam International Airport in 2003, it became highly popular city. The Latitude: 25° 4' 3.4536" N, Longitude: 34° 52' 44.292" E

Meteorological data

Marsa Alam has a hot tropical desert climate like Hurghada and Sharm El Sheik. The collection site was along the semi-exposed shores of Marsa Alam and Marsa Hemera Red Sea coast of Egypt (Figs.1 and 2). It is one of the most important places of interest for brown algae growth in Egypt.

Meteorological Studies

Meteorological data obtained from nearest weather Station: El Qoseir, Egypt.

Sampling

Collection of brown algae (*Sargassum sp.*) and all associates.

Taxonomical studies of the all sea weeds.

The Identification of *Sargassum* sp. (Fig.3) and associated sea weeds. According to (Bhavanath et al 2009)

Separation of the different species according (De Széchy, 2012).

Identification of the collected sea weeds.

Sargassum sp. and its associated seaweeds were collected during September 2018 (Fig. 4 and 5). Macro-algae were collected using three quadrates (10 m × 10 m) in order to record each species. The identification and nomenclature of macro-algae followed (De Clerck, 2013, Bhavath et al 2009) and verified with illustrations by (De Széchy, 2012)

S. muticum, is commonly known as Japanese wire weed, large brown seaweed of the genus *Sargassum*. It is invasive seaweed with high growth rate. It has an efficient dispersion.

Higher classification: *Sargassum*

Order: Fucals

Class: Phaeophyceae

Family: Sargassaceae

Scientific name: *Sargassum muticum* (Yendo) Fensholt

Fig.1. Map showing Red Sea coast of Egypt

Fig. 2. Show Red Sea coast and the study site of Marsa Hemera After Rayan et al 2003

Fig. 3. Genral view of *Sargassum muticum*

Fig. 4. Japaneese Wire weed

Fig. 5. *Sargassum muticum* (Japaneese Wire weed) collected from the Red Sea coast at Marsa Hemera

S. muticum is submerged macro-algae attached to the sea floor either on mud or rocks by hold fast has been collected. Seven other associated species of macroalgae have been found, collected and identified. They are belonging to 6 families.

Collection and analysis of soil and water

Collection of soil and water samples

Water samples were collected at a depth 50 cm below the surface, then filtered using membrane filter of 47 mm diameter and 0.45 µm pore size, and were kept frozen at -20^{o}C for later analysis.

Physico-chemical analysis of water

Physicochemical parameters were measured according to (APHA, 1992) which including temperature, pH, salinity, K, Na, Ca, Mg and heavy metals were determined in lab of Soil Fertility Tests and Fertilizers Quality Control Laboratory Accredited according to ISO 17025/2005 Faculty of Agriculture, Mansoura University. The total contents of different elements were determined according to (Allen et al. 1997)

Physico-chemical analysis of soil samples

Soil samples were air dried and passed through a 2 mm sieve for eliminates gravels and coarse fragments. Analysis of soil samples included: texture, colour and calcium carbonate content. Texture and Calcium carbonate content analysis performed using standard hydrometer method according to (Carter and Gregorich, 2008). The soil colour was measured using Munsell soil colour charts (Munsell Colour Company, 1975).

Preparation of *S. muticum* samples.

S. muticum was washed with tap water and distilled water to remove salts on exposed surface, shade dried, and then kept in an oven at 60 °C for 4 h, then ground and stored in polyethylene bags at room temperature.

Chemical analysis of *S. muticum* aqueous extract.

Minerals (Na, Ca, K and Mg) and (Cu, Co, Zn, Fe, Cr, Cd and Mn) heavy metals were determined using Lab of Soil Fertility Tests and Fertilizers Quality Control Laboratory Accredited according to ISO 17025/2005 faculty of agriculture Mansoura university, using Thermo scientific iCap 7000 (Fig.6).

Protein content of *S. muticum* was determined using spectrophotometer followed (Bradford 1976), while, total carbohydrates were determined using spectrophotometer anthrone method (Hedge and Hofreiter 1962). The lipid content determined using the method following (Van Wychen et al, 2015), but the agar content extracted using method of (Roberts et al. 2015).

Fig.6 Thermo scientific iCap 7000

Antioxidant activity of *Sargassum species* aqueous extract

Detection method according to: Free radical scavenging of plant extracts was determined using ferric reducing antioxidant power assay (FRAP) procedure described by (Yu W et. al 2004).

Statistical analysis

All determinations were in triplicate. Data were expressed in terms of mean and were expressed in terms of mean ± SD. While, analyzed for variance and the least significant difference (LSD) using One-way ANOVA ($P < 0.05$), (SPSS, 2007).

RESULTS

Meteorological data of Marsa Alam area

Climate and average monthly weather in Marsa Alam, Egypt

Data showed in Table 1 that; Air temperature (Max) varied from 29,31,32,33 and 31°C in May, June, July, August, and September respectively. The months have a high chance of precipitation October, Novamber and December where 1mm the rate of rainfall. The warmest (air temp) month is July and August 32 and 33°C. October is the wettest month where the relative humidity 56%.

Taxonomical Studies of the collected species

Identification of *Sargassum* sp. and associated seaweeds.

The morphological study of *S. muticum* showed that plants were dark brown, 30 - 200 cm in length, leaves were 6-8 cm length, shape: linear to ovate, apex: acute, midrib inconspicuous and having serrate margin.

The relative abundance of each individual was estimated according to the equation folowed (Ashraf, Salman and Mohamed Azzazy, 2013):

$$\text{Abundance \%} = \frac{\text{No. individuals of a given species X 100}}{\text{Total No of all}}$$

Data in Table 2 revealed that, about 7 species belonging to 6 algal families identified at the Herbarium of the Environmental Studies and Research Institute, University of Sadat City during September 2018. The seaweeds community was quite diverse and dominated with *S. cinereum* Sargassaceae, with relative abundance 27.08 % followed by *C. myrica and H. johnsonii* 14.58% for each, *T. ornata* 12.5% and *L. papillosa* recorded 10.41%, and *P. minor* with relative aboundance 8.33 %, while *C. racemosa* recorded lowest representation 4.16%.

Table 1. Average climatic factors in Marsa alam (Mersa Hemera) 2018/2019

Climate Item / Month	Temprature 0°C		Water Temprature 0°C	Rain fall mm	Wind speed Km/h	Relative humidity %
	Max	Min				
January	28	25	26	0	14.4	48%
February	22	14	22	0	14.4	48%
March	24	16	24	0	14.4	50%
April	27	19	23	0	14.4	50%
May	29	22	25	0	10.8	48%
June	31	25	26	0	14.4	48%
July	32	26	28	0	10.8	50%
August	33	26	29	0	10.8	51%
September	31	25	28	0	14.4	54%
October	29	22	27	1mm	7.2	56%
November	26	18	26	1mm	14.4	54%
December	23	15	24	1mm	14.4	54%

* Data obtained from nearest weather station: El Qoseir, Egypt (70.0 KM)

Table 2: Analysis of the associated sea weeds to the brown macro algae *Sargassum muticum* (Yendo) Fensholt quantitatively

Dominant Sp.	Associates	Family	Number of Individuals	Abundance %
Sargassum muticum (Yendo) Fensholt	*Sargassum cinereum* J.Agardh	Sargassaceae	13	27.08
	Turbinaria ornata (Turner) J. Agardh		6	12.5
	Cystoseira myrica (S.G. Gmelin) C. Agardh	*Fucaceae*	7	14.58
	Padina minor yamada	Phaeophyceae	4	8.33
	Laurencia papillosa (C. Agardh) Greville	Rhodomelaceae	5	10.41
	Caulerpa racemosa (C. Ag ardh) .	Caulerpaceae Chlorophyta	2	4.16
	Halophila johnsonii Eiseman (seagrass	Hydrocharitaceae	7	14.58

Table 3. Minerals and heavy metals of sea water sample

Parameters	Temprature(C)°	pH	Salinity (%)	Na (%)	CL (%)	Mg ppm	Ca ppm	K ppm	Tl ppm	Zn ppm	Cu ppm	Co ppm	Ni ppm	Pb ppm	Al ppm	Cr ppm	Mn ppm	In ppm	Ba ppm	Sr ppm	Bi ppm	B ppm	Ag ppm	Cd ppm	Fe ppm	Ga ppm	Li ppm
Average vaue	28	8.48	3.83 M/mohs	1.7510	1.5904	1,102.909	449.540	484.492	N. D	0.010	0.192	0.013	N.D.	0.070	90.848	000	N.D	N.D	0.043	9.479	N.D.	N.D.	N.D.	0.029	0.038	0.392	0.105 ppm

Table 4. Showed mean values of pH, salinity, temperature and metal concentration (lg/L) in sea water samples at Marsa Alam (Marsa Hamera) Red Sea coast

Parameter	Max	Min	Average	Median	SD[a]	CV%[b]
pH	8.72	8.41	8.56	8.56	0.23	2.61
Salinity	41.34	38.21	39.77	39.00	1.07	2.71
Temperature	31.00	25.00	27.50	27.50	1.02	2.21
Fe	8.99	5.75	5.93	6.02	1.41	14.63
Mn	10.20	2.90	5.28	4.35	2.81	53.28
Ni	10.10	6.70	8.65	9.05	1.16	13.44
Cu	0.165	0.100	3.33	3.30	0.99	29.85
Zn	5.70	0.94	2.62	2.40	1.70	64.98
Cd	0.14	0.09	0.12	0.12	0.02	12.60
Pb	1.80	0.93	1.49	1.65	0.34	22.85

a Standard deviation (SD), b Coefficient of variation (CV)

Physical and chemical analysis of *Sargassum* habitat

Water

Table 3 Showed that water sample recorded moderate temperature (28°C), alkaline (8.4) the relative high concentration of Na (1.75%) and Cl (1.59%). Higher mineral content was found of Ca, K and Al, 449.540, 484.492 and 90.848ppm respectively, the mineral contents of Zn, Cu, Co, Fe were 0.010, 0.192, 0.013 and 0.038ppm respectively. The heavy metals contents in tested water sample of tested study were (0.00ppm) in case Ag, Ni or very low amounts in case of Cd (0.02ppm).

Table 4 showed amounts of elements in water sample associated with the studied macro-algae. Data revealed that the highest value Potassium (K) recorded 484.492 ppm, followed by by Ca (Calcium) 449.540 ppm, Mg (Magnesium) recorded. 1,102ppm. Iron (Fe) recorded 0.038ppm, while Silver (Ag), Boron (B) and Bithmus (Bi) were not recorded in water sample.

Soil

Table 5 showed soil samples associated to *S. muticum* of study area have soil moisture 12.32% and the salinity was 3.00 dsm^{-1}, The chemical analysis of soil samples in Table 5 showed that have moderate alkaline (pH= 8.47). The real density and Virtual density were 1.80 and 1.14 g/cm3 respectively.

Data obtained in Table 6, Showed the soluble cations contents K^+, Na^+, Ca^{+2} and Mg^{+2} were 0.68, 18.64, 4.16 and 19.39 meq/100g respectively. Also, the soluble anions of Cl^-, So_4^{-2}, H Co_3^- and Co_3^{-2} were 19.92, 10.17, 1.71 and 0.0 meq/100g respectively.

Biochemical analysis of *S. muticum*

Table 7, showed the biochemical analysis of the dominant macro-algae S. muticum during September 2018, data revealed that; total carbohydrates 35.37 ± 0.40 mg/g dry weight, protein content recorded 3.20 ± 0.30; lipids recorded 2.80 ± 0.04 mg/g while, the agar content recorded 91.37±1.20 mg/g of dry weight.

Table 8, showed the amounts of elements in aqueous extract of *S. muticum* Data revealed Table 8 that the highest value 21258.86 ppm recorded by Na (Sodium) followed by Mg (Magnesium) 878.064 ppm; Potassium (K) recorded 5,469.139 ppm; Phosphorus (P) recorded 379.0905 ppm, Iron (Fe) recorded 8.990 ppm while Silver (Ag), Cobalt (Co) and Gallium (Ga) were not recorded.

Table5. Physical analysis of soil

NO	Humidity (%)	Real denisity g/ cm^{-3}	Virtual density g/ cm^{-3}	Salinity dSm^{-1}	pH
2	12.32	1.80	1.14	3.00	8.47

Table 6. Chemical analysis of soil

Soluble Cations meq/100g				Soluble Anions meq/100g			
K^+	Na^+	Ca^{+2}	Mg^{+2}	Cl^-	SO_4^{-2}	HCO_3^-	CO_3^{-2}
0.68	18.64	4.16	19.39	19.92	10.17	1.71	---

Table 7. Total carbohydrates, Protein, Lipids and agar of *S. muticum* mg/g dry weight

Item	Carbohydrates	Protein	Lipids	Agar
September 2018	35.370 ± 0.40	3.20 ± 0.30	2.80 ± 0.04	91.37 ± 1.20

Table 8. Analysis of the minerals aqueous extract of *S. muticum* during September 2018

Elements	Concentrati
As 189.042	3.986 ppm
Mo 204.598	0.363 ppm
Hg 184.950	1.170 ppm
Ag 328.068	N.D
B 249.773	0.108 ppm
Ca 393.366	1,382.113
Cd 228.802	0.163 ppm
Co 228.616	N.D
Cr 283.563	0.121 ppm
Cu 324.754	0.156 ppm
Fe 259.940	8.990 ppm
Ga 294.364	N.D
In 230.606	0.200 ppm
K 766.490	5,469.139
Li 670.784	0.311 ppm
Mg 279.553	878.064 ppm
Mn 257.610	0.754 ppm
Ni 221.647	0.004 ppm
Pb 220.353	0.291 ppm
Sr 407.771	16.295 ppm
Zn 213.856	0.323 ppm
P 379.553	379.0905
Na 491.366	21258.86
Ti 334.941	691.758 ppm
Al 237.312	6.312 ppm
Bi 223.061	0.927 ppm
Li ppm	0.105

Table 9. Mean values of heavy metals (ppm) in brown algae *S. muticum* aqueous extract at Marsa Alam (Marsa Hemera) Red Sea

Metal	Min	Max	Average	Median	SD[a]	CV%[b]
Cr	0.121	0.142	0.1315	0.1315	0.48	1.03
Mn	0.754	2.912	1.833	1.833	72.51	47.20
Ni	0.004	1.31	0.657	0.657	1.22	18.01
Cu	0.192	1.75	0.971	0.971	2.97	46.25
Zn	0.64	0.323	0.481	0.481	2.34	71.38
Cd	0.33	0.163	0.246	0.246	0.05	21.25
Pb	0.51	0.291	0.400	0.400	0.24	18.12

While, a Standard deviation [b] Coefficient of variation

Data in Table 9 showed elements in aqueous extract of *S. muticum* where, highest value 2.912ppm recorded by Manganeze (Mn) , while the lowest value 0.163 ppm Cadmium(Cd).

Table 10 revealed that Glutamine amino acid recorded the highest value 0.38% followed by Asprteine 0.355, while the lowest value recorded by cysteine 0.04% of the dominant macro-algae species *S. muticum* aqueous extract.

Table 10. Amino acids analysis of *S. muticum* aqueous extract

Parameters	% crude protein
Asprteine	0.35
Threonine	0.16
Serine	0.15
Glutamine	0.38
Glycine	0.22
Alanine	0.28
Valine	0.19
Isoleucine	0.15
Leucine	0.22
Tyrosine	0.14
Phenylalanine	0.16
Histedine	0.05
Lysine	0.15
Argenine	0.16
Proline	0.11
Cysteine	0.04
Methionine	0.07

Table 11 represent the antioxidant activity of *S. muticum* aqueous extract showed that, DPPH recorded highest value 54.74 ± 0.59% and 54.32± 0.47% at concentrations 200 and 150 ug/ml respectively, while the lowest value 51.88± 0.27% at concentration 50ug/ml.

Table 11. Antioxidant of *S. muticum* aqueous extract

Sample I.D	Sample Concentration (ug/ml)	DPPH % "RSA"
Aqueous extract of *S. muticum*	50	51.88± 0.27%
	100	53.56± 0.39%
	150	54.32± 0.47%
	200	54.74 ± 0.59%

DISCUSSION

The environmental factors can become a stress to a given seaweed species, if it exceeds the upper or lower threshold values of tolerance (Hurd et al 2014). Marine organisms grow in often distinctive vertical or horizontal “zones” or “bands” along these gradients, thereby providing “natural laboratories” in which to study environmental (abiotic) and biological processes shaping the communities (Raffaelli and Hawkins 1996). *S. muticum* grows from half-tide to infra littoral areas (to a depth of 10 m (Thomas2002). Water transparency have profound effects on the quantity and quality of the light reaches seaweeds at their growth sites, where the primary importance of light to seaweeds is in providing the energy for photosynthesis (Huard et al 2014).

The temperature of the studied site during September 2018 varied from 33.00 ± 0.21 to 25.00 ±0.21°C (Table 1). Temperature affects the growth stages of macro- algae as tide level. Temperature is considered as a vital environmental factor controlling the growth and metabolic rates of marine organisms, especially on metabolic processes of photosynthesis and respiration in macro- algae (Zou and Gao, 2014). The physicochemical analysis of water indicates such as relative decrease of temperature, high alkalinity and salinity from September to November were parallel with Egyptian climate where water evaporation decreased and ran off beginning during October and increased during November (Jeeva et al, 2012).

The present study revealed that, macro- algal community was quite diverse with 6 families and 7 species recorded at Red Sea coast at Marsa Alam (Mersa Hemera study area), Sargassaceae represented by (*S. muticum, S. cinereum and T. ornate*). Fucaceae (*C. myrica*), Phaeophyceae (*P. minor*), Rhodomelaceae (*L. papillosa*), Chlorophyta Caulerpaceae (*C. racemose*) and Hydrocharitaceae (*H. johnsonii*) (Negm, 1988). *S. muticum* recorded the dominant community were associates represented with *S. cinereum* abundance 27.08% of the total associated macro-algae during September Table 2, this findings agreed with (Nazni and Renuga, 2015) who reported that the highest growth of *Sargassum* sp. recorded in September and October on the semi-exposed shore in Thailand. *S. muticum* is brown seaweed uses energy from sunlight to perform photosynthesis due to aerial vesicles allows the algae to raise to the sea water surface (Mohamed Abdel-Kareem, 2009).

The relative content of carbohydrates (35.370 ± 0.40), protein (3.20 ± 0.30), lipids (2.80 ± 0.04) and agar (91.37 ± 1.20) mg/g dry weight were recorded in *Sargassum muticum* extract during mature stage of alga in september Table 7. The relative low content of protein, lipids in *S. muticum* aqueous extract may due to relative low trophic (oligo-mesotrophic) status of the Red Sea water. Natural products such as agar content (91.37 ± 1.20) mg/g dry weight in *S. muticum* was agreed with that obtained by (Chee et al.2011) in *Sargassum* sp. in Malaysia. Minerals analysis of *S. muticum* showed higher contents of Na, K and Ca during September Table 8, this high value of Ca may due to the geographic changes of sediment and shores (Zubia et al. 2014).

Table 9 showed that heavy metals contents in *S. muticum* aqueous extract were higher during September. This may due to the long-term variations of heavy metals level in the marine environment. Metal content in macro-algae depends on various biological and environmental factors (the concentration and availability of elements in water, interactions between chemical elements, temperature, salinity, pH, light intensity and area geology) (Wasi and Ahmed 2013). Lead content (Pb) in surrounding water were relatively high. (Al-Homaidan 2006) reported that, Pb in brown algae from the Arabian Gulf were higher than those from the Sudanese Red Sea coast. High levels in the Arabian Gulf could be attributed to more man made activities, in particular oil industry, than in the Red Sea. The considerable high content of heavy metals and minerals in *S. muticum* Table 8 than that found in sea water Table 3 may due to algal accumulation of heavy metals. This may attribute to the presence of charged polysaccharides and alginic acid in cell walls of brown seaweeds. (Murugaiyan and Narasimman, 2012).

Table 10 represented amino acids of *S. muticum* aqueous extract, data revealed that, Glutamine amino acid recorded highest value 0.38% followed by Asprteine 0.355, while the lowest value recorded by cysteine 0.04% of the dominant macro-algae species *S. muticum* aqueous extract. In this connection, (Mattioli et al,2009) reported that, the growth enhancement effect of proline amino acid is mainly due to its role in regulating gene expression and providing hydroxyproline-rich glycoproteins that serve as structural constituents of the cell wall. Considering seaweeds as a rich source of proteins according to (Angell et al., 2016) the levels of different amino acids were profiled in plants supplemented with Sar and Jan extracts, while aspartate serves as an intermediate to support the synthesis of other amino acids, including lysine, threonine, isoleucine and methionine (Viola, 2001). The antioxidant property of the aqueous sea weed *Sargassum muticum* extract is shown in Table 11. The aqueous extracts of *S. muticum* capable of scavenging hydrogen peroxide in an amount dependent manner. 200ug/ml of aqueus extract exhibited 54.74 ± 0.59% scavenging activity on hydrogen peroxide. The results of antioxidant activity of different assays (DPPH, H_2O_2) showed that, the brown sea weed *S. muticum* has a higher radical scavenging property. Our presented study revealed that, the brown seaweed *S. muticum* aqueous extract showed excellent antioxidant activity as reported earlier (Hedge and Hofreiter, 1962). The antioxidant activity of brown seaweed extracts may due to their polyphenol content which might be the cause of recorded inhibitory effects (Van Wychen et al, 2015).

CONCLUSION

Our study indicated that, the physicochemical studied Red Sea water at Marsa Alam (Marsa Hemera) recorded moderate water temperature, slight alkaline pH; low turbidity, and valuable nutrient contents of the saline water which exerted massive growth of *S. muticum* (Yendo) Fensholt with maximum abundance during September 2018. Six macroalgae families were recorded and dominated with Sargassaceae family (*S. muticum*). The parameters evaluated in this study help in identification and standardization of seaweed *S. muticum*. Biochemical analysis of *S. muticum* aqueous extract showed its content of vital components (carbohydrates, protein, amino acids, minerals and metals). This seaweed may be valuable as bio fertilizer and in pharmaceutical and food industry. Also, biological evaluation using human and animal feeding investigations would be required to establish the expected nutritional and therapeutically values of this seaweed.

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الملخص العربي

دراسات بيئية وفيتوكيميائية على طحلب السارجاسوم ميوتيكم من الطحالب البنية لساحل البحر الأحمر، مصر

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كشفت هذه الدراسة على منطقة البحر الاحمر بطول حدود مرسى علم بمصر عن أن منطقة الدراسة تعتبرمأوى لمجموعات متنوعة من الأنواع البحرية الطحلبية المسجلة على طول شاطئ مرسى علم خصوصا منطقة مرسى حميرة حيث تنمو مجتمعات المانجروف التى بدورها تمد الأعشاب البحرية وجميع الكائنات المحيطة بالغذاء، وهذه المجموعة من الطحالب تنتمي إلى فايوفيتا ورودوفيتا وكلوروفيتا. واظهرت الدراسات البيئية ان المنطقة تتميز باعتدال فى درجات الحرارة ، ودرجة الحموضة والقلوية طفيفة. اثبتت الدراسة ايضا أن نقاء المياة وتوافر المغذيات للمياه المالحة ادت إلى نمو هائل وسيادة لنوع من الطحالب وهو *Sargassum muticum* (Yendo) Fensholt لاقصى قدر من الوفرة خلال شهر سبتمبر ٢٠١٨. أظهرت الخصائص البيئية خصوصا الفيزيائية والكيميائية لمياه البحر الأحمر اختلافات في الخصائص للمياه السطحية مثل درجة الحرارة، الملوحة، الرقم الهيدروجيني، والمعادن الذائبة. اثبتت الدراسة أن الأعشاب البحرية غنية بالأحماض الأمينية الأساسية والعناصر الصغرى. وتنتمي مجموعة الطحالب المرافقة والتي تم جمعها خلال هذه الدراسة إلى ست عائلات وهى: Sargassaceae, Fucaceae, Phaeophyceae, Rhodomelaceae, Caulerpaceae and Hydrocharitaceae وسجلت الاعشاب البحرية محل الدراسة ٧ انواع كالتالى: *Sargassum muticum, S. cinereum, Turbinaria ornate, Cystoseira myrica, Padina minor, Laurencia papillosa, Caulerpa racemose* and *Halophila johnsonii*.

أظهرت النتائج أن هذه الأنواع من الطحالب البحرية تحتوي على نسبة جيدة من الكربوهيدرات ذات القيمة الغذائية والبروتين والدهون والأجار وهي واعدة في مجال المستحضرات الصيدلانية والصناعة والزراعة وأن هذه الطحالب لها أهمية اقتصادية ليس فقط كعلف ولكن أيضًا كأسمدة حيوية.