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Temporal Variation in the Epiphytes of *Laurencia obtusa* and *Cystoseira myrica* from South Sinai, Northern Red Sea

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ABSTRACT

Algal epiphytes were examined for 12 months at Shura El-Roweysia and several tidal levels on the shore of South Sinai dominated by *Laurencia obtusa* and *Cystoseira myrica*. Sixty seven species of the epiphytes were recorded (41 Bacillariophyta, 20 Cyanophyta, 3 Chlorophyta and 3 Pyrrhophyta). An inverse relationship between percentage cover of *L. obtusa* and their epiphytes were observed to be affected by desiccation stress due to frequent emersion of the intertidal flat and exposure to strong radiation, while high cover percentage of *C. myrica* was associated with the high number of epiphytes.

Key words: Epiphytes, seaweeds, *Laurencia obtusa*, *Cystoseira myrica*, South Sinai, Red Sea.

INTRODUCTION

Epiphytic algae are found in marine environments all over the world, but many of the most beautiful come from the tropical seas (Dawes, 1981). Epiphytic algae can be found high up in the thallus, growing from branches, hold fast, decaying leaves like or other organic matter.

Epiphytic algae, that grow normally on seaweeds for support, do not harm their hosts, simply using them as surfaces for attachment to. They do so to take advantage of the available growing space up in the thallus, where they can have access to more sun light (Ballantine, 1979).

Investigations on the epiphytic communities on submerged or emergent macrophytes, such as *Myriophyllum* spp., *Potamogeton* spp. or *Phragmites* spp. (Cattaneo and Kalff, 1980; Cattaneo, 1983; Şen and Aksakal, 1988; Muller, 1995) have been more common than those on floating leafy species, such as *Nymphaea* spp. and *Nuphar* spp. (Romo and Galanti, 1998). Most of the descriptions are restricted to Bacillariophyceae and, consequently, aspects such as diversity, evenness and species richness of the complete algal assemblage, in which diatoms may sometimes be only a minor part, have been completely investigated by Van Dijk (1993). Furthermore, little information is available about vertical distribution of epiphytic biomass or its species composition in seaweed stands (Rogers and Breen, 1983; Muller, 1995), although it is recognized that lentic epiphyton is strongly influenced by its position in relation to depth (Walton *et al.,* 1995). Some workers suggest that light and turbulence are the main factors influencing epiphytic algal abundance with depth and these, in turn, are related to lake morphometry and trophic status (Lalonde and Downing, 1991).

Epiphyte loads reduce the productivity of macrophytes by shading and reducing nutrient availability (Bulthuis and Woelkerling, 1983; Tomasko and Lapointe, 1991; Neckles *et al.,* 1993 and 1994). Epiphyte abundance has been experimentally demonstrated to be a function of nutrient availability (Tomasko and Lapointe 1991; Neckles *et al.*, 1993 and 1994).

Although some reports have been published on epiphytic algae in Sinai (Potts, 1979 and 1984; Por *et al.,* 1977; Potts, 1979 and 1980), no general seasonal pattern of succession for epiphytic algae has been described. This is to be expected, since epiphyton community composition will depend on the substratum, environmental conditions and the level of grazing experienced (Cattaneo *et al.*, 1998). Nevertheless, the literature upholds the generalization that epiphytic algal abundance on submerged macrophytes fluctuates little or decreases slowly through the summer and increases in spring and autumn in temperate zones (Anna, 1999), and during the summer in southern regions (Underwood *et al.,* 1990). On emergent macrophytes, the maximum biomass is commonly attained in spring (Muller, 1994).

The northern part of the Red Sea has received extensive research efforts on seaweeds, but few investigations were done on epiphyte algae since Nasr (1947) and followed by Rayss (1959), Rayss and Dor (1963), and Hegazi (1992). They illustrated the distribution of seaweed species in this area. Therefore, the aim of this study is basically to form a data base of Sinai marine epiphytes, to describe the seasonal variation of epiphytes, and to increase the awareness on this very attractive group of algae.

MATERIALS AND METHODS

Algal Sampling

Monthly samples, of the most common biomass and perennial seaweed species in South Sinai, *Laurencia obtusa* (Hudson) Lamouroux and *Cystoseira myrica* (S. Gmelin) C. Agardh, were collected from Shura El-Roweysia, Sinai, Northern Red Sea (Fig. 1), between April 2002 and March 2003. Samples were collected by Snorkeling on rocky bottoms and pebble grounds in sub-littoral area of reef flat at 0.5-2 m depths. Each

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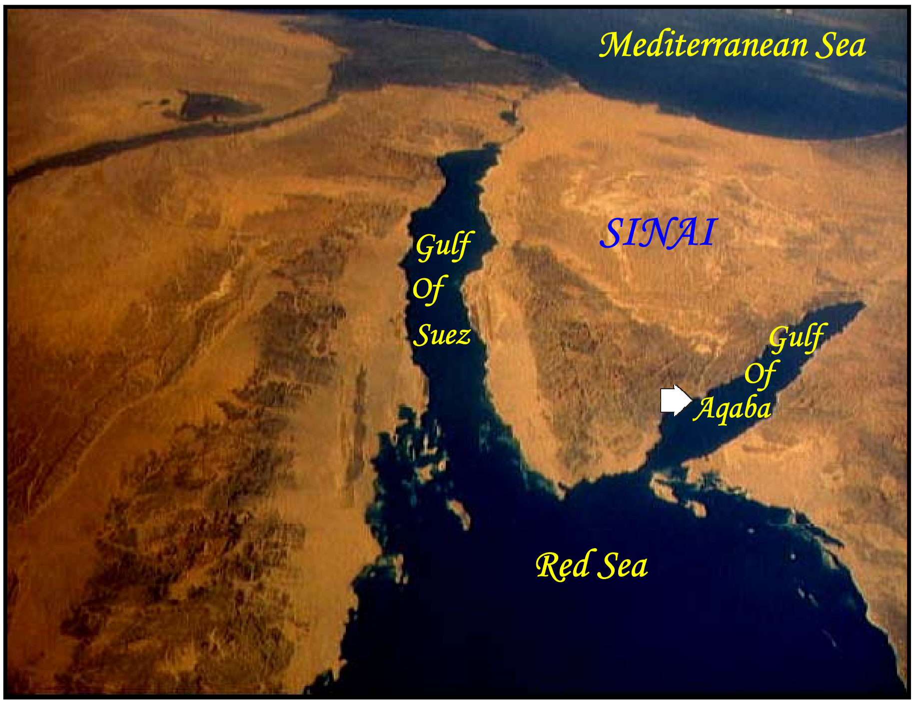

Figure (1): Satellite map showing South Sinai, Northern Red Sea. Localization of sample site. Shura E-Roweysia is marked with right arrow.

sample was collected by cutting out a square of *Laurencia obtusa* and *Cystoseira myrica* contained within a 2500 cm^2 metal quadrate.

Qualitative analysis of epiphytes

Epiphytes were collected according to Michael (1984), by scraping materials from the selected two species of seaweeds. Thallus of seaweeds were cut close to the bottom and allowed to float up. Pieces of the submerged portion were cut off with least disturbance and put into bottles containing filtered seawater. Scrapings from seaweeds thallus were washed in a beaker containing filtered seawater. The washings were concentrated by passing through a plankton net (0.45 µm), then were transfered to a Petri-dish and examined. The samples were examined using an inverted microscope; an Olympus 1 X 70 equipped with SC35 camera (type 12) and a Panasonic color monitor TC-1470 Y. The main references used for identification of epiphytic species were Desikachary (1959), Hendey (1964), Hindak (1984, 1988 and 1990), Humm and Wicks (1980), Hustedt (1939), Prescott (1978), Sykes (1981), and Tomas (1997).

Results

Epiphytes, most common on *Laurencia obtusa* and *Cystoseira myrica*, were represented in figure (2) and (3). The number of studies on epiphytic algae from marine habitats is small when compared with those from lentic or lotic systems, and both are overshadowed by the number devoted to phytoplankton. However, the importance of epiphytes in littoral zones, especially those

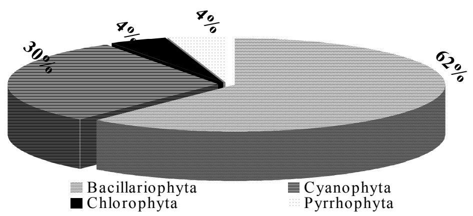

Figure (2): Number of species in different algal groups expressed as percentage epiphytes on *Laurencia obtusa* and *Cystoseira myrica*.

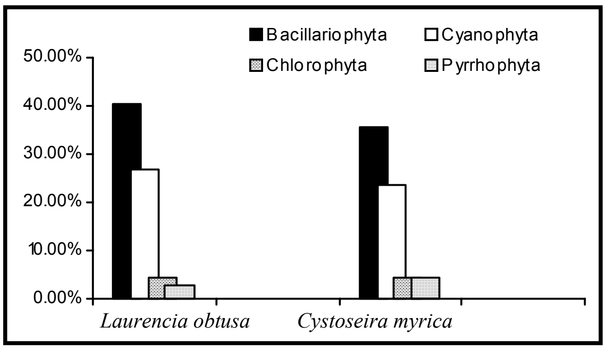

Figure (3): Comparison between number of species in different algal groups expressed as percentage epiphytes on *Laurencia obtusa* and *Cystoseira myrica*

colonized by seaweeds, is increasingly recognized, since it is now clear that the epiphytes can contribute significantly to the primary production of these zones, and represent a readily available food base for many invertebrates and fishes as mentioned by Cattaneo (1983).

Epiphytic algae grow on a variety of surfaces of both *Laurencia obtusa* and *Cystoseira myrica*. These fast-growing algae can compete for light. During the summer and autumn 2002, the dominant species on *L. obtusa* and *C. myrica* architectures included the diatoms *Centronella reichelti*, *Epithemia argus* and *Surirella didyma*. The maximum number of epiphytic diatoms was recorded in August 2002 on *C. myrica*; and in December 2002 and March 2003 on *L. obtusa* (Fig. 4 and 5).

Small Chlorophyta such as, *Cladophora* spp. and *Dictyosphaerium pulchellum* were observed on both species in Shura El-Roweysia. These green algae are fine and filamentous. When they were out of the water, they appeared as nothing more than a course film on the host alga, but when submerged these epiphytes branch out. On *Cystoseira myrica* during July 2002 and March 2003, no species of *Cladophora* and *Dictyosphaerium* were recorded (TP% = 0), but in September 2002 the TP% was 100, Pyrrhophyta TP% was minimum in December 2002 and recorded the maximum in July 2002 with 0 value and 100, respectively (Table 1). Species of Chlorophyta on host *Laurencia Obtusa* were found in all months of sampling period with maximum TP% in December 2002. Pyrrhophyta recorded minimum TP% in January and February 2003 (Table 1).

Table 2. identifies the epiphytic algae according to their presence or absence on *Laurencia obtusa* and *Cystoseira myrica* all over the study period (Plate 1). On *Laurencia obtusa*, fifty species of epiphytic algae were identified (27 Bacillariophyta, 18 Cyanophyta, 3 Chlorophyta and 2 Pyrrhophyta). While in *Cystoseira*

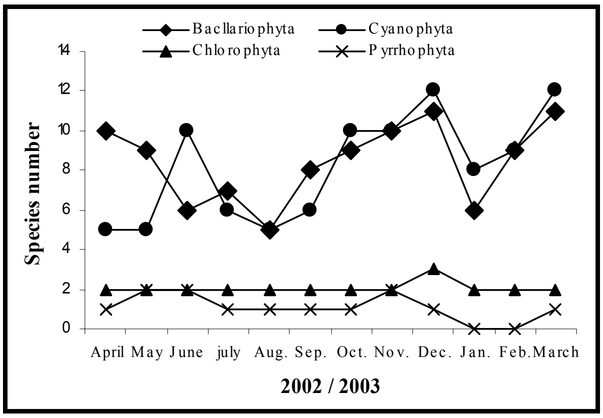

Figure (4): Temporal variation of epiphytes on *Laurencia obtusa*.

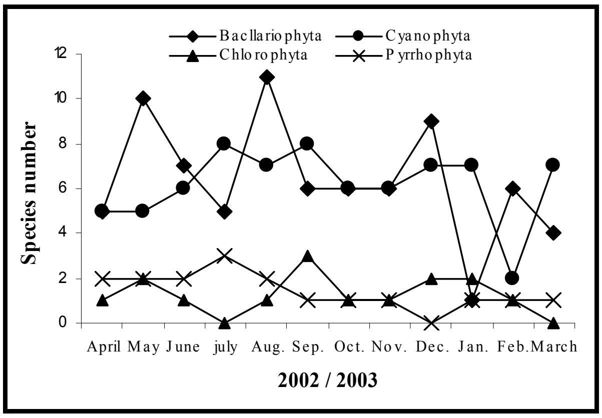

Figure (5): Temporal variation of epiphytes on *Cystoseira myrica*

Table (1): Relative percentage of epiphyte groups on *Cystoseira myrica* and *Laurencia obtusa* in different months.

Months	Bacillariophyta			Cyanophyta			Chlorophyta			Pyrrhophyta		
	N	TP%	GP%	N	TP%	GP%	N	TP%	GP%	N	TP%	GP%
Cystoseira myrica												
April 2002	5	12.1	7.4	5	25	7.4	1	33.3	1.4	2	66.6	2.9
May	10	24.3	14.9	5	25	7.4	2	66.6	2.9	2	66.6	2.9
June	7	17.07	10.4	6	30	8.9	1	33.3	1.4	2	66.6	2.9
July	5	12.1	7.4	8	40	11.9	-	-	-	3	100	4.4
Aug.	11	26.8	16.4	7	35	10.4	1	33.3	1.4	2	66.6	2.9
Sep.	6	14.6	8.9	8	40	11.9	3	100	4.4	1	33.3	1.4
Oct.	6	14.6	8.9	6	30	8.9	1	33.3	1.4	1	33.3	1.4
Nov.	6	14.6	8.9	6	30	8.9	1	33.3	1.4	1	33.3	1.4
Dec.	9	21.9	13.4	7	35	10.4	2	66.6	2.9	-	-	-
January 2003	1	2.4	1.49	7	35	10.4	2	66.6	2.9	1	33.3	1.4
Feb.	6	14.6	8.9	2	10	2.9	2	66.6	2.9	1	33.3	1.4
March	4	9.7	5.9	7	35	10.4	-	-	-	1	33.3	1.4
Laurencia obtusa												
April 2002	10	24.3	14.9	5	25	7.4	2	66.6	2.9	1	33.3	4.4
May	9	21.9	13.4	5	25	7.4	2	66.6	2.9	2	66.6	2.9
June	6	14.6	8.9	10	50	14.9	2	66.6	2.9	2	66.6	2.9
July	7	17.07	10.4	6	30	8.9	2	66.6	2.9	1	33.3	4.4
Aug.	5	12.1	7.4	5	25	7.4	2	66.6	2.9	1	33.3	4.4
Sep.	8	19.5	11.9	6	30	8.9	2	66.6	2.9	1	33.3	4.4
Oct.	9	21.9	13.4	10	50	14.9	2	66.6	2.9	1	33.3	4.4
Nov.	10	24.3	14.9	10	50	14.9	2	66.6	2.9	2	66.6	2.9
Dec.	11	26.8	16.4	8	40	11.9	3	100	4.4	1	33.3	4.4
January 2003	6	14.6	8.9	8	40	11.9	2	66.6	2.9	-	-	-
Feb.	9	21.9	13.4	9	45	13.4	2	66.6	2.9	-	-	-
March	11	26.8	16.4	12	60	17.9	2	66.6	2.9	1	33.3	4.4

N: number of species; **GP:** percentage of algal number in relation to the total number of species in an algal group; **TP:** percentage of algal number in relation to the total number in all algal groups.

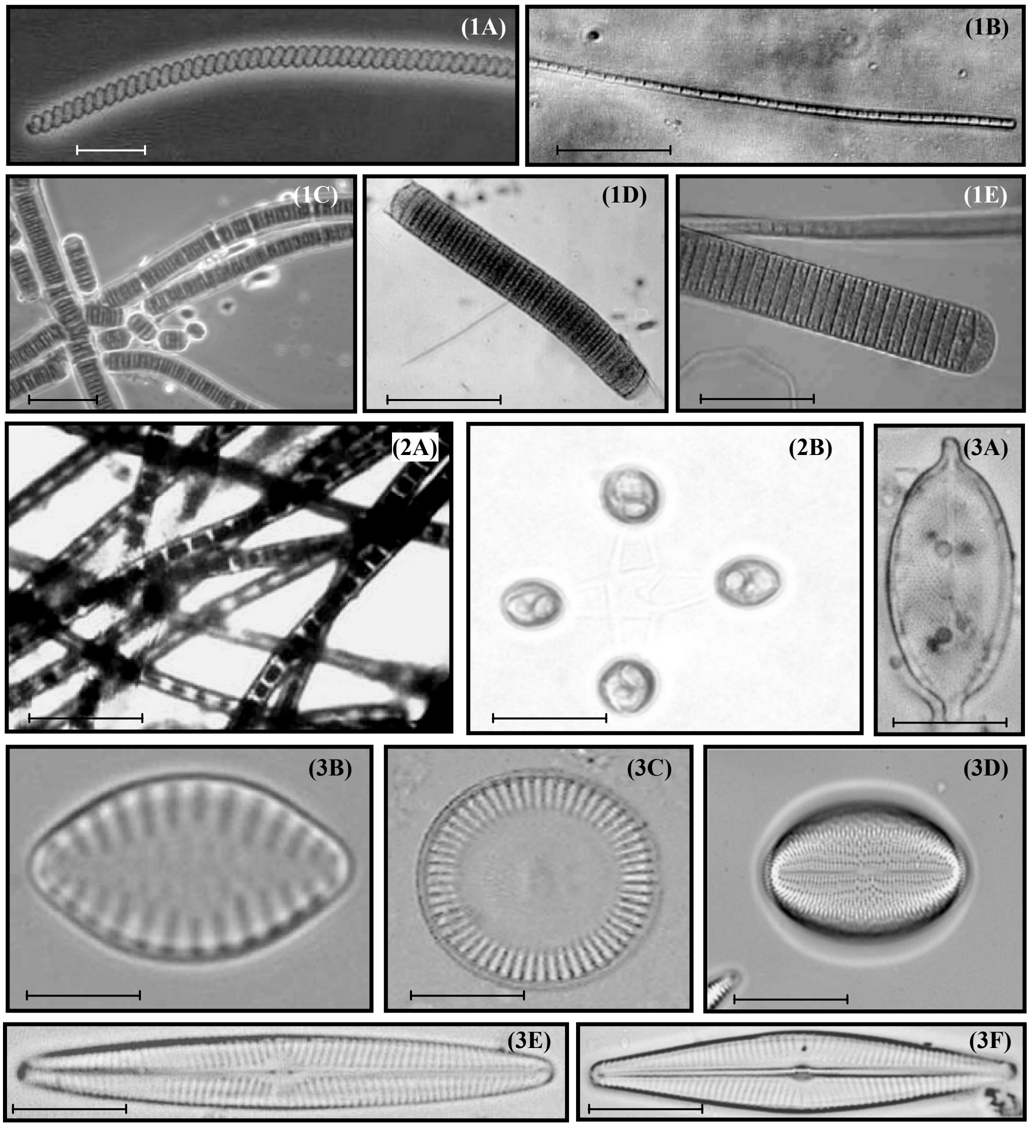

Plate (1): Epiphytic algae recorded allover the study period. **Cyanophyta**: (1A) *Spirulina subsalsa* Ostred; (1B) *Oscillatoria geminata* Meneghini, (1C) *Lyngbya epiphytica* Hicron, (1D) *Oscillatoria princeps* Vaucher, (1E) *Oscillatoria limosa* Agardh. **Chlorophyta**: (2A) *Cladophora fracta* Nil Kutzing, (2B) *Dictyosphaerium pulchellum* Wood. **Diatoms**: (3A) *Navicula placenta* Ehrenberg, (3B) *Achnanthes delicatula* Kutzing, (3C) *Cyclotella ocellata* Pantocsek, (3D) *Cocconeis pediculus* Ehrenb., (3E) *Navicula radiosa* kutzing, and (3F) *Navicula peregrina* (Ehr.) kutz. Photos were taken by the inverted light microscope; bar = 5 µm.

myrica, forty six epiphytic algae were identified (24 Bacillariophyta, 16 Cyanophyta,3 Chlorophyta and 3 Pyrrhophyta). Members of the epiphytic Rhodophyceae and Phaeophyceae were not recorded during this study.

Discussion

Many different algal families contain epiphytic members, and they are not always found growing epiphytically, and can be found growing on rocks or even in soil, wherever the conditions are suitable. Our field observations and investigations are in agreement with those of Kowalczewski (1975), Cattaneo and Kalff (1978 and 1980), Goldsborough and Hickman (1991), Lalonde and Downing (1991), Engle and Melack (1993), and Muller, 1995; Zimba (1995) that some biotic and abiotic factors may influence the presence of epiphytes. Among the most important are the host seaweeds architecture, the light regime and the disturbance of water by rain and wind. Also, our data are in agreement with those of Rogers and Breen (1981), Goldsborough and Hickman (1991), Muller (1994), Shamsudin and Sleigh (1994) that grazing and substratum ageing having the greatest impact on the seasonal variations of epiphytic algae.

Our results showed that *Cocconeis* spp. was abundant. All the upright diatoms were most abundant on the middle sections of the thallus architecture, whereas those epiphytes with most of their cell surfaces directly in contact with the substratum constituted the greatest part of the biomass on the lowest sections of the thallus. *Epithemia* spp. and *Rhopalodia parallela* attained their highest abundance near the sediment as

Table (2): Check list of epiphyte species

Algal species	*Laurencia obtusa*	*Cystoseira myrica*
Bacillariophyta		
Achnanthes delicatula Kutzing	-	+
Achnanthes gibberula. Grun.	-	+
Amphiprora alata Kutzing	+	-
Amphora perpusilla Grun.	+	-
Centronella reichelti Voigt	+	-
Cocconeis pediculus Ehrenb.	+	+
Cocconeis thumensis A.Mayer	+	-
Cyclotella ocellata Pantocsek	+	-
Cyclotella planctonica Brunnthaler	+	+
Denticula Gurtelbandseiten Kutzing	+	-
Diatomella balfouriana Grev.	+	-
Epithemia argus Ehrenb. Kutzing	+	+
Epithemia sorex Kutzing	+	-
Fragilaria virescens Ralfs	+	-
Gomphonema bohemicum Reichelt & Fricke	+	-
Hanzschia amphioxys (Ehr.) Grun.	+	-
Navicula anceps Ehrenberg	-	+
Navicula cardinalis Ehrenberg	-	+
Navicula elegans W. Smith	+	+
Navicula minima Grun.	-	+
Navicula peregrina (Ehr.) kutz.	-	+
Navicula placenta Ehrenberg	-	+
Navicula radiosa kutzing	+	-
Navicula salinarum Grunow	+	+
Navicula spicula Dickie Cleve	+	-
Neidium bisulcatum Lagerstr.	+	-
Nitzschia acicularis W. Smith	-	+
Nitzschia closterium Ehr . W.Smith	-	+
Nitzschia filiformis W.Smith. Hust	+	+
Nitzschia hungarica Grunow	+	+
Nitzschia palea var. palea (Kutz.)	+	-
Nitzschia pandurformis Gregory	+	-
Nitzschia reversa W. Smith	-	+
Nitzschia vermicularis Kutz. Grun.	-	+
Pleurosigma elongatum W.Smith	+	+
Rhopalodia parallela Grun. O.Mull.	-	+
Stephanodiscus hanzschii Grim .	+	-
Surirella biseriata Breb.	-	+
Surirella didyma Kutzing	+	+
Surirella striatula Turpin.	-	+
Synedra ulna Nitz Ehrenberg	+	+
Cyanophyta		
Anabaena constricta (Szalf) Geitler	+	-
Aphanothyce bullosa Menegh. Rabenh.	+	+
Aphanothece caldariorum Richter	+	+
Calothrix clavata West. G.S.	+	+
Dermocarpa clavata Setchell and	+	-
Gomphosphaerea aponina Kutzing	+	+
Lyngbya bipunctata Lemmermann	+	+
Lyngbya epiphytica Hicron.	+	+
Lyngbya limnetica Lemmermann	+	+
Lyngbya majuscula Harv.	-	+
Oscillatoria chalybea (Mert) Gom.	-	+
Oscillatoria geminata Meneghini	+	+
Oscillatoria limosa Agardh	+	+
Oscillatoria princeps Vaucher	+	+
Phormidium autumnale Ag. Gomont	+	+
Spirulina major Kutzing	+	+
Spirulina subsalsa Ostred.	+	+
Stigonema turfaceum (Berk.) Cooke.	+	-
Stigonema minutum Ag. Hass.	+	-
Tetrapedia reinchiana Archer	+	+
Chlorophyta		
Cladophora fracta Nil Kutzing	+	+
Cladophora prolifera Roth) Kutzing	+	+
Dictyosphaerium pulchellum Wood	+	+
Pyrrhophyta		
Amphidinium carterae Cao Vien	-	+
Exuviella compressa Ostef	+	+
Glenodinium foliaceum Stein.	+	+

well as buried beneath the most dense periphyton aggregations, while there were dense populations of *Cocconeis* spp. on the entire surface of the thallus. It seems that *Cocconeis* spp. are able to tolerate higher light intensities than *Epithemia* spp. and *Rhopalodia parallela*, which preferred to settle down.

One consequence could be increased forming a canopy structure in *Laurencia obtusa* and *Cystoseira myrica* beds which could decrease foraging efficiency of fish and decrease the rate of predation on small invertebrates.

In conclusion, for a shallow reef flat with an abundance of *Laurencia obtusa* and *Cystoseira myrica*, epiphytic algae can reach positions where more light is available and they don't have to compete with seaweed hosts on the substrate for space and light. Epiphytic algae become important component of the primary productivity and a major regulator of nutrient fluxes as mentioned by Jorgensen and Loffler (1990) and Anna (1999) for such a habitat. They also represent a food resource complementary to that of phytoplankton for primary consumers and increase the biological diversity in all trophic levels**.**

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PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON CONSERVATION AND MANAGEMENT OF NATURAL RESOURCES, ISMAILIA, EGYPT, JUNE 18-19, 2006

التغيرات الوقتية للطحالب الفوقية على طحلبى اللورانسيا أوبتوسا والسيستوسيرا ميريكا من منطقة جنوب سيناء، شمال البحر الأحمر

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الملخص العربي

تم فحص الطحالب الفوقية الموجودة على طحلبى اللورانسيا أوبتوسا والسيستوسيرا ميريكا المجمعة من منطقة شورى الرويسية والمناطق المحيطة من مستويات المد والجذر فى جنوب سيناء لمدة 12 شهر. وقد تم تسجيل 67 نوعا من الطحالب الفوقية 41 من مجموعة الدياتومات و20 من مجموعة الطحالب الخضراء المزرقة وثلاثة من مجموعة الطحالب الخضراء و ثلاثة من مجموعة الدينوفلاجيلات.

وقد أظهرت النتائج علاقة عكسية بين النسبة المئوية للكساء الطحلبى لطحلب اللورانسيا والطحالب الفوقية، وهذا يرجع إلى تأثير شدة الجفاف وعملية المد والجذر المستمرة والتعرض الضوئى الشديد، بينما النسبه العالية للكساء الطحلبى للسيستوسيرا يرتبط بعدد أكبر من الطحالب الفوقية بناءاً على طبيعة الشكل الظاهرى لها.