

**EPIPHYTES GROWING ON SOME MARINE ALGAE IN
THE EASTERN HARBOUR OF ALEXANDRIA, EGYPT**

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ABSTRACT

The estimation of epiphytes growing on *Ulva lactuca* and *Caulerpa prolifera* was performed during the four seasons. On the other hand, epiphytes on *Pterocladia capillacea* and *Codium dichotomum* was restricted to autumn and winter, respectively. Altogether about 70 species were found epiphytic on these algae. Diatoms were predominant (47 species) while dinoflagellates (5 species) together with other groups (18 species) were less frequent. Epiphytic growth in general was poor in spring and maximal in summer. The seasonal variations in the epiphytic population were mainly in the species abundance rather than in the community composition. The number of species growing on *Ulva lactuca* and *Caulerpa prolifera* is equable during the four seasons. The genus *Grammatophora* dominated the flora on both thalli.

INTRODUCTION

The study of algal epiphytic communities grown on macrophytes in the Mediterranean was especially stressed on those attached to *Posidonia oceanica*. In this regard, elaborate studies were made by several investigators e.g. Aleem (1955) in Egypt; Molini er (1960) in Corsica; Boudouresque (1968 and 1974) in France; Boudouresque and Fresi (1976) in Italy; Panayotidis (1979 a) in the Egean Sea, Greece. Panayotidis (1979 b) in Corsica, France; Boudouresque et al. (1981) in the Gulf of Naples; Wittman et al (1981) in Naples; Maurice Libes et al. (1983) in Port-Cros, France and Cinelli et al. (1983) in Italy.

Further investigations concerning the epiphytic flora on the macroalgae were also carried out in the Mediterranean and adjacent seas. Thus Ben et al (1972) reported on the epiphytes on *Acetabularia mediterranea* from the Isle of Ischia (Italy). Rombaut (1977) studied the epiphytes on *Halimida tuna* and *Padina pavonica* in the Adriatic Sea. Nicholas and Gray (1973) investigated the epiphytic flora on *Sargassum muticum*. The present study deals with the investigation of epiphytes developed on the common macro-algae in the Eastern Harbour of Alexandria. For this reason the

lactuca Linn., *Caulerpa prolifera* (Forsk.) Lam., *Codium dichotomum* (Huds.) Setchell and *Pterocladia capillacea* (Gmel.) Born. were investigated seasonally.

MATERIALS AND METHODS

A semiquantitative estimation of the epiphytic flora attached to the above mentioned macroalgae was made by collecting and examining fresh samples taken in different seasons from the North-West margin of the Eastern Harbour of Alexandria, adjoining the Institute of Oceanography and Fisheries. Collections made covered one year. About 20 gm of the epiphytes were washed out each time from the algal fronds and kept in 50 ml filtered sea water, using a camel hair brush, two ml were then transferred into a counting cell and examined under the microscope. The density of these epiphytes on the host algae during the different seasons was estimated as abundant, frequent, rare or very rare.

RESULTS

Estimation of the epiphytes growing on algal thalli throughout the four seasons was confined to the green algae *Ulva lactuca* Linn. and *Caulerpa prolifera* (Forsk.) Lamour. (Fig. 1). The growth on *Pterocladia capillacea* (Gmel.) Born. et Thur. and *Codium dichotomum* (Huds.) Setchell occurred in the autumn and winter respectively. Altogether, about 70 species were found on these seaweeds. The diatom population predominated the community while the other groups were of less importance. The growth of epiphytes in general was poor in the spring followed by a peak in the summer.

The following is an account of the periodicity of epiphytes on the host algae during the different seasons:

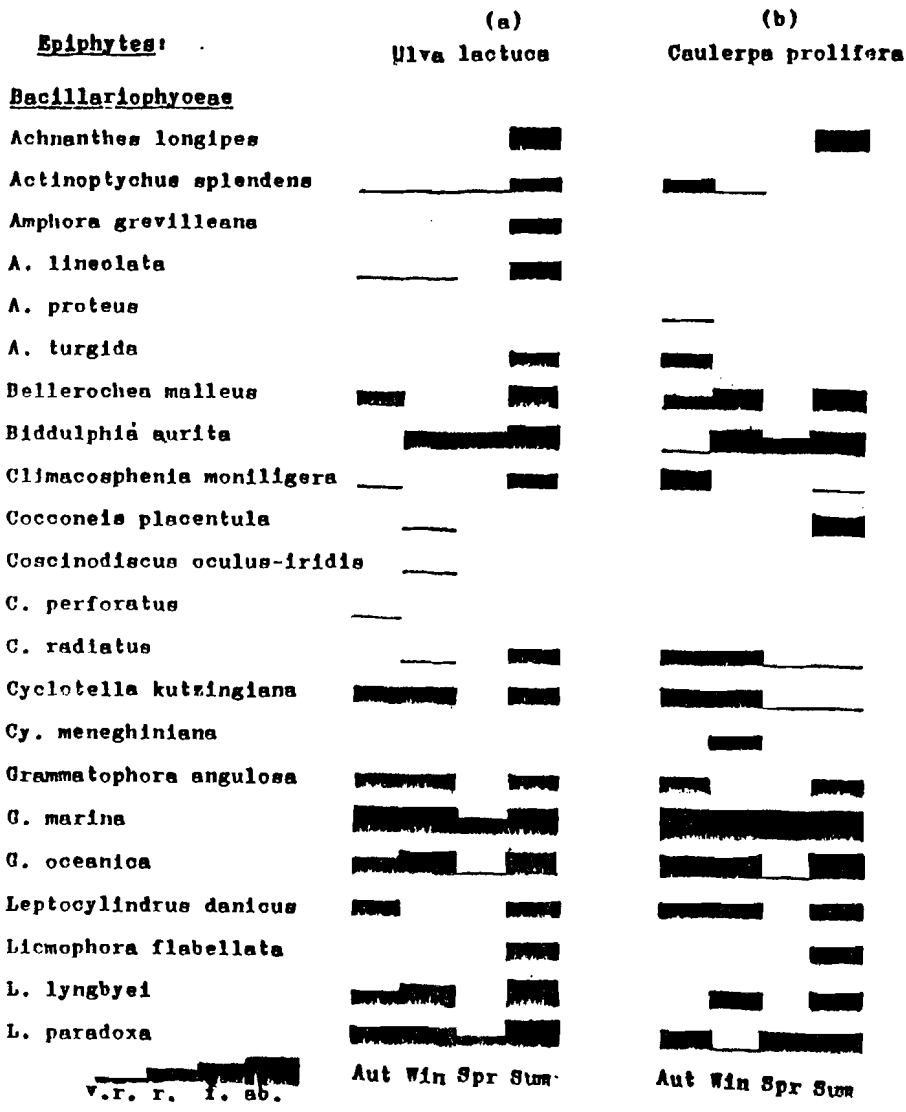
A. Epiphytes on *Ulva lactuca*

1. During the autumn (October-December)

A total of 70 species were recorded, most of them were diatom (24 species). *Grammatophora marina* was most abundant, while the frequent forms included *Grammatophora angulosa*, *Cyclotella kützingeriana*, *Nitzschia microcephala*, *Navicula ammophila*, *Skeletonema costatum*, *Liemophora paradoxa*, *Melosira granulata*, *M. crucipunctata* and the blue green *Plectononema* sp. The growth of *Spirulina* sp. was restricted to *U. lactuca* during this season.

2. During the winter (January-March)

The epiphytes grown during the winter comprised 26 species. The diatoms still formed the major fraction of the population. *Grammatophora marina* was also the most important species. Another 11 species belonging to



v.r. r. f. ab.

Fig. (1)
 Relative abundance of the epiphytic species grown on
 Ulva lactuca (a) and Caulerpa prolifera (b)
 during the different seasons.

the genera *Grammatophora*, *Biddulphia*, *Cyclotella*, *Licmophora*, *Melosira*, *Navicula*, *Nitzschia* and *Skeletonema* appeared frequently. The growth of *Coscinodiscus* *Oculus-Iridis* and *Nitzschia* *plana* was found to be restricted to *U. lactuca* during this season.

3. During the spring (April-June)

Only 13 species were encountered on *U. lactuca* during the spring and were dominated by *Skeletonema costatum*, *Grammatophora marina*, *Melosira granulata* and *Peridinium trochoideum*, while other species were scarce. *Peridinium trochoideum*, *Prorocentrum micans* and *Exuviella marina* were confined to *U. lactuca* in the spring.

4. During the summer (July-September)

The summer afforded the richest epiphytic flora on *Ulva*, comprising 39 species. *Grammatophora marina*, *Licmophora lyngbei*, *L. paradoxa* and *Nitzschia closterium* were the abundant forms. On the other hand, 11 species were frequent (Fig. 1 a). The species which showed restricted growth on *U. lactuca* during this season comprised *Amphora turgida*, *Achnanthes longipes*, *Licmophora flabellata*, *Lithodesmium undulatum*, *Navicula atlantica*, *Pleurosigma decorum*, *Thalassionema nitzschioides* and *Pyrophacus horologicum* in addition to species of *Merismopedia*, *Ulothrix*, *Ceramium* and *Vaucheria*. The last three taxa are brought by drainage water into the harbour and seem to thrive in low salinity water.

B. Epiphytes On *Caulerpa prolifera*

1. During the autumn (October-December)

The epiphytes growing on *Caulerpa prolifera* during the autumn included 30 species, mostly diatoms (26 species). *Grammatophora marina* was also abundant, while *Cyclotella kutzingiana*, *Grammatophora angulosa*, *G. oceanica*, *Licmophora undulatum*, *Navicula ammophila*, *Nitzschia microcephala*, *Skeletonema costatum*, *Plectonema*, and *Spirulina* sp. were less frequent. *Amphora proteus*, *A. turgida*, *Cyclotella meneghiniana*, *Coscinodiscus perforatus* and *Spirulina* seem to be restricted to *C. prolifera* during this season.

2. During the winter (January - March)

A total of 34 species were recorded, of which 25 species belong to diatoms. *Grammatophora marina* and *Nitzschia closterium* were most abundant. The frequent epiphytes included 18 species, as shown in Fig. 1 b. The species which seemed confined to *C. prolifera* during this season comprised *Navicula humerosa*, *Toxonidia insignis*, together with species of *Chaetomorpha*, *Ulothrix*, *Chaetophora*, *Erythritrichia* and *Trichodesmium*.

As in *U. lactuca*, the spring was the poorest season concerning the number of epiphytic species on *Caulerpa*. *Grammatophora marina* predominated the community, while *Melosira granulata*, *Skeletonema costatum* and *Predinium trochoideum* were frequent. *Thalassionema nitzschioides* and *Callithamnion* showed restricted growth on *C. prolifera* in spring.

4. During the summer (July-September)

The epiphytes on *Caulerpa* included 39 species in summer. *Grammatophora marina*, *G. oceanica* and *Navicula grevillei* represented the abundant forms. Another 16 species were less frequent, (Fig. 1 b). Fourteen species were confined to *C. prolifera* during this season, namely: *Achnanthes longipes*, *Cocconeis placentula*, *Licmophora flabellata*, *Lithodesmium undulatum*, *Melosira crucipunctata*, *Navicula atlantica*, *N. hamulifera*, *Pleurosigma decorum*. *Trachyneis aspera* var. *intermedia*, *Peridinium stejini* together with species of *Cladophora*, *Ectocarpus* and *Ceramium*.

C. Epiphytes On *Pterocladia capillacea*:

The epiphytes on the red alga *P. capillacea* during autumn comprised 34 species. *Grammatophora* spp. predominated the community while twenty other species appeared less frequent, (Table 1).

TABLE 1
Relative abundance of the epiphytes species on
Pterocladia capillacea during the autumn and *Codium dichotomum*
during the winter.
ab. abundant, f. frequent, r. rare, v.r. very rare.

Epiphytes	Algae		Epiphytes	Algae	
	P.c.	C.d.		P.c.	C.d.
<i>Actinoptychus splendens</i>	r.	r.	<i>Melosira crucipunctata</i>	f.	r.
<i>Amphora lineolata</i>	r.	r.	<i>Navicula cancellata</i>	r.	v.r.
<i>Amphora proteus</i>	r.	-	<i>N. humerosa</i>	f.	v.r.
<i>A. turgida</i>	f.	-	<i>N. humerosa</i>	-	v.r.
<i>Bellerophon malleus</i>	r.	-	<i>Nitzschia lanceolata</i>	f.	-
<i>Biddulphia aurita</i>	r.	f.	<i>N. closterium</i>	f.	f.
<i>Climacosphenia monilifera</i>	r.	f.	<i>N. lorenziana</i>	r.	v.r.
<i>Cocconeis placentula</i>	f.	-	<i>N. microcephala</i>	f.	-
<i>Coscinodiscus radiatus</i>	-	f.	<i>Pleurosigma rigidum</i>	r.	-
<i>Cyclotella kutzingiana</i>	f.	f.	<i>Rhizosolenia hebetata</i>	-	v.r.
<i>Cy. meneghiniana</i>	f.	-	<i>Skeletonema costatum</i>	f.	r.
<i>Grammatophora angulosa</i>	ab.	-	<i>Synedra affinis</i>	f.	-
<i>G. marina</i>	ab.	ab.	<i>Oscillatoria</i> sp.	r.	-
<i>G. oceanica</i>	ab.	f.	<i>Plectonema</i> sp.	f.	-
<i>Leptocylindrus danicus</i>	f.	-	<i>Spirulina</i> sp.	f.	-
<i>Licmophora lyngbali</i>	f.	-	<i>Trichodesmium</i> sp.	f.	-
<i>L. paradoxa</i>	f.	f.	<i>Callithamnion</i> sp.	f.	-
<i>Lithodesmium undulatum</i>	r.	f.	<i>Gonioliticium</i> sp.	-	ab.
<i>Melosira granulata</i>	f.	f.	<i>Polysiphonia</i> sp.	f.	-

D. Epiphytes On *Codium dichotomum*:

The epiphytic species on *C. dichotomum* during the winter are shown in table (1). There was a remarkable decrease in their number (18 species) compared with those attached to *U. lactuca* and *C. prolifera* in the same season. *Grammatophora marina* and *Goniotrichum* sp. represented the abundant epiphytes. *Biddulphia aurita*, *Climacophenia monilifera*, *Grammatophora oceanica*, *Licmophora paradoxa* and *Nitzschia closterium* persisted as frequent forms.

DISCUSSION

The periodicity of epiphytes growing in the Eastern Harbour, Alexandria on four common macrophytic algae, *Ulva lactuca*, *Caulerpa prolifera*, *Pterocladia capillacea* and *Codium dichotomum* was estimated seasonally during one year. Some workers (e.g. Linskens, 1963 a,b) use the term basiphytes for the host algae. Previous works on algal epiphytes in marine habitats in Egypt are scarce, (Aleson 1960 a and 1955).

In this investigation a total of 70 species were recorded, most of them belong to diatoms (47 species). The dinoflagellates include 4 genera with 5 species, while the other classes comprised 18 genera. Humm (1964) recorded 113 species growing on *Thalassia* in the Caribbean Sea while Chudyba (1965, 1968) found a total of 220 species of epiphytic algae on *Cladophora glomerata* of which 176 species belonged to diatoms. Masella (1963) mentioned that the diatoms growing on *Posidonia oceanica* comprised 93 species.

The term epiphytes in the present paper is used to include both attached algae as well as others associated with the host plant such as planktonic diatoms and dinoflagellates. The variation in the epiphytic population growing on *U. lactuca* and *C. prolifera* was mainly in the abundance of species rather than to the community composition.

Some epiphytes were observed on algal thalli throughout the whole year and these comprised; *Actinopteryx splendens*, *Biddulphia aurita*, *Coccolodiscus radiatus*, *Cyclotella kuetzingiana*, *Melosira granulata*, *Navicula ammoniophila* and *Plectononema* sp. The genus *Grammatophora* was the dominant diatom growing on the thalli of both *U. lactuca* and *C. prolifera*. It was represented by *G. angulosa*, *G. marina* and *G. oceanica*. The last two species appeared throughout the year as abundant or frequent forms, except in spring.

The increased numbers of species growing on *Pterocladia capillacea* compared with that on the smooth surface of *Codium dichotomum* confirm the result of Aleson (1960 b) and Round (1961) who stated that the physical nature of the host surface may be a factor affecting selection; the smooth algal surface has few epiphytes relative to the rough one. Throughout

conditions favouring the establishment of the others. Some of the microscopic forms may influence the attachment of the others, providing more or less favourable conditions or otherwise inhibit further growth. Bleibarth and Conover (1963) found that the host algae produce various extracellular products, some of which have been shown to have antibiotic properties and could influence colonization of epiphytes. Nutrient transference from basiphyte and *Vicia versa*, and transport of photosynthetic products could influence colonization and growth of epiphytes (Linskens, 1963 b). The present study advocates that there exists a clear relationship between the growth of epiphytes and the prevailing environmental conditions including physical, chemical and biological factors. Nevertheless, this relationship still needs extensive studies so as to reveal the different aspects controlling the growth rates of epiphytes and their relation to

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