

DIVERSITY AND DISTRIBUTION OF MACROPHYTES ALONG THE COAST OF LEBANON (LEVANTINE BASIN, EASTERN MEDITERRANEAN)

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Abstract

A total of 243 taxa of macroalgae were found along the coast of Lebanon. They include: 25 Cyanophyta, 58 Chlorophyta, 29 Phaeophyta, 127 Rhodophyta, 3 Phanerogams and 1 Xanthophyta. Brown algae are very sensitive to organic pollution, on the contrary of green algae which tolerate polluted sites. Several phaeophyte species from the genera: *Cystoseira*, *Sargassum*, *Corallina*, *Laurencia* and *Padina pavonica*, are good indicators of unpolluted coastal seawater, while, *Ulva*, *Enteromorpha*, *Colpomenia* and *Cladophora* thrive in organic polluted coastal waters. High taxonomic diversity and biomass occurred in spring and summer; while most of the algae are qualitatively and quantitatively poor during fall and winter. Several introduced species of Indo-Pacific origin were found, many of them have established stable populations.

Keywords : *Algae, Coastal Waters, Levantine Basin, Biodiversity, Biomass.*

Introduction

Marine flora of the Levantine Basin, including the coast of Lebanon belongs to the Atlanto-Mediterranean province. However, the occurrence of several introduced Indo-Pacific species, attribute to this region a certain tropical and subtropical characteristics. Few data are available regarding the phytobenthos of the Lebanese coast [1-2] 75% of the occurring species inhabit the western Mediterranean [3], whereas many others considered as Lessepsian were introduced in the Levantine Basin, where they established permanent populations. Most Phaeophytes are very sensitive to organic pollution whereas chlorophytes are very tolerant to polluted coast. These circum-tropical species present along the Lebanese coast may be either endemic or relicts from the period of the Tethys, or migrant species introduced, directly, or indirectly, through the Suez Canal into the Mediterranean. In this paper we present the spatio-temporal distribution of macroalgae along the Lebanese coast, focusing on their relation to environmental factors.

Material, methods and investigated area

Samples were made during 2000 and 2004 at a frequency of two times a year: in spring and in summer, at six sites along the coast of Lebanon. (33°50' -34 55' N and 35°30' E), covering polluted and unpolluted soft and rocky shores. Five sampling points were chosen on each transect, covering the supralittoral, mediolittoral and infralittoral zones [4]. A 0.04 m² metallic quadrat was used for quantitative and qualitative sampling. Temperature, salinity, dissolved oxygen and pH were measured in situ, and water samples were collected from surface for chemical analysis, namely ammonia, phosphate and nitrite-nitrate. In the intertidal zone, samples were collected directly, while in sub-tidal, scuba diving was used for collecting algae. In addition to the biomass, the % of algal coverage was estimated. Semi-diurnal tide amplitude along the Levantine coast is very small (15-20 cm.). Hydrology is characterized with two thermal phases: 1) a cold phase during winter (December-March), characterized with cool seawater (min 16°C in February) and moderate salinity (S=39.25psu), and marked with vertical isothermal conditions in the water column; 2) a warm phase during summer-fall (May-November) characterized with high surface temperature and salinity (max in August-September T= 30°C and S=39.75psu), accompanied with sharp thermocline in the layer 35-75 m, and with water layer stratification. The Lebanese seawater is highly oligotrophic as in all Levantine Basin.

Results

In total 243 taxa were found, in all sites, including 25 Cyanophyta, 58 Chlorophyta, 29 Phaeophyta, 127 Rhodophyta, 3 Phanerogams and 1 Xanthophyta. The bathymetric distribution is not very clear since the limit between two adjacent zones is not well defined, due to sea level variability. Many overlaps among species distribution are always observed. In all sites, the supralittoral is the poorest zone, while the infralittoral is the richest in diversity and in algal biomass. The sites St1, St3 and St6 situated in unpolluted coast, are the most rich, while St4 (near thermo-electric power plant) and St5 (near big urban sewer) are very poor; except in green algae. Sciaphile algae, mostly from rhodophytes, are the most important in the infralittoral, whereas green algae are more important in the mediolittoral. The brown algae grow only in the intertidal zone and are not as tolerant as the green algae, they are very sensible to pollution (St4 and St5).

Supralittoral - Most of the species in this zone are tolerant to changing environmental conditions such as moistening, dryness, dumping of freshwater and organic pollution. *Cyanophyceae* are dominant along with some benthic diatoms. 13 species characterizing this zone were recorded, namely *Hormatonema sphaerica*, *Hyella caespitosa*, *Anabena* sp., *Oscillatoria nigroviridis*, *Chroococcus turgidus*, *Hydrocoleus lynghyaceus*, *Phromidium ambiguum*, *Rivularia mesenterica* and *R. atra*. The sites St1, St2, St3 and St6 show similar species associations, different from those of polluted sites St4 and St5.

Mediolittoral - The maximum number of species found in all mediolittoral sites was approximately 148. In upper mediolittoral at all sites dominant species are: *Porphyra leucostica*, *Enteromorpha compressa*, *E. flexuosa*, *E. aragoensis*, *Nemalion helminthoides*, *Polysiphonia sertularioides*, *P. tenerrima*, *Calothrix aeruginosa*. Several accompanying species from Cyanophyta and Chlorophyta are also present. Lower mediolittoral is dominated by *Neogoniolithon notarisii*, *Laurencia papillosa*, *L. pinnatifida*, *L. obtusa*, *Cladophora* spp., *Enteromorpha* spp., *Jania rubens* and *Corallina mediterranea*, with 26 accompanying species.

Infralittoral - The subtidal level which is always covered with the seawater, is the richest and the most diversified. The species in this zone grow within stable environmental conditions. About 190 species were recorded in the subtidal at all the investigated sites, St3 being the richest with 115 species. Several species from the mediolittoral are also present in the infralittoral. *Cystoseira* spp. and *Sargassum vulgare* are good indicators of the infralittoral low-water tide. Upper infralittoral extending to depth -10 m is dominated by many species such as: *Jania rubens*, *Bryopsis mucosa*, *B. hypnoides*, *Liagora farinosa*, *Anadiomene stellata*, *Lophocladia lallemandii*, *Hydroclathrus clathrus*, *Sargassum vulgare*, *Bryopsis* sp., *Corallina elongata*, *Padina pavonica*, *Udotea patiolata*, *Dasycladus vermicularis*. Several accompanying species are present with less abundance. Lower infralittoral is dominated by sciaphile algae, namely: *Acanthophora delilei*, *Rityphlaea tinctoria*, *Siphonocladus pusillus* and Phanerogams growing on soft bottom: *Zostera noltii*, *Cymodocea nodosa* and *Halophila stipulacea*. On sediment seafloor we also record the caulerpales: *Caulerpa scalpelliformis*, *C. prolifera*, *C. racemosa*. Many accompanying species grow in this level such as: *Valonia utricularis*, *Bryopsis hypnoides*, *B. pinnata*, *Lithophyllum incrustans*, *L. lenormandii*, etc.

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