

MARINE ALGAE OF THE LESVOS ISLAND, GREECE.

I. SYSTEMATIC IDENTIFICATION AND GEOGRAPHICAL DISTRIBUTION

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ABSTRACT

The marine flora of Lesvos as well as its geographical distribution along the coasts of the island have been studied.

149 species of algae and 2 marine phanerogams are noted. From these 26 are Chlorophyceae, 33 Phaeophyceae and 90 Rhodophyceae. The flora can be characterized as rich. The ratio R/P is 2.73, which according to Feldmann (1938) characterises the vegetation as boreal than subtropical; the ratio R+C/P is 4.79 which according to Cheney (1977) the vegetation is strictly tropical. In 42 of the species of macrophyceae reproductive organs are found.

I. INTRODUCTION

Studies made the last 25-30 years and dealing with the marine flora of the Greek coasts have shed light on the relative subject the little knowledge of which was due only to a number of several scientific expeditions (Haritonidis 1978 and the relevant literature, Diapoulis 1983).

This investigation including certain biotopes of the Lesvos island (Eastern Sporades, Fig.1.) aims at a broader contribution to the survey of the Greek marine flora. All sample collections presented here were carried out during the summer of 1983 in the scope of an investigation for Institute of Oceanographic and Fisheries Research on the Geras Gulf (Fig. 1.) Which displays certain ecological peculiarities such as pollution from tannery wastes, hot springs, small opening of the Gulf towards the open sea etc.

The marine flora of Lesvos has been little investigated up till now. Candargy (1897) provides us with a number of data noting only 14 species of marine algae. Haritonidis and Tsekos (1974) have identified 70 algal species (sample collections summer 1970) at the Gulf of Kalloni (Fig. 1.).

2. METHODS AND BIOTOPES

Direct divers at the 18 stations of the island (Fig. 1) have given us sam-

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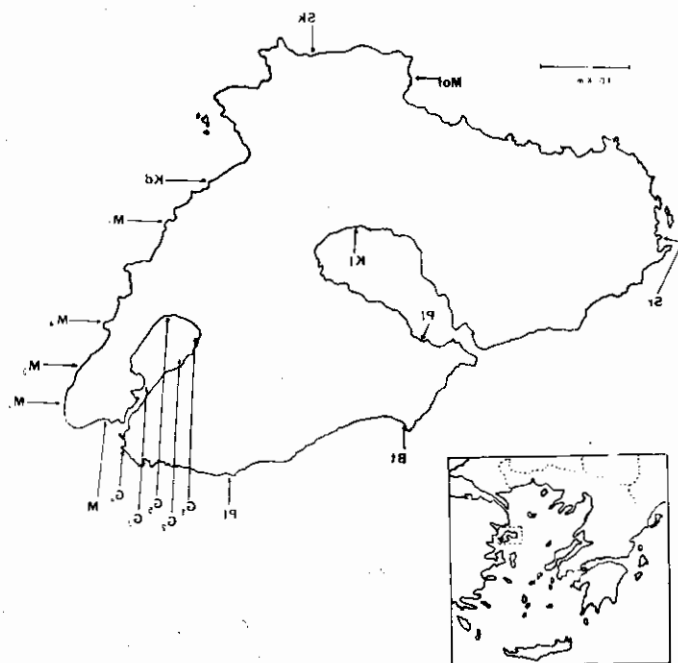


Fig. 1

Fig. 1. Map of Lesvos island with the sampling stations

ples from which the smallest were kept in a formole solution whereas the greater ones in plastic bags and were then carried to the Laboratory for classification.

Selection of the different biotopes covered all peculiarities concerning the substrate, depth, declination and orientation. In the Geras Gulf (Fig. 1) in particular, biotopes G_1 - G_3 were chosen so that its peculiarity as regards the problem of waste waters and the small aperture of the Gulf to the open sea, will be checked in the future. Another five stations (M_1 - M_5 , Fig. 1) were selected at the eastern coasts of the island, near the capital Mytilene, for a detailed map plotting of the marine flora to take place in the scope of a new drainage tube that is to be built in the sea. The remaining 8 biotopes are scattered on the rest of the island's coast.

The seasonal distribution of Lesvos marine flora will be indicated after a series of seasonal sampling and measurements have been performed.

For the classification of the marine flora, we used the following literature: Borgesen (1934), Cardinal (1964), Ercegovic (1952, 1957), Feldmann (1937), Feldmann-Mazoyer (1940), Hamel (1931-1939), Kylin (1956).

3. RESULTS

The results of the sample collections of the Lesvos island are classified in Table 1, which includes 149 species of marine algae plus the 2 marine phanerogams that have been identified. Their geographical spreading is noted, while the reproductive organs and cells observed are given symbols:

unicellular sporangia, tetrasporangia,	carposporophyte, propagoula	multicellular sporangia, female gametangia
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Tab. 1. Systematic table of algal species from 18 sampling stations on Lesvos island

CHLOROPHYCEAE

a. Cladophorales

Chaetomorpha aerea (Dillwyn) Kützing
G₁, G₂, G₃, Pl. M₁, M₂, M₃, M₄, Kl. Ml. Sk

Chaetomorpha capillaris (Kützing) Borgesen
C., Pl. Pol. M₁, M₂, Kd. Sk. Ml. Sr

Cladophora albida (Hudson) Kützing
Sk

Cladophora dalmatica Kützing
G₁, G₂, G₃, G₄, Pol. M₃, M₄, M₅, Kd

Cladophora laetevirens (Dillwyn) Kützing
Ml

Cladophora pellucida (Hudson) Kützing
G₁, G₂, G₃, M₂, M₃, Ml

Cladophora prolifera (Roth) Kützing
Pol. M₃, M₄, Ml, Sr

Cladophora sp₁
G₁, G₂, G₃, Pl. Bt. Pol. M₁, Sk. Kl

Cladophora sp₂
Pl. M₁, Kl. Sr

Rhizoclonium riparium (Roth) Harvey
G₁, M₃

b. Siphonocladales

Cladophoropsis modonensis (Kützing) Borgesen

G₃, M₂
Valonia utricularis (Roth) Agardh
 G₃, G₄, Pl. M₄, Kd. Ml
 c. Derbesiales
Halicystis parvula Schmitz
 G₃
 d. Codiales
Bryopsis disticha (J. Agardh) Kützing
 Pol. Sk
Bryopsis hypnoides Lamouroux
 G₃
Bryopsis monoica Berthold
 M₄
Pseudochlorodesmis furcellata (Zanardini) **Börgesen**
 G₃, G₄, Bt. M₄, Kd
 e. Caulerpales
Halimeda tuna (Ellis et Solander) Lamouroux
 Pl. M₄
Udotea petiolata (Turra) Börgesen
 Pl
 f. Daycladales
Acetabularia acetabulum (Linné) Silva
 Pl. Bt
Dasycladus claviformis (Roth) Agardh
 G₄, Pl. Bt. M₁, Sk
 g. Ulvales
Enteromorpha compressa (Linné) Greville
 G₂, M₁, M₃
Enteromorpha intestinalis (Linné) Hamel
 Pol. M₂, Sk. Kl
Enteromorpha ramulosa (Smith) Hooker
 G₁, G₄, G₅, Pol. M₂, M₄
Enteromorpha sp
 G₄
Ulva rigida (Agardh) Le Jolis
 G₂, G₄, M₁, Sr
PHAEOPHYCEAE
 a. Ectocarpales
Acinetospora vidovichii (Meneghini) Sauvageau
 Pl. Sr
Ectocarpus confervoides (Roth) Kjellman
 G₁, G₅, Bt. Pol. M₃, Kl

Feldmannia globifera (Kützing) Hamel
 M₃
Feldmannia irregularis (Kützing) Hamel
 G₁, G₄
Feldmannia sp
 G₄, G₅, M₂, M₄, M₅
Giraudia sphaclarioides Dèrbes et Solier
 G₃, G₅, M₁, M₂

Kuckuaeckia spinosa (Kützing) Kornmann

M₁, Sk

Stilophora rhizodes (Turner) J. Agardh

Pl. Bt. Ml

Chordariaceae ind.

Kd

Myrionemataceae ind

G₁

b. Sphacelariales

Cladostephus verticullatus (Lightfoot) Lyngbye

G₁, M₁, M₄

Sphacelaria cirrosa (Roth) C. Agardh

G₁, G₂, G₃, G₄, G₅, Pl. Bt. Pol. M₁, M₃, M₄, M₅, Kd. Sk. Kl. Ml. Sr

Sphacelaria furcigera Kützing

G₁, G₄, G₅, M₃, Kl

Sphacelaria tribuloides Meneghini

G₁, M₁, M₅, Kl

Stypocaulon scoparium (Linnè) Kützing

G₂, G₃, G₄, G₅, Pl. Bt. Pol. M₁, M₃, M₄, M₅, Kd. Sk. Ml. Sr

c. Dictyotales

Dictyopteris membranacea (Stackhouse) Batters

M₄, Sk

Dictyota dichotoma (Hudson) Lamouroux

G₃, Pl. M₃, M₄, Kd. Sk

Dictyota dichotoma var implexa (Desfontaine) Agardh

M₁, M₄, Sk

Dictyota linearis (Agardh) Greville

M₁, Sr

Dilophus fasciola (Roth) Howe

M₁, M₃, M₄, Kd. Sk

Dilophus mediterraneus Schiffner

G₄, Pl. Bt. M₁, Kd. Mol

Dilophus spiralis (Montagne) Hamel

Bt. Sr

Padina pavonica (Linnè) Thivy

G₁, G₂, G₃, G₄, G₅, Pl. Bt. Pol. M₁, M₃, M₄, M₅, Kd. Kl. Sr

d. Scytosiphonales

Colpomenia sinuosa Dérbes et Solier

Kl

e. Fucales

Cystoseira amentacea Bory

Sk

Cystoseira barbata (Good et Wood) J. Agardh

Pl. Kl. Mol

Cystoseira compressa (Esper) Gerloff et Nizamuddin

Bt. M₃, Kd

Cystoseira corniculata (Wulfen) Zanardini

Kd

Cystoseira crinita (Desfontaine) Bory

G₁, G₂, G₄, G₅, Pl. M₃, M₄

Gyostoseira discors (Linné) Agardh

M₁

Cystoseira mediterranea Sauvageau

Pl. M₅, Mol. Sr

Sargassum vulgare Agardh

M₄, Sk

Phacophyceae ind.

Pl. M₂, M₄, Kd, Sk

RHODOPHYCEAE

a. Acrochaetiales

Acrochaetium crassipes Börgesen

G₂

Acrochaetium daviesii (Dillwyn) Nägeli

G₂, G₃, Pl. Bt. Sk. Kl. Ml

Acrochaetium mediterraneum Levring

G₂, Bt. M₁, M₃

b. Bangiales

Erithrocladia subitengra Rosenvinge

M₄

Erithrotrichia carnea (Dillwyn) J. Agardh

G₁, G₄, Pl. Bt. M₁, M₄, M₅, Kd. Sk. Kl. Ml, Pl

c. Goniotrihales

Chroodactylon ornatum (Agardh) Drew et Rose

G₁, G₂, G₃, G₅, Pl. Bt. M₄, Kd. Sk. Kl. Pol

Goniotrichum alsidii (Zanardini) Howe

G₁, G₂, G₃, G₄, G₅, M₁, M₄, M₅, Sk. Kl

Goniotrichum cornu-cervi (Reinsh) Hauck

Kl

d. Nemalionales

Liagora viscida (Forsk.) C. Agardh

M₁

e. Bonnemaisoniales

Falkenbergia sp

Sk

f. Gelidiales

Gelidium crinale (Turner) Lamouroux

G₁, G₂, G₃, G₄, M₁, M₂, Kl. Sr. Pol

Gelidium melanoideum (Shousboe) Bornet

G₂, G₃, G₄, G₅, Pl. M₃, M₄, M₅

Gelidiella pannosa (Feldmann) Feldmann et Hamel

G₂, G₅, Pl. M₁, M₂, Ml

g. Gigartinales

Gigartina acicularis (Wulfen) Lamouroux

Pl. M₁, M₄

Hypnea musciformis (Wulfen) Lamouroux

M₁, M₄, Kl. Pl

- Hypnea valentiae* (Turner) Montagne
Pl
- Plocamium cartilagineum* (Lamouroux) Dixon
M₁
- Phylliphora epiphylla* (Müller) Batters
M₁, M₂
- Rhodophyllis divaricata* (Stackhouse) Papenfuss
Sk
- h. Rhodymeniales
- Champia parvula* (Agardh) Harvey
Pl. Bt. M₁, M₂, Sk. Ml
- Chylocladia verticillata* (Ligh.) Bliding
Kl
- Lomentaria articulata* (Hudson) Lingbye
Kl
- Rhodymenia ardissoni* (Ardissoni) J. Feldmann
M₁, M₂, Sk
- i. Cryptonemiales
- Amphiroa rigida* Lamouroux
Pl. M₁, Kd. Sk. Sr
- Corallina elongata* Ellis et Solander
Kd. Sr
- Corallina granifera* Ellis et Solander
Pl. Bt. M₁, M₂, M₃, Sk Ml. Sr
- Corallina officinalis* Linné
G₁, Bt
- Dermatolithon pustulatum* (Lamonoux) Foslie
G₁, Pl. Bt. M₁, M₂, M₃, Kd. Ml. Sr. Pol
- Fostiella farinosa* (Lamouroux) Howe
G₁, G₂, G₃, G₄, Pl. Bt. M₁, M₂, M₃, M₄, M₅, Kd. Sk. Ml. Sr. Pol
- Jania adhaerens* Lamouroux
Pl. M₂, Kd. Ml
- Jania longifurca* Zanardini
G₁, G₂, M₁, M₂
- Jania rubens* (Linné) Lamouroux
Bt. M₁, M₂, Kd. Sk. Sr. Pol
- Lithophyllum incrustans Philippi*
Pl. Bt. M₁, M₂
- Peyssonnelia rubra* (Greville) J. Agardh
Pl. Bt. M₁, M₂
- Peyssonnelia squamaria* (Gmelin) Decaisne
Sk
- J. Ceramiales
Ceramiales
- Aglaothamnion tripinatum* (Grateloup) Feldmann-Mazoyer
Pl. M₂, Sk
- Aglaothamnion* sp
Ml

- Antithamnion cruciatum* (C: Agardh) Nägeli
 C₄, Pl. Bt. Kd. Sk. Ml
Antithamnion heterocladum Funk
 Sk
Antithamnion plumula (Ellis) Thuret
 M₂, Ml
Ceramium bertholdi Funk
 M₂
Ceramium byssoideum Harvey
 G₂, G₃, G₄, Pl. Bt. M₃, M₄, M₅, Kd. Sk. Kl. Sr. Pol
Ceramium ciliatum (Ellis) Ducluzeau
 G₂, Pl. Bt. M₁, M₂, Sk. Kl. Ml. Pl
Ceramium circinatum (Kützting) J. Agardh
 Pl. Bt. M₄, Sk
Ceramium codii (Richards) Mazoyer
 G₂, G₃, G₄, G₅, Bt. M₁, M₂, M₄, Kd
Ceramium diaphanum (Roth) Harvey
 Pl. Bt. M₂, M₃, Kd. Sk. Kl. Ml. Pol
Ceramium fastigiatum (Roth) Harvey
 G₁
Ceramium rubrum (Hudson) C. Agardh
 G₁, G₃, M₃, Sk
Ceramium tenuissimum (Lyngbye) Agardh
 Pl. M₁, M₄, Kd. Sk. Kl. Ml
Compsothamnion thyoides (Smith) Schmitz
 M₂
Crouania attenuata (Bonnemaison) J. Agardh
 Bt. M₁, Ml
Griffithsia barbata (Smith) C. Agardh
 G₂, Pl
Griffithsia flosculosa (Ellis) Batters
 Pl. Sr
Griffithsia tenuis C. Agardh
 G₂, Ml
Griffithsia sp
 Bt
Lejolisia mediterranea Bornet
 G₂, M₁, M₃, Kd. Sk. Ml
Ptilothamnion pluma (Dillwyn) Thuret
 Sk
Seirospora sphaerospora Feldmann
 Kd
Spermothamnion repens (Dillwyn) Rosenvinge
 M₁, Ml
Sphodylothamnion multifidum (Hudson) Nägeli
 Ml

- Spyridia filamentosa* (Wulfen) Harvey
 G₃, G₄, Pl. M₁, Ml
- Wrangelia penicillata* C. Agardh
 Dasyaceae
Dasya corymbifera J. Agardh
 G₄, Pl. M₁
- Dasya rigidula* (Kützing) Ardissona
 Bt. Sk. Ml. Sr
Dasya ocellata (Grateloup) Harvey
 G₂, M₄, M₄, Kd. Kl
Heterosiphonia wurdemanii (Bail) Falkenberg
 G₃, M₄
 Delesseriaceae
Acrosorium uncinatum (J. Agardh) Kylin
 M₁
Hypoglossum woodwardii Kützing
 Sk
Radicilingua reptans (Zanardini) Papenfuss
 M₄
 Rhodomelaceae
Chondria dasyphylla (Woodward) C. Agardh
 G₃, Pl. Bt. M₁, Ml
- Chondria tenuissima* (Goodward) C. Agardh
 G₃, Pl. Bt. M₄
- Borgeseniella fruticulosa* (Wulfen) Kylin
 G₂, Pl. Bt. M₁, M₄, M₄, Sr. Kl. Ml. Pol. Sk
Dipterosiphonia rigens (Schousboe) Falkenberg
 G₃, G₄, Pl. Bt. M₁, M₄, Kd. Sk. Ml
Halopitys incurvus (Gomel) Kützing
 M₃
Herposiphonia tenella (C. Agardh) Ambronn
 G₁, G₃, G₄, G₄, Pl. Bt. M₁, M₃, M₄, M₄, Kd. Sk. Ml. Sr. Pol
Laurencia obtusa (Hudson) Lamouroux
 G₄, G₄, Pl. Bt. M₁, M₄, M₄, Kd. Sk. Ml. Pol
Laurencia paniculata (C. Agardh) J. Agardh
 G₁, M₄, Pol
Laurencia pinnatifida (Gmelin) Lamouroux
 M₄
- Lophosiphonia cristata* Falkenberg
 G₄, G₄, Bt. M₄, Pol
Lophosiphonia scopulorum (Harvey) Wormesley
 G₂, G₃, G₄, G₄, M₁, M₄, Ml. Pol
- Lophosiphonia subadunca* (Kützing) Falkenberg
 M₁, Kl. Ml
Polysiphonia opaca (C. Agardh) Zanardini
 M₄, G₄
- Polysiphonia tripinnata* J. Agardh
 G₃

Polysiphonia sp₁
pl. Bt. kd. Sk. Pol

Polysiphonia sp₂
Kd

Pterosiphonia complanata (Clemente) Falkenberg
M₁, Sr

Pterosiphonia paracitica (Hudson) Falkenberg
M₂

Pterosiphonia pennata (Roth) Falkenberg
M₁

Rytidloea tinctoria (Clemente) C. Agardh
Pl. M₁

Rhodomelaceae ind.
Kd

PHANEROGAMS

Cymodocea nodosa (Ucria) Archers.

G₁, G₂, G₃, G₄, G₅, Pl. Pol

Posidonia oceanica Delile
G₁, M₁, M₂, M₃, M₄

4. DISCUSSION

According to Table 1 it seems that 149 species of marine algae as well as the 2 marine phanerogams *Posidonia oceanica* and *Cymodocea nodosa* have been identified.

From these 26 (17.4%) are Chlorophyceae, 33 (22.1%), Phaeophyceae and 90 (60.41%) Rhodophyceae. According to Feldmann (1938) the R/P ratio is 2.73. This is found in agreement with Haritonidis and Tsekos (1974, 1977) as regards marine algae of Rhodos coasts and the islands of the Ionian Sea. The ratio 2.73 shows that the marine flora of the island may be subtropical. Cheney (1977) has included Chlorophyceae to calculate the type of the flora. Consequently, for Lesvos the flora ratio is $R+C/P=4.79$. (According to Cheney 1977 the flora is tropical between 3-6).

Our observations concerning each of the sample stations carefully examined are as follows: The number of the specimens from collection places G₁-G₅ of the Geras Gulf is indicated in Tab. 1 and 2. 21 Species occur in biotopes G₂ and G₃ respectively while 25 are present in biotope G₁. The remaining two biotopes (G₄ away from the Gulf, and G₅ in the inner part of the Gulf, Fig. 1) reach the 39 species each respectively (Tab. 1 and 2). Haritonidis and Tsekos (1974) note 70 species in the same Gulf but from different places of collection (Fig. 1, K1 and Pol).

Tab. 2.

Systematic unities of the marine flora determined at 18 sample stations of Le-svos island

Systematic unities Sampling stations	Phaeo-phyceae	Chloro-phyceae	Rhodo-phyceae	Spermatophytes	Total
G ₁	8	6	10	1	25
G ₂	4	4	13	—	21
G ₂	5	2	13	1	21
G ₄	8	8	21	2	39
G ₅	9	10	19	1	39
Pol	5	7	19	1	32
Kl	7	4	16	—	27
Pl	10	9	33	1	53
M ₁	5	8	22	1	36
M ₂	1	3	4	1	9
M ₃	5	12	24	—	41
M ₄	9	12	32	—	53
M ₅	8	8	23	—	39
Kd	4	10	23	—	37
Sk	6	10	31	—	47
MI	7	7	29	1	44
Sr	5	7	13	—	25
Bt	4	8	29	—	41

The Geras and Kalloni Gulfs (Fig. 1) exhibit enough geographical similarities (small aperture towards the sea and much internal). If we compare the large systematic classes among them we will observe the following (see also Tab. 2.).

Biotopes	Chlor.	Phaeoph.	Rhod.	Sörensen index
Geras Gulf	13	13	31	
Kalloni Gulf	8	8	29	0.53

The conclusion is that although these gulfs present almost the same number of species they finally display no considerable affinities between them because these are remarkably different, as far, as, the existing algal species are concerned.

From the rest of the collection stations the muddy biotope M₂ (Fig. 1) has the smallest number of species (only 9, Tab. 2) due to recent ambankings of the coast and the little depth.

On the contrary the richest in flora are M₄ and P1 (Fig. 1, Tab. 2) with 53 species each, also showing a small relationship between (Sørensen index $S=0.54$). The flora of the remaining stations shows some variety starting from 25 to 47 species (Tab. 2).

Certain species of algae rarely encountered in the Greek area are detected (cf. Haritonidis and Tsekos 1974, 1975, Tsekos and Haritonidis 1974, 1977, Diapoulis 1983 and literature cited therein).

From Candargy's 1897, 14 species *Anadyomene stellata*, *Codium bursa*, *Halimeda opuntia*, *Ulva latissima* and *Chorda filum* are not detected during our collections: *Chorda filum* and *Halimeda opuntia*, in particular, have not yet been found in the Mediterranean region. It is probable that owing to the absence of the appropriate references, these had not been recognized by Candargy (1897).

The presence of reproductive organs and cells in the algae examined is quite remarkable (Tab. 1.). This happens to be a rather large number and is in accord with Haritonidis and Tsekos (1975) and Tsekos and Haritonidis (1974, 1977).

In Redalgae 30 species with reproductive organs are noted, while Brownalgae are only with 11. *Cladophora dalmatica* the unique Greenalga which presents reproductive organs (plurilocular sporangia, Tab. 1.).

ΠΕΡΙΛΗΨΗ

Στην παρούσα εργασία μελετήθηκε η υδρόβια χλωρίδα των ακτών της νήσου Λέσβου. Σημειώθηκαν 149 είδη φυκών καθώς και 2 Φανερόγαμα. Από τα 149 είδη των φυκών που προσδιορίστηκαν τα 26 ήταν Chlorophyceae, 33 Rhaeophyceae και 90 Rhodophyceae. Η αναλογία R/P είναι 2.73 και κατά τόν Feldmann (1938) η χλωρίδα χαρακτηρίζεται σαν βόρεια παρά σάν ύποτροπική. Αντίθετα κατά τόν Cheney (1977) που χρησιμοποιεί την αναλογία R+C/P και που δίνει τιμή 4.79, η χλωρίδα στην περιοχή χαρακτηρίζεται σαν τροπική. Σέ 42 είδη από τα μακροφύκη βρέθηκαν αναπαραγωγικά όργανα.

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