

UDK: 581.55 + 581.44 : 582.2 (262.3)

Original scientific paper

**DISTRIBUTION OF EPIPHYTIC FLORA ON *POSIDONIA OCEANICA* (L.) DELILE LEAVES (NATIONAL PARK »KORNATI« — CENTRAL ADRIATIC)**

RASPORED EPIFITSKJE FLORE NA LIŠĆU *POSIDONIA OCEANICA* (L.)  
DELILE (NACIONALNI PARK »KORNATI« — SREDNJI JADRAN)

Boris Antolić

*Institute of Oceanography and Fisheries, Split, Yugoslavia*

Samplings were carried out in the area of National park »Kornati« (Kornat Island — central Adriatic) at 5 m depth in August 1980 and June 1982. A total of 59 taxa (Cyanophyceae and Diatomeae excluded) were established. Rhodophyceae were absolutely predominant constituting 43 taxa (72.9%) followed by Phaeophyceae with 9 taxa (15.2%) and Chlorophyceae with 7 taxa (11.9%). Rather small number of species was recorded to grow on all thirds and surfaces. Species which prefer individual leaf portions and surfaces were also established.

INTRODUCTION

This paper presents for the first time the data on qualitative — quantitative distribution of epiphytic flora on *Posidonia oceanica* leaves from the area along the eastern Adriatic coast. Large number of authors which studied the benthic flora and vegetation along the eastern Adriatic coast have only mentioned *Posidonia oceanica* as a host plant of some algal species, but have never described in more detail the epiphytic flora. In 1979 the studies of *Posidonia oceanica* beds (biomass, horizontal and vertical distribution, epiphytic flora composition on leaves and rhizomes etc.) were therefore intensified all along the eastern Adriatic coast. The obtained data added to our knowledge of this phytocoenosis in the Adriatic sea. From 1976 on the complex studies of *Posidonia oceanica* beds have been extended in the Mediterranean particularly along the French shores, considering not only biological parameters but relevant physical, chemical, geological and other ones as well, to get better insight into this important part of benthic vegetation. This paper presents only a part of the results of the studies carried out in the area of National Park »Kornati« for few recent Years.

## STUDY AREA, MATERIALS AND METHODS

Samplings were carried out at 5 m depth in Stinjiva cove at Kornat Island (43°48'5" N, 15°20'7" E) in August 1980 and June 1982. The method of direct sampling from defined surfaces (50 cm × 50 cm) by Scuba dives applied. We separated 10—15 fascicles from these samples and preserved them in 4% buffered formol solution. They were determined in the laboratory by binocular magnifier and microscopy. To obtain the data on the vertical distribution of epiphytes on *Posidonia oceanica* leaves (as to their position on a leaf) every leaf was divided into portions (apical, central and basic third), and both sides of these portions observed (upper and lower surfaces). About 9500 cm<sup>2</sup> of surface area of *Posidonia oceanica* leaves were examined.

## RESULTS AND DISCUSSION

A total of 59 taxa (Cyanophyceae and Diatomeae excluded) were established. Rhodophyceae were absolutely predominant constituting 43 taxa (72.9%) followed by Phaeophyceae with 9 taxa (15.2%) and Chlorophyceae with 7 taxa (11.9%; Tab. 1).

The comparison of our results with those of Panayotidis (1979) who studied the epiphytic flora on *Posidonia oceanica* leaves in the Gulf of Thessaloniki (Greece) showed the following:

- the number of epiphytic species exceeded for about 40% the number this author recorded from the same number of samples, approximately the same seasons and almost the same depth;
- Rhodophyceae were more poorly represented (55.6%), Chlorophyceae somewhat better (13.9%) and Phaeophyceae much better (30.5%) represented.

The comparison of our data with the data of Dick van der Ben (1969) who studied the epiphytic flora on *Posidonia oceanica* leaves along the Mediterranean coast of France (Banyuls and Villefranche) showed the following:

- Dick van der Ben recorded for about 35% more epiphytic species (90);
- this author recorded lower numbers of Rhodophyceae (66.7%) and Chlorophyceae (8.9%) and much higher numbers of Phaeophyceae (24.4%).

These considerable differences between our results and results of Panayotidis (total number and presence of Rhodophyceae and Phaeophyceae) and Dick van der Ben (total number and presence of Phaeophyceae) are probably due to the fact that Panayotidis studied the flora of *Posidonia oceanica* in the close vicinity of the big industrial centre where waste waters are likely to affect the formation of benthic flora, and Dick van der Ben observations of *Posidonia oceanica* leaves were carried



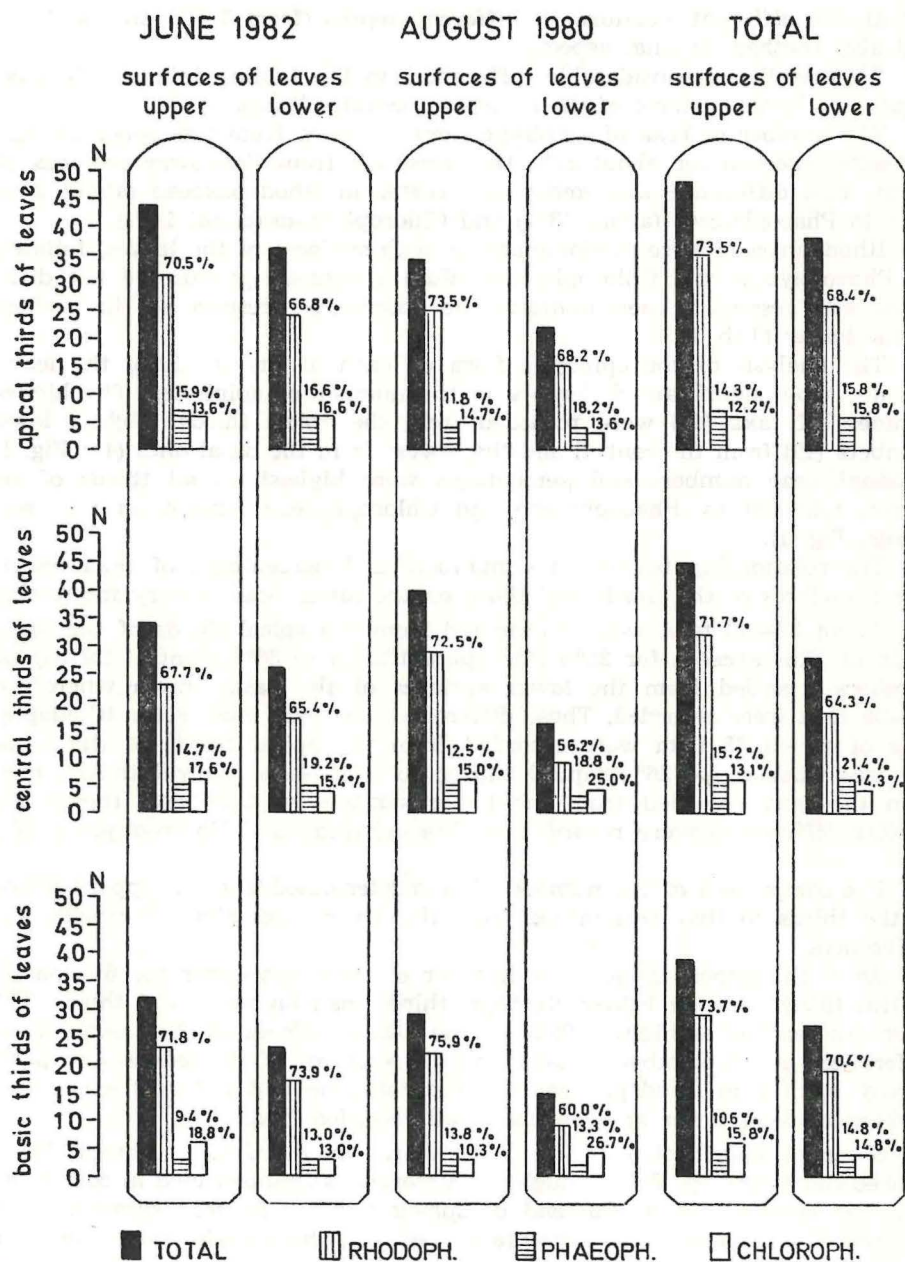


FIG. 1. Numerical and percentage presence of epiphytic algae on the portions (thirds) and surfaces (upper and lower) of *Posidonia oceanica* Leaves.

out at two different locations, at different depths (from 3-35 m) and included also another seasonal aspect.

We established considerable differences in the fouling intensity between upper and lower surfaces of the *Posidonia oceanica* leaves.

The number of taxa of epiphytic flora recorded from the upper surfaces (57 taxa) exceeded for about 21% that recorded from the lower surfaces (45 taxa). This difference was somewhat greater in Rhodophyceae (about 24%) than in Phaeophyceae (about 13%) and Chlorophyceae (about 14%).

Rhodophyceae were predominant on both surfaces of the leaves, followed by Phaeophyceae and Chlorophyceae. Main systematic groups did not differ much with respect to their numbers and percentage presence on the surfaces of the leaves (Tab. 1).

The analysis of the epiphytic flora on each of the thirds of the leaves did not show significant difference in the number of epiphytes. The highest numbers of taxa (48) were recorded from the apical thirds, slightly lower numbers (46) from the central and the lowest from the basal ones (44; Fig. 1). Rhodophyceae numbers and percentages were highest on all thirds of the leaves, followed by Phaeophyceae and Chlorophyceae (except on the basal thirds; Fig. 1).

The relationship between the numbers and percentages of taxa on the upper surfaces of the thirds and those on the lower ones is very interesting.

About 39-48 taxa were determined from the apical thirds of the upper surfaces. This exceeds for 21% (the apical thirds) to 38% (central thirds) the numbers recorded from the lower surfaces of the basal thirds wherefrom 27-38 taxa were recorded. These differences are even higher for Rhodophyceae of which 35 taxa were recorded from the apical thirds of the upper surfaces what is for 26% (apical thirds) to even 44% (central thirds) more than the taxa recorded from the lower surfaces of the basal thirds. Far smaller differences were recorded in Phaeophyceae and Chlorophyceae (Fig. 1).

The comparison of the number of taxa determined from the upper surfaces of the thirds to that determined from the lower ones showed considerable differences.

As to the upper surfaces the number of taxa was lower for 6% on the central thirds to even 19% on the basal thirds than on the apical thirds. This difference reached as high as 29% on the lower surfaces of the leaves. These differences in the number of taxa on both surfaces of the leaves was particularly marked in Rhodophyceae. In Phaeophyceae and Chlorophyceae these differences were lower or even not at all recorded (Fig. 1).

Seasonal distribution of epiphytic flora on *Posidonia oceanica* leaves showed the following. Even though the material was not collected in completely different seasons but at the end of spring and in the mid summer, some differences in number and percentages between the samples were observed.

Total number of taxa recorded in June (53) exceeded for about 13% that in August (46). In Rhodophyceae this number in June (38) exceeded that in August (35) for about 8%. In Chlorophyceae this difference was 14% (7 taxa in June, 6 taxa in August) and in Phaeophyceae it was highest reaching even 37% (8 taxa in June and 5 taxa in August; Table 1).



Panayotidis (1979) reported quite different quantitative relations between individual epiphytic flora groups on *Posidonia oceanica*. This was to be expected since he studied the samples from two different seasons (May and September). The number of taxa recorded in September (30) exceeded for about 7% that recorded in May (28). In Rhodophyceae the difference was 20% (20 and 16 taxa respectively), in Chlorophyceae 50% (4 and 2 taxa) while in Phaeophyceae the number recorded in September (6 taxa) was for about 40% lower than the number recorded in May (10 taxa).

Our results show that the total number of taxa recorded from the upper surfaces of the leaves in June (51) exceeds for 12% that recorded in August (45). This difference reached as high as 42% (43 in June and 25 in August) on the lower surfaces of the leaves (Table 1).

Higher number of epiphytic forms in June in relation to that in August was also recorded from individual thirds of the leaves. The number of taxa on the apical thirds of the leaves recorded in June (45) was for 24% higher than that recorded in August (34). The difference recorded from basal thirds was smaller (36 taxa in June, 31 taxa in August). However, the number of taxa recorded from central thirds in August (40) exceeded for about 8% that in June (37; Table 1).

Similar relations were recorded between three main systematic groups as well as between the epiphytic flora on the upper surfaces and that on the lower surfaces of individual thirds. The only significant difference between the upper and lower surfaces of the apical, central and basal thirds of the leaves were recorded in Rhodophyceae. The number of forms recorded from the surfaces of individual thirds of the leaves recorded in June (24, 17, 17) exceeded for 33–47% the number of forms recorded from the respective surfaces in August (15, 9, 9; Fig. 1).

This paper is not intended to discuss the phytocoenological observations, even though data are available. Only some basic properties of qualitative distribution of epiphytic flora on *Posidonia oceanica* leaves will be mentioned.

Relatively small number of taxa were recorded with respect to the fact that this number refers to all parts (both surfaces and all thirds) of *Posidonia oceanica* leaves. These are the following Rhodophyceae: *Goniotrichum alsidii*, *Acrochaetium* sp., *Fosliella farinosa*, *Fosliella lejolisii*, *Antithamnion cruciatum* v. *profundum*, *Ceramium codii*, *Crouania attenuata*, *Lejolisia mediterranea* and *Laurencia obtusa* and the following Phaeophyceae: *Sphacelaria cirrosa* and *Ascocyclus orbicularis* and Chlorophyceae: *Pringsheimiella scutata*, *Ulvella lens* and *Rizoclonium kochianum* (Table 1).

However, some other species of benthic algae were also well represented, such as Rhodophyceae *Erythrocladia subintegra*, *Acrochaetium daviesii*, *Agla-othamnion furcellariae*, *Ceramium tenuissimum*, *Seirospora interrupta*, *Spermonthamnion johanis*, *Spyridia filamentosa*, *Arachnophyllum confervaceum* and *Polysiphonia* sp., Phaeophyceae *Sphacelaria fusca* and Chlorophyceae *Phaeophylla dendroides* (Table 1).

As distinct from the species of benthic algae which were found to grow on almost all the portions of *Posidonia oceanica* leaves, some species grow predominantly on some of the thirds. Thus some species recorded from the apical thirds of both surfaces were rarely recorded from other thirds (central

Table 1. List of epiphytic algae recorded (+) in June 1982 (JUN.) and August 1980 (AUG.) on the upper (U) and lower (L) surface of apical (ATL), central (CTL) and basic (BTL) thirds of *Posidonia oceanica* leaves

	ATL				CTL				BTL			
	JUN.		AUG.		JUN.		AUG.		JUN.		AUG.	
	U	L	U	L	U	L	U	L	U	L	U	L
RHODOPHYCEAE												
<i>Asterocytis ornata</i> (C. Ag.) Hame 1	+	+	+		+							
<i>Goniotrichum alsidii</i> (Zanard.) Howe	+	+	+	+	+	+	+	+	+	+	+	+
<i>Erythrocladia subintegra</i> Rosenv.	+	+	+	+	+	+	+		+	+		
<i>Erythrotrichia carnea</i> (Dillw.) J. Ag.												+
<i>Acrochaetium deviesii</i> (Dillw.) Nägeli	+	+	+		+	+	+		+	+		
<i>Acrochaetium</i> sp.	+	+	+	+	+	+	+	+	+		+	+
<i>Fosliella cruciata</i> Bressan			+		+		+		+			
<i>Fosliella farinosa</i> (Lamour.) Howe	+	+	+	+	+	+	+	+	+	+	+	+
<i>Fosliella farinosa</i> ssp. <i>solmsiana</i> (Falken.) Foslie					+				+			
<i>Fosliella lejolisii</i> (Rosanoff) Howe	+	+	+	+	+	+	+	+	+	+	+	+
<i>Dudresnaia verticillata</i> (With.) Le Jol.	+											
<i>Chylocladia verticillata</i> (Lightf.) Blid.				+	+		+				+	
<i>Lomentaria chylocladiella</i> Funk		+	+								+	
<i>Aglaothamnion furcellariae</i> J. Ag.	+	+	+		+	+	+		+		+	
<i>Aglaothamnion tenuissimum</i> (Bonnem.) G. Feldm.	+	+									+	
<i>Antithamnion cruciatum</i> v. <i>profundum</i> G. Feldm.	+	+	+	+	+	+	+	+	+	+	+	+
<i>Antithamnion tenuissimum</i> Hauck							+					
<i>Centroceras cinnabarinum</i> (Grat.) J. Ag.	+	+										
<i>Ceramium bertholdii</i> Funk					+				+			
<i>Ceramium codii</i> (Rich.) G. Feldm.	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ceramium tenuissimum</i> (Lyngb.) J. Ag.	+	+	+	+	+		+		+			
<i>Crouania attenuata</i> (Bonnem.) J. Ag.	+	+	+	+	+	+	+	+	+	+	+	
<i>Griffithsia schousboei</i> Mont.	+											
<i>Lejolisia mediterranea</i> Bornet	+	+	+	+	+		+	+	+	+	+	+
<i>Seirospora interrupta</i> (Smith) Schmitz	+	+	+	+	+		+		+			
<i>Spermothamnion flabellatum</i> Bornet							+		+	+	+	+
<i>Spermothamnion johanis</i> G. Feldm.	+	+	+		+	+	+		+	+	+	
<i>Spermothamnion repens</i> (Dillw.) Rosenv.							+		+			
<i>Spyridia filamentosa</i> (Wulf.) Harv.	+		+		+	+			+	+	+	
<i>Wrangelia penicillata</i> C. Ag.	+				+	+						
<i>Dasya arbuscula</i> (Dillw.) C. Ag.									+			
<i>Dasya ocellata</i> (Grat.) Harv.			+				+				+	
<i>Dasya</i> sp.	+	+			+		+					



<i>Apoglossum ruscifolium</i> (Tur.) J. Ag.												+
<i>Arachnophyllum confervaceum</i> (Menegh.) Zanard.	+		+	+	+	+	+		+	+	+	
<i>Börgeseniella fruticulosa</i> (Wulf.) Kylin	+	+	+		+							
<i>Chondria tenuissima</i> (Good. et Woodw.) C. Ag.	+	+	+		+		+					+
<i>Dipterosiphonia rigens</i> (Schousb.) Falk.	+											
<i>Herposiphonia secunda</i> (C. Ag.) Nägeli	+	+					+					
<i>Laurencia obtusa</i> (Huds.) Lamour.	+	+	+	+	+	+	+	+	+	+	+	+
<i>Laurencia pinnatifida</i> (Gmel.) Lamour.	+						+		+			+
<i>Polysiphonia subulifera</i> (C. Ag.) Harv.	+									+		
<i>Polysiphonia</i> sp.	+	+	+	+	+	+	+		+			+

PHAEOPHYCEAE

[illegible]

## CHLOROPHYCEAE

<i>Ulothrix subflacida</i> Wille												+
<i>Bulbocoleon piliferum</i> Pringsh.	+	+			+			+				
<i>Phaeophylla dendroides</i> (Crouan) Batt.	+	+	+	+	+	+	+	+	+			+
<i>Pringsheimiella scutata</i> (Reinke) Schmidt	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ulveilla lens</i> Crouan	+	+	+	+	+	+	+	+	+	+	+	+
<i>Caldophora</i> sp.	+	+	+		+		+		+			
<i>Rhizoclonium kochianum</i> Kütz.	+	+	+		+	+	+	+	+	+	+	+

and basal). They are the following Rhodophyceae: *Dudressnaia verticillata*, *Centroceras cinnabarinum*, *Criffithsia schousboei*, *Dipterosiphonia rigens*, *Herposiphonia secunda* and Phaeophyceae: *Giraudya sphacelarioides*, *Castagnea mediterranea* and *Stilophora rhizodes* (Table 1).

Some species absent from the apical thirds and rare on central thirds were, for example, recorded from basal thirds. These are Rhodophyceae *Erythrotrichia carnea*, *Spermothamnion flabellatum*, *Spermothamnion repens*,

*Dasya arbuscula* and *Apoglossum ruscifolium*, Phaeophyceae *Myrionema strangulans* and Chlorophyceae *Ulothrix subflacida* (Table 1).

The epiphytic species which mainly grow on the upper surfaces of the leaves are Rhodophyceae *Fosliella cruciata*, *Fosliella farinosa* ssp. *solmsiana*, *Dudresnaia verticillata*, *Chylocladia kaliformis*, *Lomentaria chylocladiella*, *Antithamnion tenuissimum*, *Griffithsia schousboei*, *Spermothamnion repens*, *Dasya ocellata*, *Chondria tenuissima*, *Laurencia pinnatifida* and *Polysiphonia subulifera*, and Chlorophyceae *Cladophora* sp. (Table 1).

### CONCLUSIONS

Distribution of epiphytic flora on *Posidonia oceanica* leaves in the surface waters (5 m depth) of Stinjiva cove on the Kornat Island (central Adriatic) showed the following properties:

- epiphytic flora recorded is relatively rich (59 taxa with Cyanophyceae and Diatomeae not included) and dominated by Rhodophyceae (43 taxa or 72.9%), followed by Phaeophyceae (9 taxa or 15.2%) and Chlorophyceae (7 taxa or 11.9%);
- taxa recorded from the upper surfaces of the leaves exceeded for about 21% those recorded from the lower surfaces of the leaves; similar was recorded for Rhodophyceae: these differences are much smaller in Phaeophyceae and Chlorophyceae; Rhodophyceae were predominant on both surfaces of the leaves;
- the number of taxa recorded in June outnumbered those recorded in August for about 13%;
- relatively small number of taxa were equally represented at all the portions (thirds) and upper and lower leaf surfaces; forms which prefer only some of the leaf thirds (apical and basal) were also established, as well as those which mainly prefer upper leaf surfaces.

### REFERENCES

- Ben, D. van der. 1969. Les épiphytes des feuilles de *Posidonia oceanica* sur les cotes francaises de la Méditerranée. Proc. international Seaweed Symp., 6: 79—84.
- Panayotidis, P. 1979. Etude phytosociologique de deux aspects saisonniers de la flore épiphyte des feuilles de *Posidonia oceanica* (Linnaeus) Delile, dans le Golfe de Thessaloniki (Mer Egée, Grèce). Thalassographica, Greece, 3: 93—104.

Received: June 18, 1985.



RASPORED EPIFITSKE FLORE NA LIŠĆU *POSIDONIA OCEANICA* (L.)  
DELILE (NACIONALNI PARK »KORNATI« — SREDNJI JADRAN)

Boris Antolić

*Institut za oceanografiju i ribarstvo, Split, Yugoslavia*

KRATKI SADRŽAJ

U ovom radu prvi put se iznose podaci o kvalitativno-kvantitativnom rasporedu epifitske flore na lišću *Posidonia oceanica* sa istočne obale Jadranskog mora.

Uzrokovanja su izvršena u kolovozu 1980. i lipnju 1982. godine na dubini od 5 m u uvali Stinjiva na otoku Kornat (Nacionalni park »Kornati«).

Ukupno je utvrđeno 59 taksona (skupine Cyanophyceae i Diatomeae nisu uključene). Dominiraju predstavnici iz skupine Rhodophyceae sa 43 taksona (72,9%), a slijede predstavnici skupina Phaeophyceae sa 9 (15,2%) i Chlorophyceae sa 7 (11,9%) taksona.

Na gornjim površinama listova nađeno je za oko 21% više taksona nego na donjim. Slične razlike utvrđene su i u skupini Rhodophyceae, dok su u skupinama Phaeophyceae i Chlorophyceae razlike manje. Na obim površinama dominiraju oblici iz skupine Rhodophyceae.

U lipnju je utvrđeno za oko 13% više taksona nego u kolovozu.

Utvrđeni su oblici koji su podjednako dobro zastupljeni na svim dijelovima (trećinama) i površinama (gornjim i donjim) listova. Utvrđene su i vrste koje preferiraju samo pojedine dijelove (vršne ili bazalne trećine) listova, kao i one koje dolaze uglavnom samo na gornjim površinama listova.

