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PHENOLOGY OF SEAGRASS *POSIDONIA OCEANICA* (L.) DEL. IN THE SOUTH-EAST ADRIATIC (CAPE OF KOČIŠTE)

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ABSTRACT

The aim of this work is to show some basic information about meadows of seagrass *Posidonia oceanica* (L.) Del in the area of southeastern Adriatic Sea and to contribute the better knowledge of phenological characteristics. For basic phenological information number, length and width of different categories of leaves (adult, intermediate, juvenile), length of leaf sheaths, coefficient "A" and LAI (Leaf Area Index) were measured. It is interesting that the remains of last year's blossom with undeveloped fruits and successful germination were found on the several different positions. More detailed data about this plant in the southeast Adriatic Sea are sparse so further researches are necessary.

Key words: Posidonia, Adriatic, phenology, flowering

FENOLOGIJA MORSKE CVJETNICE POSIDONIA OCENICA (L.) DEL. U JUGO-ISTOČNOM JADRANU (RT KOČIŠTE)

REZIME

Cilj ovog rada je da se prikažu neki osnovni podaci o podvodnim livadama morske cvjetnice *Posidonia oceanica* (L.) Del. u jugo-istočnom dijelu Jadranskog mora i da se doprinese poznavanju fenoloških karakteristika biljke. Od fenoloških parametara mjereni su: broj, dužina i širina listova različitih kategorija (adultni, intermedijerni i juvenilni), dužina rukavca, koeficijent "A" i LAI (indeks lisne površine). Interesantno je da su pronađeni ostaci cvjetanja iz prošle godine sa nerazvijenim plodovima, kao i uspješno klijanje na nekoliko različitih pozicija. Detaljniji podaci za ovu biljku u oblasti jugo-istočnog Jadrana su malobrojni pa su, neophodna dalja istraživanja.

Ključne riječi: Posidonija, Jadran, fenologija, cvjetanje

INTRODUCTION

Seaweeds are very important for maintenance of stability of numerous ecosystems and in the Mediterranean region, in connection with that, *Posidonia oceanica* (L.) Del. meadows have the most important role (Molinier, Picard, 1952). In general, this phanerogamic plant has been examined a lot, but information for the area of southeastern Adriatic Sea is rather scarce. It seems there are numerous colonies of this species in the region of Montenegrin coast (Špan & Antolić, 1983; Stjepčević & Parenzan 1980) but more detailed data are sparse (Mačić, 2000; 2001).

The aim of this work is to show some basic information about meadows of *Posidonia oceanica* in the region of Montenegro and to contribute to gaining better knowledge about their characteristics. Only with numerous basic information on these colonies we will be able to carry out the program of monitoring, to understand natural dynamic of these colonies and to detect eventual disturbance in the early stage in order to apply adequate protection measures (Kirkman, 1996).

MATERIAL AND METHODS

The place of research is the coast of Montenegro, southwest from the Bay of Boka Kotorska, (Figure 1.). Observation of underwater meadows, measurement and sampling were done by scuba diving in October 2000. In order to calculate the density of the colony we used metal frames 25 x 25 cm, at three depths (10 m, 17 m and 23 m). For examination of phenological parameters 15 orotropic shoots were collected (at the depth of 10 m) and the bellow mentioned parameters were followed: number, length and width of different leaves categories (adult, intermediate and juvenile), length of the leaf sheaths, coefficient "A" and LAI (Leaf Area Index). Shoots with the remains of blossom from 1999 were also collected, as well as several specimens of germinated seeds.

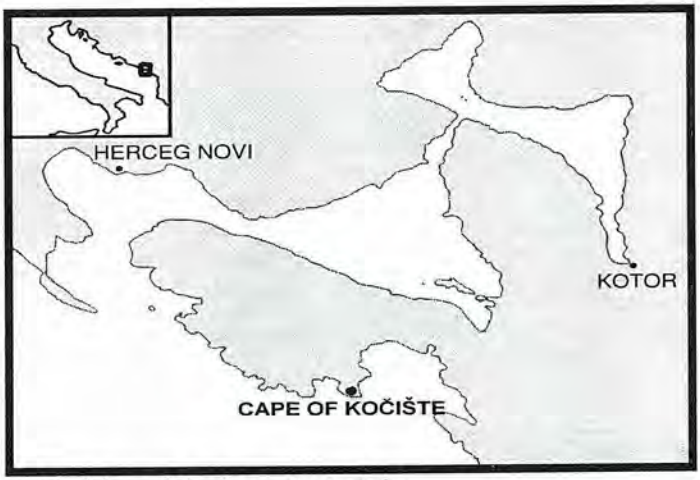

Figure 1. Position of the investigated site

RESULTS AND DISCUSSION

On examined terrain underwater meadows *Posidonia oceanica* extend from 8 to 26 meters in the depth, the density of meadow ranges from 352 to 624 and decreases in the relation to increase in depth. The density of the colony, in relation to meadows in the other parts of the Mediterranean, is relatively high even when compared to some colonies at smaller depth (Table 1.).

Mean values of phenological parameters are shown on the Table 2. The number of adult and intermediate leaves by a shoot varies from 3 to 6 with mean value 4.7. The length of adult leaves varies from 35.6 to 78.4 cm and such great variations are result of taking into account measurements of all leaves. Great variations in leaves length are understandable since the coefficient of damaged leaves tips is great (coefficient A=64%). Mean length of sheaths was 3.7 cm. Intermediate leaves shows smaller variations in length, from 8.5 to 17.9 and coefficient A was 7.5% only. As it is usually, intermediate leaves were narrower than adult ones.

Table 1. Mean density of *Posidonia oceanica* meadows from different localities

Localities	Depth (m)	LAI (m^2/m^2)	References
Banyulus sur Mer	2	5.8	Pergent, Pergent-Martini, 1988
	12	8.1	
Port Cros	2	13.3	
	11	6.4	
Urla Iskele	5	5.1	
Kopar	2	12.1	Turk, Vuković, 1998
Otranto	6.5	2.72	Mazzella et al. 1998
Lacco Ameno	5	6.18	Zupo et al., 1997
	22	2.43	
Boka Kotorska	7	4.6	Mačić, 2000
Cape of Kočište	10	9.7	new data

Table 2. Phenological characteristics of *Posidonia oceanica* on the Cape Kočište

Parameter	adult	intermediate	juvenile
Length (cm)	58.5	12.8	2.3
Length of leaf sheaths (cm)	3.7		
Width (mm)	8.8	8.5	
Coefficient "A" (%)	64.5	7.5	
LAI (cm^2/shoots)	154.4	20.4	
Total (cm^2/shoots) / (m^2/m^2)		174.8 / 9.7	

LAI by a shoot and by an m^2 was calculated and it is shown on the Table 2. Since these data are obtained on the basis of a single sampling only, monitoring is planned in other seasons too, in order to render phenological data on this underwater meadow precise to the greatest extent, and to make possible comparison to meadows in other parts of the Mediterranean.

It is interesting that the remains of last year's blossom with undeveloped fruits were found at the depth of 22m. Data from literature show that blossoming is phenomenon, which varies from place to place and from year to year, but is also subject to meteorological parameters and characteristics of the base (Panayotidis *et al.* 1989). The remains of blossoms in the meadows *Posidonia oceanica* are found in the Bay of Boka Kotorska too (Mačić, 2000), but in the absence of other literary data for this region, further researches will

show whether this was an exception rather than the rule for the colonies in this region.

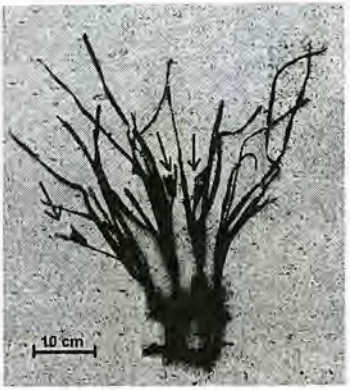

Figure 2. *Posidonia oceanica* with remains of flowers

It is also very important to point out that the germination of *P. oceanica* was observed at the locality Cape of Kočište at the depths of 21 m, 17 m and 8 m. Germination at greater depths was observed on a sand base, on the meadow's edge, and at the depth of 8 m germination was completely outside the meadow. It is known that the depth and characteristics of the base are very important for germination (Piazzi et al. 1999), so we assume that the seeds were carried by water current to such position where they found convenient ground for their further growth and from which they were sampled.

CONCLUSIONS

According to available literature these are the first facts about phenological parameters, blossoming and germination in this locality and they do not show drastic differences in comparison to data from literature concerning other parts of the Mediterranean. However, bearing in mind the fact that these information are obtained only on the basis of materials collected in October, further researches are needed for more detailed comparisons with other colonies. Besides, more detailed researches are planned in the seashore in the Adriatic Sea, to finding out characteristics of the colony and to implementing adequate protection measures.

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