

SPATIAL DENSITY AND MORPHOLOGY VARIATION OF *CAULERPA SCALPELLIFORMIS* (BROWN EX TURNER) C. AGARDH (CAULERPACEAE, CHLOROPHYCEAE) IN ANTALYA GULF (TURKEY)

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Abstract

Morphology and density variations of *C. scalpelliformis* at four locations in the Gulf of Antalya (Levantine Basin) are studied in the period July-September 2009. There were differences in 6 (frond length, number of frond, rhizome length; P<0.05 and apical frond width, pinnule length, diameter of stolons; P<0.01) of 10 morphological characters among the stations. The lowest total stolon length (197 cm/m²) and density (94,76±0,99 frond/m²) are observed at the station IV with highest sediment porosity (%44,35).

Keywords: *Levantine Basin, Phytobenthos, Density*

Introduction

The first record of alien species *Caulerpa scalpelliformis* (Brown ex Turner) C. Agardh from Turkey is reported from Antalya harbour in the period August-September 1995, from depth of 0,5 to 2 meter in seawater with a temperature range of 26.5-27°C. But that species was not found at the same location in the period 1995-1997 because of the low water temperature[1]. Hereafter *C. scalpelliformis* was observed again around the same station at 25.02.99 (low water temperature) from dept of 1-3 meter[2]. This green alga has been cover property as other invasion species and has the rapid spread[2][3]. It may negatively effect biological diversity when didn't take measure[2].

Materials and Methods

Specimens of *C. scalpelliformis* were hand-collected by SCUBA diving in the period July-September 2009 in the Gulf of Antalya from 4 locations (St.I: 36°53'02.78"N,30°42'02.70"E; St.II: 36°52'35.56"N,30°39'56.79"E; St.III: 36°52'11.87"N,30°39'17.98"E; St.IV: 36°51'36.49"N,30°38'21.58"E). The morphological characteristics were measured by using 150 mm 1/100 digital caliper in the laboratory of Faculty of Fisheries. Analysis of variance (ANOVA) and Duncan Multiple Range Test were employed to test the effect of morphological characters and density of *C. scalpelliformis* between the locations. Pearson Correlation Coefficients were measured to indicate the relationship between morphological characters. SPSS version 14.0 was used for all analyses.

Results

The colonies of *C. scalpelliformis* were found at the each station from depth of 15-25 meter in seawater with a temperature range of 28-29°C and salinity of 38.2 psu. The feather-like thallus is delicate with narrow stolons, erect fronds and wide pinnules. The stolons are slender, 0.12-0.17 cm in diameter, with long rhizoids, 4.17-5.91 cm long. The fronds are olive to dark green, 7.26-8.74 cm high and 1.17-1.37 cm broad. Total stolon length (cm), frond number and dry weight (g) of *C. scalpelliformis* in m² have highest value (977, 645.79±2.44, 48.3 respectively) on the sandy-slimy sediment with lowest porosity at the Station I (Table 1).

Tab. 1. Summary statistics of morphological characters, density of *C. scalpelliformis* and sediment porosity in different locations (means±standard errors) FL:frond length, RL: rachis length, FW: frond width, AFW: apical frond width, PN: number of pinnule, PL: pinnule length, FN: number of frond, SLR: stolon length between two rhizomes, RHL: rhizome length, SD: diameter of stolons

Morphological character	Station I	Station II	Station III	Station IV
FL (cm)	8,21±0,42	8,74±0,39	7,99±0,44	7,26±0,37
RL (cm)	1,08±0,06	1,09±0,09	0,92±0,06	1,12±0,05
FW (cm)	1,37±0,03	1,31±0,01	1,28±0,05	1,17±0,03
AFW (cm)	0,42±0,02	0,69±0,02	0,48±0,04	0,41±0,03
PN (on the one frond)	28,53±1,68	28,13±1,46	28,73±1,55	26,67±1,34
PL (cm)	0,81±0,02	0,82±0,02	0,73±0,05	0,67±0,01
FN (in 10 cm of stolon)	6,61±0,05	8,12±0,04	7,74±0,05	4,81±0,05
SLR (cm)	2,86±0,02	2,02±0,06	2,26±0,03	2,54±0,03
RHL (cm)	5,91±0,47	5,37±0,41	4,17±0,53	4,33±0,39
SD (cm)	0,17±0,08	0,16±0,08	0,14±0,09	0,12±0,05
Porosity of sediment (%)				
in	16,09	23,97	21,65	44,35
out	17,39	21,74	19,36	39,52
Total stolon length (cm) (in 1 m ²)	977	209,51	494	197
Total frond number (in 1 m ²)	645,79±2,44	169,78±0,84	382,36±1,24	94,76±0,99
Dry weight (g) (in 1 m ²)	48,3	17,2	33	8,2

Correlations between the 12 morphological characters of *C. scalpelliformis* are significant (Table 2).

Tab. 2. Correlation coefficients (Pearson product moment correlation) among the morphological characters on sampled individuals *Caulerpa scalpelliformis* (N=120 and N=40). ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level, Morphological codes are given in Table 1

	FL	RL	FW	AFW	PN	PL
FL	1	0,375(**)	0,395(**)	0,307(**)	0,864(**)	0,372(**)
RL		1	0,232(*)	0,239(**)	0,104	0,293(**)
FW			1	0,378(**)	0,093	0,721(**)
AFW				1	0,032	0,469(**)
PN					1	-0,011
PL						1

	FN	SLR	RHL	SD
FN	1	-0,26	0,19	0,548(**)
SLR		1	0,41	-0,009
RHL			1	0,051
SD				1

Discussion

C. scalpelliformis is an Indo-Pacific species with a wide distribution in the Indian Ocean and the Pacific as well as on warm-temperate Atlantic coasts[4]. It was found on concrete walls sheltered from waves from depth of 0,5 to 2 meter with stolons 20-21 cm long, 1.2 mm wide, with well-developed rhizoids 1.4 to 4.1 cm long; fronds, up to 5-5.5 cm high and 10-13 mm wide[1]. Our results are greater than these for some morphological characters but correspond to morphological data of *C. taxifolia*[5]. *C. scalpelliformis* was not observed shallower than 15 meter and deeper than 40 m in our study. Despite monthly observations carried out in Antalya harbour as well as in other stations of the Antalya Gulf from October 1995 to June 1997, the species was never detected again. It is indicated that could be due to the low water temperatures occurring in winter at that station which cannot support *C. scalpelliformis*[1]. Recovery of this species at 1999 in winter time at the same station[2] and at 2009 at 4 stations through the Antalya Gulf indicate expansion of the distribution area of *C. scalpelliformis* in the Mediterranean Sea. Our results show that species prefer sandy-muddy bottom to spread.

References

- 1 - Ertan, Ö.O., Turna, I.I. and Cormaci, M., 1998. A new record for the marine algal flora of Turkey: *Caulerpa scalpelliformis* (Brown ex Turner) C. Agardh (Caulerpaceae, Chlorophyceae). *Tr. J. of Botany*, 22: 285-287.
- 2 - Aysel, V., Senkardesler, A. and Aysel, F., 2002. Türkiye denizlerine gelen yeni bir tehlikeli alg *Caulerpa scalpelliformis* (R. Brown ex Turner) C. Ag. var. denticulata (Dacaisne) Weber van Bosse (Caulerpaceae, Caulerpales). *E.U. Journal of Fisheries & Aquatic Sciences*, 19(1-2): 105 – 108.
- 3 - Davis, A.R., Roberts, D.E. and Cummins, S.P., 1997. Rapid invasion of a sponge-dominated deep-reef by *Caulerpa scalpelliformis* (Chlorophyta) in Botany Bay, New South Wales. *Australian Journal of Ecology*, 22: 146-150.
- 4 - Silva, P.C., Basson, P.W., Moe, R.L., 1996. Catalogue of the Benthic Marine Algae of Indian Ocean. University of California press.
- 5 - Cevik, C., Yokes M.B., Cavas, L., Erkol, L.I., Derici, O.B. and Verlaque, M., 2007. First report of *Caulerpa taxifolia* (Bryopsidales, Chlorophyta) on the Levantine coast (Turkey, Eastern Mediterranean). *Estuarine, Coastal and Shelf Science*, 74: 549-556.