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Investigation of seasonal variations in biochemical composition of *Polysiphonia morrowii* (Harvey) from different locations in the strait of Canakkale.

Latife Ceyda Irkin¹, Huseyin Erdugan^{2*}

¹Faculty of Marine Sciences and Technology, Canakkale Onsekiz Mart University, Canakkale, Turkey

²Department of Biology, Faculty of Science, Canakkale Onsekiz Mart University, Canakkale, Turkey

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ABSTRACT

As a protein source for human consumption, terrestrial animal production alone may not be sufficient as a food supply for the increasing world population. The availability of high value food resources in the marine environment presents a serious potential for meeting an important amount of the food demand of the increasing world population. Studies on the utilization of marine algae as a food resource for human consumption have become an important topic in human nutrition. Marine algae with its high quality protein content are not only an important food resource for human consumption, but also an important fertilizer being used in the manure industry. The present study is aimed to investigate seasonal variation of biochemical composition of *Polysiphonia morrowii* (Harvey), a potential marine resource for high value protein supply.

Introduction

The demand on alternative food resources has become more and more important due to the increasing human population in the world. According to FAO (Food and Agriculture Organization of the United Nations) the global demand for food will need to increase by 70% until year 2050, and the human population is expected to reach up to 9 billion people in 2050.

The oceans are serving people not only as transport routes or energy sources, but also as a source for food supply. The sustainable utilization of the ocean environment, which is a challenging duty for human kind, can be achieved by understanding the present condition of marine resources and seasonal distribution of the natural resources such as marine algae.

Marine algae can be considered as alternative food sources and ingredients with high protein values and around

50% of the total algae production or harvest in the world is being used in the food industry, 40% in the pharmaceutical industry, while 10% is being used in other fields (Chapman and Chapman 1980; Güner and Aysel 1999).

The economic inputs and social benefits in terms of new employments in algae production plants especially in Asian countries has attracted other countries with marine coastal zones. Turkey, with its long coastlines is a candidate country for algae production and research on the distribution of different algae species have been increasing in recent years.

In the present study, chemical composition and seasonal distribution of *Polysiphonia morrowii* from *Rhodophyta* division in Çanakkale Strait has been investigated. Red algae (*Rhodophyta*) are dominated in the seas and characterized with red phycoerythrin pigments. There are very limited species living in freshwater. These species are very close to the blue-green algae in terms of their pigment structures and membrane types. One of the important characteristics of the red algae is that none of the cells even the sperms have flagellums. The tallus is developed like leaves. The outside structure is covered with a gelatinous material. In some of the species calcium

*Corresponding author

E-mail address: herdugan@comu.edu.tr (H. Erdugan)

Tel:+ +90 286 218 00 18/1898 fax: +90 286 218 05 33

carbonate is stored in the cell wall. In the coral reefs, these algae are serving as wave blockers and host for other living resources. In some species, the pectin structure in the cell wall is being used for the production of carrageen and polymer structured mucilage gel, called agar-agar. Some of them are used in the food and pharmaceutical industry (Pal et al. 1998).

Polysiphonia morrowii Harvey is a migratory species and was reported as a new record in Çanakkale Strait by Erdugan et al. (2009). It is abundant in Çanakkale Strait from February until the end of spring.

Material and methods

In the present study, red algae *P. morrowii*, are collected from Çanakkale Strait (40° 02'-40° 30' North and 26° 10'-26° 45' East) from 6 different sampling areas during the period of September 2007 - June 2008. The location of the study area has been given in Figure 1. The general view and tetraspores and pericentral cells of *P. Morrowii* are shown in Figure 2.

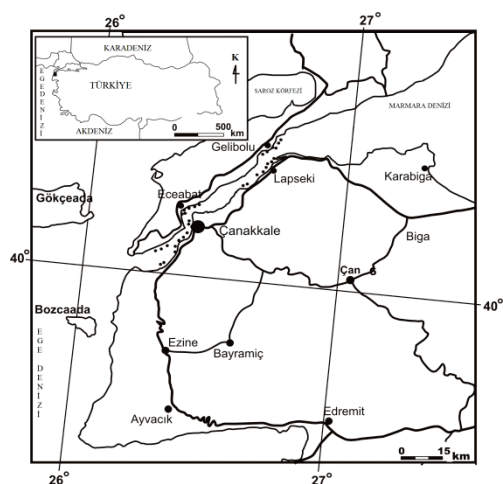


Figure 1. Research location.

Epiphytes from samples were carefully removed and gently washed with tap water and prepared for chemical analyzes. Afterwards, all samples were dried at 70 °C until constant weight was reached and grinded until flour has been produced. Crude ash, crude lipid, crude protein contents were then analyzed according to AOAC (2000) procedures, and lipid contents were determined according to Folch et al. (1957).

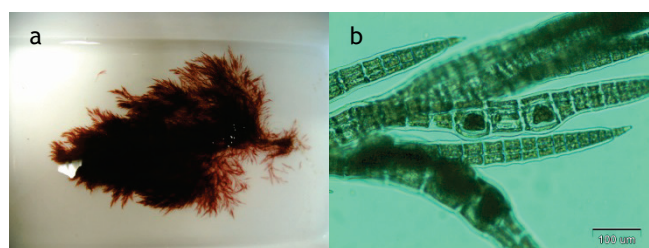


Figure 2. *P. morrowii* Harvey (general view (a), Tetraspores and pericentral cells (b)).

Results

In the present study, the *P. morrowii* takson belonging to the *Rhodophyta* division has been found in two seasons and six different locations.

Laboratory results from samples collected from six different locations and two different seasons have been presented in Tables 1 and 2 and Figures 3 and 4. Variations in chemical compositions of the species have been recorded as dependent to season and location.

Table 1. Chemical composition of *P. morrowii* collected from different locations during the winter period

Winter season	Lipid (%)	Protein (%)	Ash (%)
Yapıldak	0.33 ± 0.45	11.71 ± 0.71	32.32 ± 0.78
Eceabat	1.37 ± 0.24	27.40 ± 0.82	21.29 ± 0.71
Havuzlar	2.78 ± 0.84	33.47 ± 0.19	19.04 ± 0.28
Soğandere	0.75 ± 0.64	34.49 ± 0.24	15.10 ± 0.71

Table 1 shows that *P. morrowii* takson was found in all 4 stations during the winter period and the nutritional composition differed among stations. Highest protein content (34.49 ± 0.24) was recorded at Soğandere and lowest lipid content (0.33 ± 0.45) at Yapıldak location.

Table 2 shows that *P. morrowii* takson was found in all 5 stations during the spring period and the nutritional composition differed among the stations. The highest protein content (29.13 ± 0.42) and the lowest lipid content (0.13 ± 0.86) was found at Lapseki location.

Table 2. Chemical composition of *P. morrowii* collected from different locations during the Spring period

Spring Season	% Lipid	% Protein	% Ash
Gelibolu	0,64 ± 0,72	25,17 ± 0,91	53,05±0,68
Lapseki	0,13 ± 0,86	29,13 ± 0,42	17,99±0,62
Eceabat	0,47 ± 0,28	17,19 ± 0,68	28,62±0,88
Soğandere	0,59 ± 0,67	20,63 ± 0,38	14,49±0,51
Havuzlar	0,73 ± 0,71	16,74 ± 0,76	17,49±0,56

Discussion

In the present study, biochemical composition of the *P. morrowii* takson distributed in Çanakkale Strait was investigated at 6 locations and 2 seasons, i.e. winter and spring. At the end of the research, it was found that the nutritional contents of this species showed seasonal variations at different locations in the Strait of Çanakkale.

Wong and Cheung (2000), investigated the chemical compositions, amino acid profiles, and physicochemical characteristics of *Hypnea charoides* J. V. Lamouroux, *Hypnea japonica* Tanaka and *Ulva lactuca* Linnaeus taksons and found relatively high fiber (50.3-55.4%) and ash (21.3-22.8%) levels, while lipid levels were low (1.42-1.64%).

The protein content of red algae was found as higher than that of green algae. Both algae species contain

valuable amino acids. Better physicochemical composition was reported in red algae with a higher fiber contents. Rodde et al. (2004), in their research on the seasonal and geographic changes of the chemical composition of red algae *Palmaria palmata* found that ash, protein and carbohydrate contents were between 15-27%, 14-30%, and 3.3-25% of dry weight, respectively.

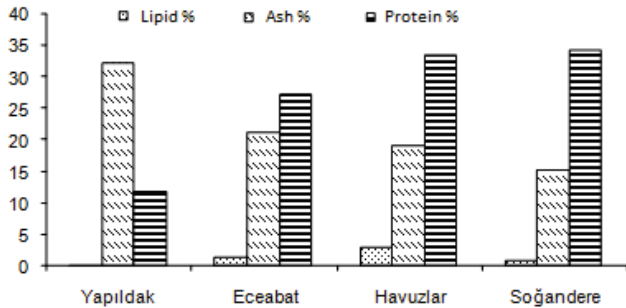


Figure 3. Results obtained for *P. morrowii* taxon during the winter period.

Marinho-Soriano et al. (2006), in their study on the chemical composition of red algae *Gracilaria cervicornis* (Turner) J. Agardh and brown algae *Sargassum vulgare* C. Agardh takson, reported protein contents between 15.97-23.05%. Highest protein content was found in *G. cervicornis* takson. Lipid levels were low in both species, while the ash content (14.20%) was recorded higher in *S. vulgare* compared to *G. cervicornis*.

Renaud and Luong-Van (2006), investigated the seasonal changes of the chemical composition (ash, soluble carbohydrates, lipid and protein) of 30 different macro algae. Relatively higher protein levels were found in red algae (4.8-12.8%). Higher energy level and inorganic materials were reported for the winter samples compared to those collected during the summer season. Our findings are in agreement with those of Renaud and Luong-Van (2006).

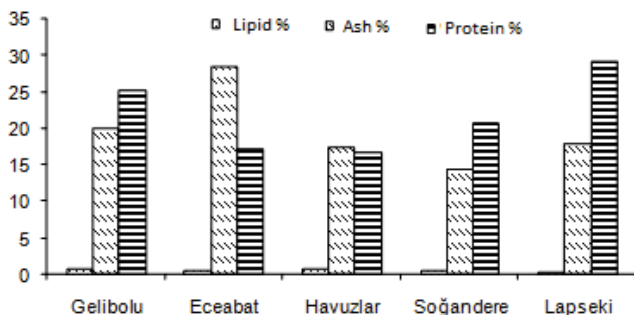


Figure 4. Results obtained for *P. morrowii* takson during the spring period.

In many countries, the utilization of algae is becoming more and more important with the increase of new knowledge of algae in terms of their nutritional composition and health benefit effects. Compared to the animal- or plant-based food sources, algae can be considered as high value food sources in terms of their protein, energy, vitamin and mineral contents.

Algae are capable to provide an important amount of daily requirement levels for vitamins A, C, B₂ and B₁₂ (Chapman and Chapman, 1980). As an important link of the food chain, algae are not only valuable food sources, but also important ingredients for the pet food industry, as fertilizer for the manure industry, pharmaceutical and cosmetics, as well as for the textile industry. The use of algae in medicine is also well known in terms of their antifungal, antiviral and antibacterial characteristics (Trono, 1999).

As an important food source with high level of protein contents, and their potential use in various fields attracts scientists and recently there is an increase of the utilization of algae in the industry. Hence the findings of the present study give important data set for determining the best season to benefit from algae in Çanakkale Strait.

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