Research Article

Contributions to Algae Flora of Gerze Coastline (Sinop, Turkey)

Dursun Kısa ᵃ, Köksal Pabuçcu ᵃ*

ᵃ Gaziosmanpasa University, Arts and Science Faculty, Biology Department, 60150, Tokat-Turkey

Abstract

In this research, algal composition of Blacksea in Gerze Coastline was studied and a total of 52 taxa were identified. Bacillariophyta was the dominant group in algal flora with 71 %, followed by Chlorophyta 11 %, Cyanobacteria 8 %, Ochrophyta % 4, Charophyta, Miozoa and Rhodophyta with 2 %, respectively. At the algal flora, *Navicula cincta, Nitzschia palea and Leptolyngbya tenuis* were the most dominant species. *Navicula* was represented by the most number of taxa species in the coastline of Gerze. According to chemical and physical analysis, sea water was slightly alkaline and mesohaline.

Keywords: Algae, Biological diversity, Black sea, Phytoplankton

Gerze (Sinop/Türkiye) Kıyı Şeridi Alg Florası

Öz

Bu çalışmada, Sinop-Gerze kıyı şeridi alg kompozisyonu incelendi ve 52 takson tanımlandı. Algal flora kompozisyonunda % 71 Bacillariophyta dominant grup olarak bulunurken onu sırasıyla Chlorophyta % 11, Cyanobacteria % 8, Charophyta, Miozoa ve Rhodophyta % 2 olarak izlemiştir. Algal florada, *Navicula cincta*, *Nitzschia palea* ve *Leptolyngbya tenuis* en dominant türler olup, Gerze kıyı şeridinde *Navicula* en çok türle temsil edilen takson olmuştur. Fiziksel ve kimyasal analizlere göre deniz suyunun hafif alkali ve mezohalin özellikte olduğu anlaşılmıştır.

Anahtar Kelimeler: Alg, Biyolojik Çeşitlilik, Fitoplankton, Karadeniz

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* Corresponding author
 e-mail: kpabuccu@gmail.com

Introduction

Algae have a major significance, since they are primary producers and are used as a biological indicator in water [1]. The algae related with sea productivity and they have pigments such as chlorophyll a and b so they perform photosynthesis, there by oxygen increase in the seawater. Oxygen is produced by algae which live with attached to stone or climbing plant bodies in the water. Algae are major group of the food chain, if any change in their quantity, dimension and composition of species, all sea livings and biosphere are affected by these factors [2].

Some of the earlier studies of the Black Sea algae were carried out by Woronichin [3], Stockmayer [4] and Zinova, [5] and then, physiological investigations have been performed in different Black Sea regions such as Sinop was studied by Öztürk [6], Rize by Erduğan et al., [7], Kastamonu by Demircan and Türkoğlu [8] and Bartın, Zonguldak, Trabzon and Sinop was investigated various times by Aysel et al., [9, 10, 11]. Tas and Okumus [12] investigated phytoplankton at the 30 stations in Black sea coast during the periods of September 2005 – October 2005. The distribution of marine algae of Samsun and the upper infralittoral zone of Sinop (Black sea, Turkey) were studied by Aysel et al., [9, 13]. Baytut et al., [14] reported the new record for marine phytoplankton of Southern Black Sea Coasts (Turkey). The monthly variation of phytoplankton composition of Samsun Bay (Black Sea, Turkey) was studied by Baytut et al., [15]. Also, some molecular studies were performed taxa collected from Black Sea by Baytut et al., [16, 17, 18] In this study, it is planned to determine composition of benthic and planktonic algal flora of Gerze Coastline and sea water quality by using chemical and physical properties.

Materials and Methods

Study area: Gerze coastline is small district at the Sinop that it's situated in the Black sea coastline (Figure 1). Black sea is surrounded by six countries; rivers from different territory bring contaminated materials. It connects open sea with Bosporus [19].
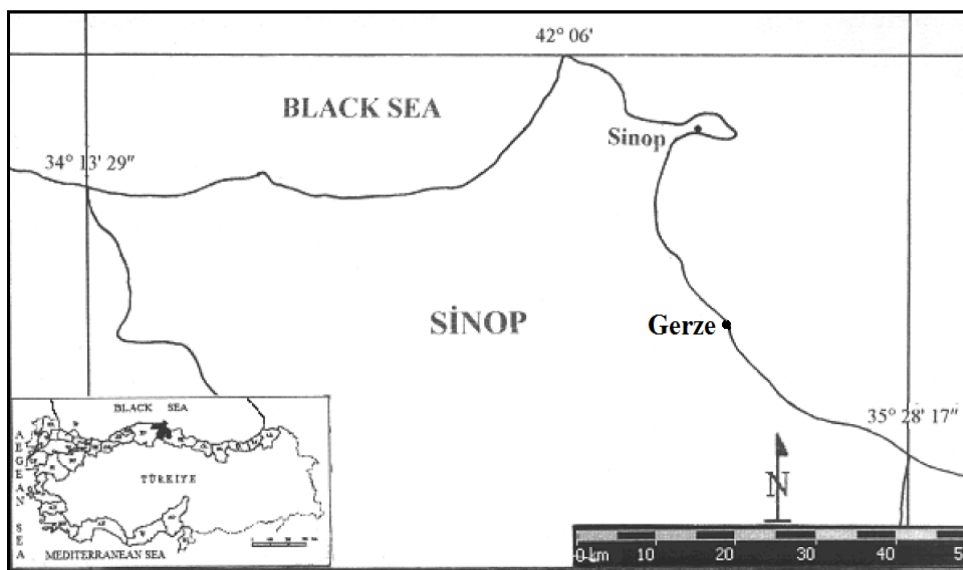
Figure 1. Map of investigated area.

Algae samples: The water samples were collected at two stations from the coast of the Gerze from September to December. Algea (epipelic, epiphytic, epilithic, planktonic habitats) were examined; also chemical and physical analyses of the sea water were determined through investigating of water pH, dissolved oxygen, phosphate, nitrate and silicate.

Epipelic algae except diatoms members were collected in plastic containers and added % 10 formaldehyde. To exemine the epipelic diatoms, sediment samples were collected by using a glass pipe, 8 mm in diameter and 1m in length, and 2-3 meters away from the shore. Samples were transferred into plastic bottles. After the muddy samples were precipitated, water was discharged and mud was transferred petri boxes. Coverslip was placed on moist mud and petri boxes were placed on the light media and then we examined the algal composition in temporary slides. Also, the samples containing the diatoms were centrifuged and then H_2O_2 was added and boiled to the smoke hood. Then the diatoms were purified from acid and organic substances. Diatoms were identified from permanent slides prepared from these [20].

To determine epiphytic and epilitic algae, stone and aquatic plant samples taken from station were washed with under the tap water and depended organism were left. The algae had been kept in the refrigerator at + 4˚C, and then temporary preparations have been identified under the light microscope.

For the qualitative analysis of phytoplankton, 1 liter of water samples taken from the stations were placed in glass bottles and fixed with 4 % formaldehyde [12]. Then, the water samples were filtrated through a filter paper (Whatman GF/A) in the water tromp. The obtained samples were prepared as temporary for observation, and identified with light microscope (Olympus CX21).

Following references were used for identification: Hasle et al. [21], Krammer and Lange Bertalot [22 – 25], Round *et al.* [26] and John *et al.* [27] . The validity of the identified species was checked by Guiry and Gury [28] and Gönülol [29] databases and their abbreviations were given according to Brummit and Powell [30].

Results and Discussion

In this study, a total of 52 taxa belonging to Bacillariophyta (37), Chylorophyta (6), Cyanobacteria (4), Ochrophyta (2), Charophyta (1), Miozoa (1) and Rhodophyta (1) were identified. In composition of algae, Bacillariophyta is dominant group with 71 %, Charophyta, Miozoa and Rhodophyta are the small group with 2 %, respectively (Figure 2, Table 1).
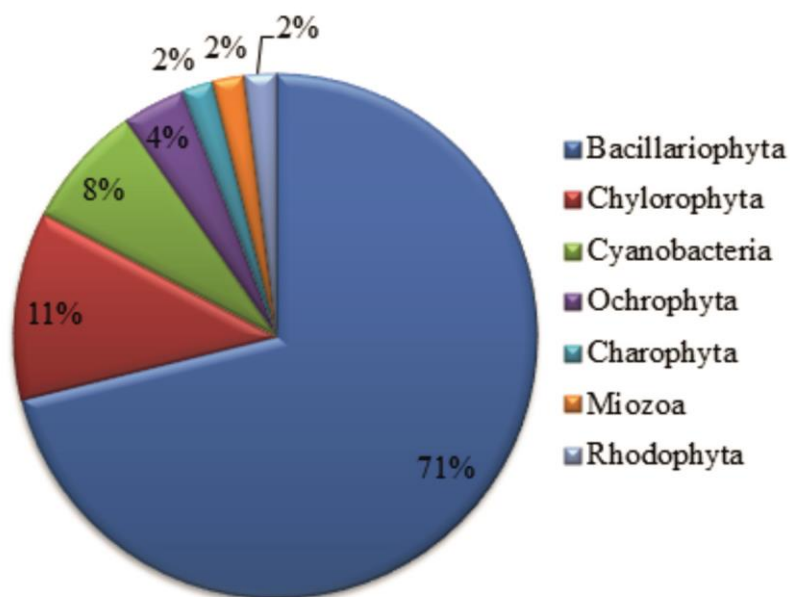
Figure 2. *Representative percentage of the algal composition of the flora*

Table 1. *Taxa distributed on Gerze coastline (Sinop, Turkey)*

TAXA	Planktonic	Epiphytic	Epilithic	Epipelic
CYANOBACTERIA				
CYANOPHYCEAE				
Chroococcales				
Microcystis incerta Lemmerm.			+	
Oscillatoriales				
Lyngbya semiplena J. Agardh ex Gomont			+	
Oscillatoria limosa C. Agardh ex Gomont			+	
Synechococcales				
Leptolyngbya tenuis Gomont		+	+	+
BACILLARIOPHYTA				
BACILLARIOPHYCEAE				
Bacillariales				
Cylindrotheca closterium (Ehrenb.) W. Sm.		+		+
Nitzschia acuta Hantzsch		+		
N. amphibia Grunov		+		
N. commutata Grunov				+
N. dissipata (Kütz.) Rabenh.		+		
N. fonticola (Grunov) Grunov		+	+	
N. ovalis H.J.Arnn.			+	

Continued…

N. palea (Kütz) W.Sm.	+	+	+	
Pseudo-nitzschia pseudodelicatissima (Hasle) Hasle	+	+		
Tryblionella victoriae Grunov		+	+	
Cocconeidales				
Achnanthidium affine (Grunov) Czarn.			+	
Cocconeis placentula Ehrenb.		+		
Planothidium hauckianum (Grunov) Bukht. Mas		+		
Cymbellales				
Cymbella affinis Kütz.			+	
C. cistula (Ehrenb.) var. *minor* Grunov		+		
C. helvetica Kütz.		+		
Gomphonema parvulum Kütz.		+		
Navicymbula pusilla (Grunov) Kramm.			+	
Placoneis elginensis (W.Greg.) E.J.Cox		+		+
Placoneis gastrum (Ehrenb.) Mereschk.		+	+	
Fragilariales				
Fragilaria vaucheriae (Kütz.) J.B.Petersen		+		
Staurosirella pinnata (Ehrenb.) D.M.Williams & Round			+	
Licmophorales				
Ulnaria ulna (Nitzsch) Compère		+		
Mastogloiales				
Achnanthes brevipes H.Perag. & M. Perag		+		
Naviculales				
Chamaepinnularia hassiaca (Krasske) Cantonati & Lange-Bert.	+			
Gyrosigma acuminatum (Kütz.) Rabenh.		+		
Haslea spicula (Hickie) Bukht.		+		
Navicula cincta (Ehrenb.) Rafls		+	+	+
N. menisculus Schum.			+	
N. rostellata Kütz.			+	
N. viridula (Kütz.) Ehrenb.		+		
Pleurosigma elongatum W.Sm.		+	+	
Tabellariales				
Diatoma vulgaris Bory		+		
Oxyneis binalis (Ehrenb.) Round	+			
Thalassionematales				
Thalassionema javanicum (Grunov) Hasle		+	+	
COSCINODISCOPHYCEAE				
Rhizosoleniales				

Continued…

Pseudosolenia calcar-avis (Schultze) Sundström		+	+	
MEDIOPHYCEAE				
Stephanodiscales				
Cyclotella comata (Her.) Kütz.	+	+		
CHAROPHYTA				
Zygnematales				
Mougeotia genuflexa (Roth) C. Agardh			+	
CHLOROPHYTA (Trebouxiophyceae)				
Chlorellales				
Chlorella vulgaris Beij.	+			
Gloeotila subconstricta (G.S.West) Printz			+	
CHLOROPHYTA (Ulvophyceae)				
Cladophorales				
Cladophora fracta (O.F. Müll. ex Vahl) Kütz.		+	+	
Rhizoclonium crassipellitum West & G.S. West		+		
Ulvales				
Ulva intestinalis L.			+	
Ulva lactuca L.			+	
MIOZOA				
DINOPHYCEAE				
Peridiniales				
Protoperidinium granii (Ostenf.) Balech		+		+
OCHROPHYTA				
XANTHOPHYCEAE				
Tribonematales				
Tribonema affine (Kütz.) G. S. West		+		
Vaucheriales				
Vaucheria sp.			+	
RHODOPHYTA				
FLORIDEOPHYCEAE				
Ceramiales				
Ceramium virgatum Roth		+		

At the algae composition, *Navicula cincta, Nitzchia palea, Leptolyngbya tenuis* are the most widespread and intense. Genus of Navicula was represented by the most species. Bacillariophyta was seen as an intense division in the other studies in Turkey's seas. The members of Bacillariophyta were more abundant than other groups, and similar results were determined in many other studies at the Black Sea by Türkoğlu and Koray [31], Demircan and Türkoğlu [8]. Baytut *et al.* declared that total of 129 taxa belonging to 5 divisions in Samsun Bay, Turkey, and

Bacillariophyta was the most common taxa [15]. Also, it was stated that 129 taxa belonging to 7 classes were identified, and diatoms represented the majority of community (52.7 %), followed by dinoflagellates (36.4 %) [12]. Aysel et al. recorded 277 and 176 taxa in their research along coast of Sinop and Samsun, Turkey, respectively [9, 13].

At the field of study was determined a toxic species that was *Pseudo-nitzchia pseudodelicatissima. Pseudo-nitzschia* is a diatom of global importance due to its production of the neurotoxin domoic acid [32]. These species can affect development of other algal species and zooplanktons. It is a cosmopolitan genus, many species of it are found over a wide range of salinity and temperature. *P. pseudodelicatissima* can be found in coastal and oceanic, tropical and temperate waters; it is especially common in the autumn [33]. It was reported that various harmful taxa such as *Dinophysis acuta, Phalacroma rotundatum, Prorocentrum compressum, P. cordatum and P. micans* are found in the southern Black Sea [18].

The physical and chemical properties of seawater measured and they are shown at the table 2. The average pH values were measured as 8.31 and seawater was slightly alkaline and mesohaline [34]. The dissolved oxygen values, phosphate, nitrate and silicate values determined 6.4 mg/L, 0.76µM, 6.50 µM and 5.13 µM, respectively (Table, 2). Diatoms live in rich nutrient water and in present study the value of nitrate and silicate were determined high. This level was suitable conditions for diatoms that need to nutrient. pH, salinity and dissolved oxygen ratio were close to earlier investigations in Black Sea [9,11]. In this study, we found that *N. palea* and *L. tenuis* were common species, and it was reported that *N. palea* exhibited dominance species at intermediate salinity waters [35]. Also, *L. tenuis* shows tolerance to the salinity conditions between 1 mM to 150 mM NaCI growth medium [36]. Chemical and physical characteristic of Black sea show differences, and phosphate concentrations varied from 0.2 to 1.5 µM, nitrate concentration 15 µM in the northwestern (Romanian) Black sea [37]. It was declared that dissolved oxygen is 4.33 (January) and 6,89 (April), Nitrite concentration is 0.50 µM, and the concentrations of ammonium, nitrate and phosphate changed with months in the Samsun Bay, Turkey [15].

Table 2. *Chemical and physical analysis of seawater*

Temperature (ºC)	21,8
PH	8,31
Salinity (‰o)	16,67
Dissolved oxygen (mg/L)	6,4
Suspended solid (mg/L)	2,5
Phosphate (µM)	0,76
Nitrate (µM)	6,50
Silicate (µM)	5,13

Black sea extends along the north of Turkey. Algal composition may change depending on place of the sample. We carried out the study before Black sea coastal highway in Gerze. Our goal is to compare the algal composition with new studies.

Marine biodiversity varies in the coastal zone depend on physical alterations of coast [38]. It is noticed that some algae species have flourished in mesohaline waters in comparison to the polyhaline waters [39]. Living organisms and habitats are easily affected by human activities, which are trawling, eutrophication and coastal constructions. Such human activities present the most important contemporary threat to biological diversity [40]. If the necessary measures are not taken, may increase water pollution in the coastal zone.

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