J. Black Sea/Mediterranean Environment
Vol 12:251-267..(2006)

Marine algae and seagrasses of Tekirdağ (Black Sea, Turkey) [1]

Tekirdağ (Karadeniz, Türkiye) deniz algleri ve deniz çayırları

Veysel Aysel [2*], Hüseyin Erduğan [2], Berrin Dural [3] , E. Şükran Okudan [4]

[2]Çanakkale Onsekiz Mart University, Faculty of Science and Arts, Biology Department, Çanakkale, Turkey

[3]Aegean University, Faculty of Science, Biology Department, İzmir, Turkey

[4]Akdeniz University, Faculty of Engineering, Department of Environmental Engineering, Antalya, Turkey

Abstract

In this study, marine algae and seagrasses in the upper infralittoral zone of the Black Sea coast of Tekirdağ (Turkey) were investigated. A total 156 taxon (153 algae and 3 seagrasses) in species or inferior to the species category were determined. 15 of them belong to blue-green bacteria (Cyanophyta), 84 to red algae (Rhodophyta), 26 to brown algae (Heterokontophyta), 28 to green algae (Chlorophyta) and 3 to marine flowering plants (Magnoliophyta).

Keywords: Turkey, Tekirdağ, algae, marine flowering plants.

[1] This investigtion includes the part of the project with TBAG-1325 number

[*] Corresponding Author: e-mail: vaysel@comu.edu.tr

Introduction

All countries located by the Black Sea coast have made systematic studies on marine algae. Important of these studies are; Zinova (1964, 1967) and Vinogradova (1974) from Russia, Celan (1948), Celan and Bavaru (1967) with Bavaru *et al.,* (1991) from Rumania, Zinova et al., (1974), Zinova and Dimitrova (1975, 1976, 1981) with Dimitrova *et al.,* (1992) from Bulgaria.

The first investigations of the Turkish Black Sea algae were carried out by Buxbaum (1740), Dumon D'urville (1822), Agardh (1851-1876), Tchichatcheff (1860), Sperk (1869), Fritsch (1899), Woronichin (1908a, b), Stockmayer (1909), Zernov (1913), Zinova, (1964) and later by Turkish researchers Öztığ (1957, 1962, 1967), Karamanoğlu (1964), Zeybek (1966,1973), Güner (1970), Güven (1970), Altındağ (1987), Cirik and Cihangir (1987), Öztürk (1988), Aysel *et al.,* (1990), Özer and Köksal (1993), Aysel and Erduğan (1995), Erduğan *et al.,*(1996, 2003) and Aysel *et al.,* (1996, 1997, 1998, 2000, 2004).

Material and Methods

In this study, marine algae (*Cyanophyta*, *Rhodophyta*, *Heterokontophyta* and *Chlorophyta*) and seagrasses (Magnoliophyta) in the upper infralittoral zone of the Black Sea coast of Tekirdağ were investigated. Tekirdağ is situated between 28^0 08' 55" and 28^0 09' 07" eastern longitudes (Fig 1).

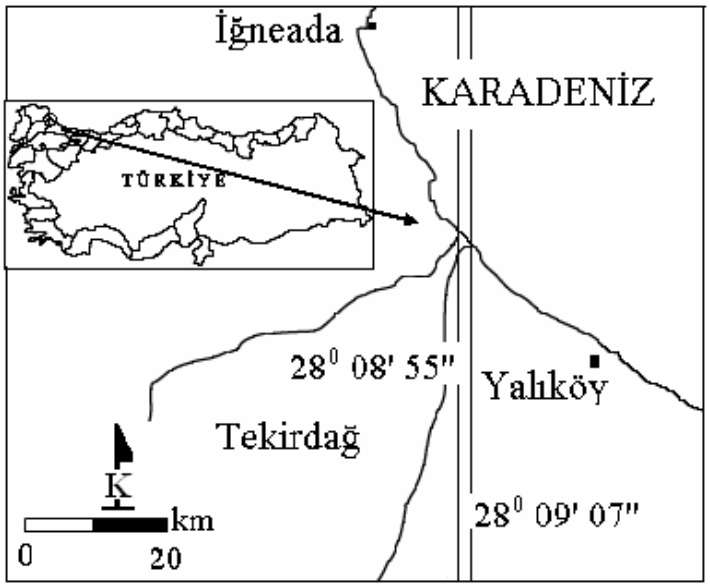

Fig 1. Map of Tekirdağ coastline

Collected specimens were fixed by using 4 % formaldehyde. Specimens belonging to *Rhodomelaceae* and *Corallinaceae* were exceptionally treated with 10 % HCl in identification procedures for specific cell wall properties.

Results

Taxa distributed in study area are listed in Table 1. In this list, classes and upper categories were arranged according to Van den Hoek *et al.,* (1997) and Guiry and Dhonncha (2005). Arrangement of lower categories, presented in the list were followed by specialists [(Silva *et al.,* (1996) for *Cyanophyta* and *Rhodophyta*, Stegenga (1985) for *Acrochaetiales*, Frederic and Hommersand (1989) for *Gracilariales*, Bressan and Babbini-Benussi (1995) for *Corallinales,* Gomez Garreta *et al.,* (2001) for *Ceramiales*, Ribera *et al.,* (1992) for *Fucophyceae,* Gallardo *et al.,* (1993) for *Chlorophyceae*].

Additionally, the studies of Barbara and Cremades (1996), Ballantine and Aponte (1997) and Hardy and Guiry (2003) were used to create an evolutionary list of taxa above genus level. Taxa in species or below species level are listed in alphabetical order.

Discussion

According to bathimetric distribution of 153 taxa (Fig 2), 73 taxa dispersal on infralittoral zone and 43 taxa dispersal on mezolittoral zone. According to this result marine algae on this area are heliophythic.

Algal composition of this area shows similarity with algal flora of Kırklareli (Aysel *et al.,* 1998). *Cystoseira barbata, Enteromorpha kylinii*, *E. linza* and *Ulva fasciata* comminity are dominant and taxa of *Rhodophyta* are abundant of algal flora.

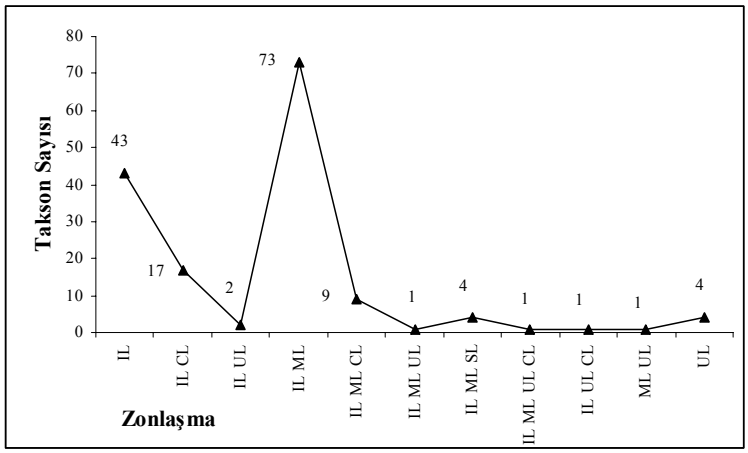

Fig 2. Bathimetric distribution of taxa on Tekirdağ (IL: İnfralittoral, CL: Sircalittoral, UL: Upperinfralittoral, ML: Mezolittoral, SL:Supralittoral).

The fitogeographic distribution of marine algae on flora of Tekirdağ coast are 54 taxa from mediterranean-Atlantic-Pasific, 47 taxa cosmopolit, 31 taxa from Mediterranean- Atlantic from total 153 taxa (Fig 3).

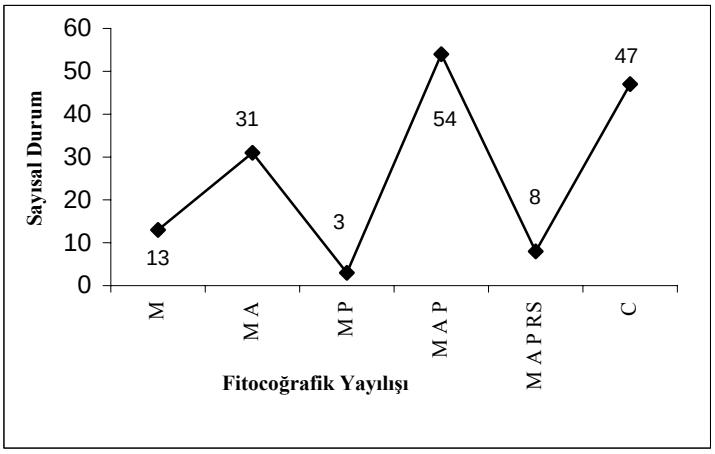

Fig 3. The fitogeographic distribution of marine algae on the Black Sea coast of Tekirdağ (M: Mediterrranean, A: Atlantic, P: Pasific, RS: Red Sea, C: Cosmoplite).

Salinity is pressure on distribution of algal flora. Marine algae belong to fresh water algal flora survive in this area because of low salinity concentration. *Phyllophora crispa* f. *crispa*, *P. pseudoceranoides* and *Eupogodon planus* were recorded only flora of Black Sea coast (Aysel *et al.*, 1996, 1997, 2000).

The number of algae species of Tekirdağ and the other the Black Sea coastal cities were shown (table 2).

.

Table 1: Taxa distributed on Tekirdağ (Black Sea) coasts of Turkey

CYANOPHYTA
[=CYANOBACTERIA]
CYANOPHYCEAE
CHROOCOCCALES
CHROOCOCCACEAE
Chroococcus dimidiatus (Kützing) Nägeli, ML, IL, C

ENTOPHYSALIDACEAE
MICROCYSTACEAE
Gloeocapsa compacta Kützing SL, ML, IL, M, A

MERISMOPEDIACEAE
GOMPHOSPHAERIOIDEAE
Gomphosphaeria aponina Kützing ML, IL, C

OSCILLATORIALES
OSCILLATORIACEAE
Lyngbya adriae **Ercégovic** ML, IL, M
L. aestuarii (Mertens) Liebmann ML, IL, C
L. confervoides C. Agardh ML, IL, C
Oscillatoria curviceps C. Agardh ML, IL, M

PHORMIDIOIDEAE
Phormidium ambiguum Gomont IL, C
P. corallinae (Gomont *ex* Gomont) Anagnostidis &Komárek, IL, C

PSEUDOANABAENACEAE
Spirocoleus tenuis (Meneghini) P.C. Silva, ML, C

LEPTOLYNGBYOIDEAE
Planktolyngbya subtilis (W. West) Anagnostidis & Komarek IL, M, A, P

NOSTOCALES
RIVULARIACEAE
Calothrix aeruginea (Kützing) Thuret, ML, IL, C
C. confervicola (Roth) C. Agardh ML, IL, C
C. scopulorum (Weber van Bosse & Mohr) C. Agardh, SL, ML, IL, C
Rivularia atra Roth *ex* Bornet & Flahault, ML, UL, C

RHODOPHYTA
RHODELLOPHYTINA
RHODELLOPHYCEAE
STYLONEMATALES
STYLONEMATACEAE
Stylonema alsidii (Zanardini) K. Drew, ML, IL, C
S. cornucervi (Reinsch) Hauck ML, IL, M, A, P

COMPSOPOGONOPHYCEAE
ERYTHROPELTIDALES
ERYTHROTRICHIACEAE
Erythrotrichia carnea (Dillwyn) J. Agardh, ML, IL, C
Sahlingia subintegra (Rosenvinge) Kornmann, ML, IL, C

MACRORHODOPHYTINA
BANGIOPHYCEAE
BANGIOPHYCIDAE
GONIOTRICHALES
GONIOTRICHACEAE
Chroodactylon ornatum (C. Agardh) Basson, ML, IL, M, A, P

BANGIALES
BANGIACEAE
Bangia atropurpurea (Roth) C. Agardh, ML, IL, C
Porphyra laciniata (Lightfoot) C.Agardh, UI, M, A, P
P. leucosticta Thuret in Le Jolis

ML, M, A, P
P. umbilicalis (Linnaeus) Kützing
ML, IL, M, A, RS

NEMALIOPHYCIDAE
ACROCHAETIALES
ACROCHAETIACEAE
Acrochaetium microscopicum
(Nägeli *ex* Kützing) Nägeli
ML, IL, M, A, P
A. parvulum (Kylin) Hoyt
ML, IL, M, A, P

COLACONEMATALES
COLACONEMATACEAE
Colaconema daviesii (Dillwyn)
Stegenga, ML, IL, M, A, P
C. membranaceum (Magnus)
Woelkerling, ML, IL, M

NEMALIALES
NEMALIACEAE
Nemalion helminthoides (Velley)
Batters, SL, ML, IL, M, A, P

RHODYMENIOPHYCIDAE
GELIDIALES
GELIDIACEAE
Gelidium spinosum (S.G. Gmelin)
P.C. Silva
var. ***hystrix*** (J. Agardh)
G. Furnari, ML, IL, M
Pterocladiella capillacea (S.G.
Gmelin) Santelices & Hommersand, ML, IL,
M, A, P

GELIDIELLACEAE
Gelidiella ramellosa (Kützing)
Feldmann & G. Hamel, IL, M, P
Parviphycus antipai (Celan)
B. Santelices, ML, IL, M, P

GRACILARIALES
GRACILARIACEAE
Gracilaria dura (C. Agardh)
J. Agardh, IL, M, A, P
G. gracilis (Stackhouse) Steentoft,
L.M. Irvine & Farnham, IL, CL, C

CORALLINALES
CORALLINACEAE
AMPHIROIDEAE
Amphiroa rigida J.V. Lamouroux
IL, CL, M, A, P

CORALLINOIDEAE
CORALLINEAE
Corallina elongata Ellis & Solander
ML, IL, M, A
C. officinalis Linnaeus,
ML, IL, M, A, P

JANIEAE
Haliptilon virgatum (Zanardini)
Garbary &H.W. Johansen
IL, M, A
Jania rubens (Linnaeus)
J.V. Lamouroux
var. ***rubens,*** ML, IL, C
var. ***corniculata*** (Linnaeus)
Yendo, IL, M, A

MASTOPHOROIDEAE
LITHOPHYLLOIDEAE
Lithophyllum cystoseirae (Hauck)
Heydrich, IL, M, A, RS

GIGARTINALES
HYPNEACEAE
Hypnea musciformis (Wulfen *in*
Jaquin) J.V. Lamouroux, ML, IL, C

PEYSSONNELICEAE
Peyssonnelia rubra (Greville)
J. Agardh, IL, CL, M, A, RS
P. squamaria (S.G. Gmelin)
Decaisne, IL, CL, C

PHYLLOPHORACEAE
Coccotylus truncatus (Pallas)
M.J. Wynne & J.N. Heine
IL, CL, M, A
Phyllophora crispa (Hudson)
P.S. Dixon, IL, CL, M, A
P. pseudoceranoïdes (S.G. Gmelin)
Newroth & A.R.A. Taylor
IL, CL, M, A, P

RHODYMENIALES
LOMENTARIACEAE
Lomentaria articulata (Hudson)
Lyngbye, IL, CL, M, A, P
L. clavellosa (Turner) Gaillon
IL, M, A, P

HALYMENIALES
GRATELOUPIACEAE
Grateloupia dichotoma J. Agardh
IL, M, A, P

CERAMIALES
CERAMIACEAE
CALLITHAMNIOIDEAE
CALLITHAMNIEAE
Aglaothamnion tenuissimum
(Bonnemaison) G. Feldmann
Mazoyer
var. ***tenuissimum,*** IL, M, A, P
Callithamnion corymbosum (Smith)
Lyngbye, ML, IL, M, A, P
C. granulatum (Ducluzeau)
C. Agardh, ML, IL, M, A

CERAMOIDEAE
ANTITHAMNIEAE
Antithamnion cruciatum
(C. Agardh) Nägeli,ML,IL,M, A, P

CERAMIEAE
Ceramium ciliatum (Ellis)
Ducluzeau
var. *ciliatum,* ML, IL, M, A, P
var. ***robustrum*** (J. Agardh)
Mazoyer, ML, IL, M, A
C. circinatum (Kützing) J. Agardh
ML, IL, M, A, P
C. deslongchampsii Chauvin *ex*
Duby, ML, IL, M, A, P
C. gaditanum (Clemente) Cremades
ML, IL, CL, M, A
C. rubrum *auctorum*
var. ***rubrum,*** ML, IL, M, A, RS
var. ***implexoconcortum*** (Solier)
G. Feldmann Mazoyer, IL, M, A
C. secundatum Lyngbye
ML, IL, M, A
C. siliquosum (Kützing) Maggs &
Hommersend
var. ***siliquosum,***ML,IL,M, A, RS
var. ***elegans*** (Roth) G. Furnari
IL, M, A, RS
var. ***zostericola*** (Feldmann
Mazoyer) G. Furnari
f. ***zostericola,,*** IL, M, A
f. ***minusculum*** (Feldmann
Mazoyer) A. Gomez Garreta,
T. Gallardo, IL, M
C. tenerrimum (Martens) Okamura
var. ***tenerrimum***
ML, IL, CL, M, A, P
var. ***brevizonatum*** (Peterson)
Feldmann Mazoyer,ML, IL, CL, M

PTEROTHAMNIEAE
Pterothamnion plumula (Ellis) Nägeli
IL, CL, M, A, P
SPERMOTHAMNIEAE
Spermothamnion flabellatum Bornet
IL, M, A

DASYACEAE
Dasya baillouviana (S.G. Gmelin)
Montagne, ML, IL, M, A, P
D. hutchinsiae Harvey *in* J.W.
Hooker, IL, M, A, P
Eupogodon planus (C. Agardh)

Kützing, IL, CL, M, A

DELESSERIACEAE
DELESSERIOIDEAE
APOGLOSSEAE
Apoglossum ruscifolium (Turner) J. Agardh, IL, CL, M, A

HYPOGLOSSEAE
Hypoglossum hypoglossoides (Stackhouse) F.S. Collins *&* Harvey, IL, CL, M, A, P

NITOPHYLLOIDEAE
NITOPHYLLEAE
Nitophyllum punctatum (Stackhouse) Greville, ML, IL, C

RHODOMELACEAE
CHONDRIEAE
Chondria capillaris (Hudson) Wynne
- var. ***capillaris,*** IL, C
- var. ***subtilis*** (Hauck) V Aysel, H Erduğan, E Ş Okudan, H Erk IL, M

C. dasyphylla (Woodward) C. Agardh, IL, M, A, P

LAURENCIEAE
Chondrophycus paniculatus (C. Agardh) G. Furnari, IL, M, P
C. papillosus (C. Agardh) Garbary *&* J. Harper, ML, IL, M, A, P
Laurencia obtusa (Hudson) J.V. Lamouroux
- var. ***obtusa,*** ML, IL, C
- var. ***gracilis*** (Kützing) Hauck IL, M, A, P
- var. ***laxa*** (Kützing) Ardissone ML, IL, M

Osmundea. pinnatifida (Hudson) Stackhouse, ML, IL, M, A, P

POLYSIPHONIEAE
Herposiphonia secunda (C. Agardh) Ambronn, ML, IL, M
- f. ***secunda,*** ML, IL, M, A, P
- f. ***tenella*** (C. Agardh) Wynne ML, IL, C

Lophosiphonia obscura (C. Agardh) Falkenberg, ML, IL, M, A, P
L. subadunca (Kützing) Falkenberg ML, IL, C
Polysiphonia brodiei (Dilliwyn) Sprengel, ML, IL, M, A, P
P. elongata (Hudson) Harvey *in* Hooker, ML, IL, CL, M, A, P
P. fucoides (Hudson) Greville ML, IL, CL, C
P. opaca (C. Agardh) Moris & De Notaris, ML, IL, M, A, P
P. sertularioides (Grateloup) J. Agardh, ML, IL, M, A, P
P. tenerrima Kützing IL, M, A, P
P. variegata (C. Agardh) Zanardini IL, UL, M, A, P
P. violacea (Roth) Spregel, IL, M, A

POLYZONIEAE
Dipterosiphonia rigens (Shousboei) Falkenberg, ML, IL, M, A

HETEROKONTOPHYTA
FUCOPHYCEAE
[=PHAEOPHYCEAE, PHAEOZOOSPOROPHYCEAE]
ECTOCARPALES
ECTOCARPACEAE
Ectocarpus siliculosus (Dillwyn) Lyngbye
- var. ***siliculosus*** , ML, IL, C
- var. ***arctus*** (Kützing) Kuckuck ML, IL, M, A, P
- var. ***dasycarpus*** (Kuckuck) Gallardo, ML, IL, M, A
- var. ***hiemalis*** (P.L. Crouan *ex*

Kjellman) Gallardo,ML,IL, M, A
Feldmannia caespitula (J. Agardh) Knoepffler Péguy
var. ***caespitula*** , IL, M, A
var. ***lebelii*** (Areschoug *ex* P.L. Crouan) Knoepffler Péguy IL, M, A
F. irregularis (Kützing) G. Hamel ML, IL, C
Mikrosyphar polysiphoniae Kuckuck, IL, M, A
Streblonema sphaericum (Derbès *&* Solier) Thuret, IL, CL, M, A

CHORDARIALES
CORYNOPHLAEACEAE
Corynophlaea umbellata (C. Agardh) Kützing, IL, M
Myriactula rivulariae (Shur) Feldmann, IL, M, A

SPERMATOCHNACEAE
Stilophora nodulosa (C. Agardh) P.C. Silva, IL, M, A
S. tenella (Esper) P.C. Silva ML, IL, C

CUTLERIALES
CUTLERIACEAE
Zanardinia typus (Nardo) G. Furnari, IL, CL, C

SPHACELARIALES
SPHACELARIACEAE
Sphacelaria cirrosa (Roth) C. Agardh, ML, IL, CL, C

STYPOCAULACEAE
Halopteris scoparia Linnaeus Sauvageau, IL, M, A, RS

CLADOSTEPHACEAE
Cladostephus spongiosus (Hudson) C. Agardh, IL, CL, C
f. ***verticillatus*** (Lightfoot) Prod'homme van Reine ML, IL, CL, M, A

DICTYOTALES
DICTYOTACEAE
Dictyopteris polypodioides (A.P. de Candolle) J.V. Lamouroux IL, CL, C
Dictyota fasciola (Roth) J.V. Lamouroux, ML, IL, C
D. menstrualis (Hoyt) Schnetter, Hornig & Weber Peukert
var. ***menstrualis,*** ML, IL, CL, C

DICTYOSIPHONALES
MYRIOTRICHIACEAE
Myriotrichia clavaeformis Harvey IL, M, A, P

STRIARIACEAE
Striaria attenuata (Greville) Greville, IL, M, A, P

PUCTARIALES
PUNCTARIACEAE
Punctaria plantaginea (Roth) Greville IL, M, A, P
FUCALES
CYSTOSEIRACEAE
Cystoseira barbata (Stackhouse) C. Agardh, IL, M

C. crinita (Desfontaines) Bory
f. ***crinita*** IL, M, A
f. ***bosphorica*** (Sauvageau.) Zinova *&* Kalugina, IL, M

CHLOROPHYTA
CHLOROPHYTINA
ULVOPHYCEAE
ULOTRICHALES
ULOTHRICHACEAE
Ulothrix flacca (Dillwyn) Thuret *in*

Le Jolis, ML, IL, M, A, P

ULVALES
ULVELLACEAE
Ulvella lens P. L. Crouan *&*
H. M. Crouan,ML,IL,CL,M,A,P

ULVACEAE
Blidingia marginata (J. Agardh)
P. Dangeard *ex*Bliding
ML, IL, M, A, P
B. minima (Nägeli *ex* Kützing)
Kylin, ML, IL, M, A, P
Enteromorpha clathrata (Roth)
Greville, IL, CL, UL, C
E. compressa (Linnaeus) Nees
ML, IL, C
E. flexuosa (Wulfen) J. Agardh
subsp. ***flexuosa,*** SL, ML, IL, C
subsp. ***pilifera*** (Kützing) Bliding
ML, IL, M, A
E. intestinalis (Linnaeus) Nees
var. ***intestinali ,*** ML, IL, C
E. kylinii Bliding, UL, M, A
E. linza (Linnaeus) J. Agardh
ML, IL, C
E. muscoides (Clemente) Cremades
ML, IL, M, A, P
Ulva fasciata Delile, IL, M, A, P
U. rigida C. Agardh, ML, IL, C

CLADOPHOROPHYCEAE
CLADOPHORALES
CLADOPHORACEAE
Chaetomorpha aerea (Dillwyn)
Kützing, UL, C
C. linum (O.F. Müller) Kützing
ML, IL, C
Cladophora albida (Nees) Kützing
IL, C
C. fracta (O.F. Müller *ex* Vahl)
Kützing, IL, M
C. glomerata (Linnaeus) Kützing
var. ***glomerata,*** ML, IL, M, A, P
var. ***marina*** Lyngbye, IL, M
C. hutchinsiae (Dillwyn) Kützing
IL, M, A, P
C. laetevirens (Dillwyn) Kützing
ML, IL, M, A, P
C. pellucida (Hudson) Kützing
f. ***pellucida,*** IL, CL, M, A
C. sericea (Hudson) Kützing
ML, IL, C
C. trichotoma (C. Agardh) Kützing
UL, M, A
Rhizoclonium tortuosum (Dillwyn)
Kützing, ML, IL, M, A, RS

BRYOPSIDOPHYCEAE
BRYOPSIDALES
BRYOPSIDACEAE
Bryopsis hypnoides J.V. Lamouroux
IL, C
B. plumosa (Hudson) C. Agardh,
ML, IL, C

MAGNOLIOPHYTA
(=TRACHEOPHYTA)
LILIOPSIDA
CYMODOCEALES
CYMODOCEACEAE
Cymodocea nodosa (Ucria)
Ascherson, IL, UL, M, A, P

ZOSTERALES
ZOSTERACEAE
Zostera marina Linnaeus
ML, IL, UL, C
Z. noltii Homermann
ML, IL, UL, CL, M, A

Table 2. The number of algae species of Tekirdağ and the other the Black Sea coastal cities (KR: Kırklareli, TK: Tekirdağ, KSD: Kocaeli, Sakarya, Düzce, ZN: Zonguldak, BR: Bartın, KS: Kastamonu, SN: Sinop, SM: Samsun OR: Ordu, TR: Trabzon, RA: Rize-Artvin).

Bölümler	Studied Cities of Turkish Black Sea Shores										
	KR	TK	KSD	ZN	BR	KS	SN	SM	OR	TR	RA
Cyanophyta (Cy)	23	15	30	20	12	22	22	20	14	1	3
Rhodophyta (R)	71	84	126	100	116	133	136	106	93	23	43
Heterokontophyta (H)	24	26	50	42	43	56	52	27	27	8	15
Chlorophyta (C)	30	28	46	43	39	48	55	22	26	23	27
Magnoliophyta	3	3	3	3	3	3	3	3	4	3	3
Toplam	151	156	255	208	213	262	268	178	164	58	91

The percent ratio of Marine algae on the Black Sea coast of cities were shown (Table 3).

Table 3. The percent ratio of marine algae on the Black Sea coast of cities

Bölümler	The percent ratio of Marine algae on the Black Sea coast of cities										
	KR	TK	KSD	ZN	BR	KS	SN	SM	OR	TR	RA
Cyanophyta (Cy)	16	9,8	11,9	9,8	5,7	8,5	8,3	11	8,8	1,8	3,4
Rhodophyta (R)	48	54,9	50	49	55	51	51	61	58	42	49
Heterokontophyta(H)	16	16,99	19,8	21	21	22	20	15	17	15	17
Chlorophyta (C)	20	18,3	18,3	21	19	19	21	13	16	42	31
Toplam	100	100	100	100	100	100	100	100	100	100	100

Dominancy in division level among Northern provinces of Turkey also were shown (Table 4).

Ratio of green algae (R/C and H/C) in Tekirdağ coast is higher than other coasts, such as coast of the Black Sea of Turkey. Ratio of H/Cy and C/Cy is nearly similar to each other. Thus, it is shown that Cyanobacteria was investigated carefully.

Table 4. Dominancy in division level among Northern provinces of Turkey (R: Rhodophyta, H: Heterokontophyta, C: Chlorophyta and CY: Cyanophyta).

Bölümler	Dominancy as cities in division level from the Black Sea shores of Turkey										
	KR	TK	KSD	ZN	BR	KS	SN	SM	OR	TR	RA
R/H	3	3,23	2,52	2,4	2,7	2,37	2,6	3,92	3,44	2,9	2,9
R/C	3,7	3	2,73	2,3	3	2,77	2,5	4,81	3,58	1	1,6
R/CY	3,1	5,6	4,2	5	9,7	6,04	6,5	5,3	6,64	23	14,3
H/C	0,8	0,92	1,08	1	1,1	1,16	0,96	1,22	1,04	0,3	0,6
H/CY	1	1,73	1,66	2,1	3,6	2,54	2,5	1,35	1,93	8	5
C/CY	1,3	1,86	1,53	2,2	3,3	2,18	2,59	1,1	1,86	23	9

Özet

Bu araştırmada, Tekirgağ'ın (Türkiye), Karadeniz kıyılarındaki üst infralittoral bölgesinin, deniz algleri ve deniz çayırları araştırılmıştır. Tür ya da tür altı düzeyde olmak üzere toplam 156 takson (153 alg ve üç deniz çayırı) tayin edilmiştir. Bunlardan 15 tanesi mavi-yeşil bakteri (Cyanophyta), 84 tanesi kırmızı alg (Rhodophyta), 26 tanesi Kahverengi alg (Heterokontophyta), 28 tanesi yeşil alg (Chlorophyta) ve üç tanesi de deniz çiçekli bitkilerine (Magnoliophyta) aittir.

References

Altındağ, S., (1987). Some *Ceramium* species of West Black Sea, *Ege Üniversitesi Su Ürünleri Yüksek Okulu Su Ürünleri Dergisi.* 6: 31-49.

Aysel, V., H. Erduğan. (1995). Checklist of Black Sea seaweeds, *Tr. J. Botany* 19: 545-554.

Aysel, V., T. Kesercioğlu., H. Güner., H. Akçay. (1990). Marine algae of Trabzon. X. Ulusal Biyoloji Kongresi. 18-20 Temmuz, Erzurum. Botanik Sirküleri 2: 183-192.

Aysel, V., H Erduğan., A Sukatar., H Güner., M Öztürk. (1996). Marine algae of Bartın. *Tr. J. Botany* 20: 251-258.

Aysel, V., B Dural., A Sukatar., H Güner., H Erduğan. (1997). Marine algae of Zonguldak, Black Sea, Turkey. XIII Ulusal Biyoloji Kongresi, 17-20 Eylül 1996, İstanbul, Hidrobiyoloji Seksiyonu 5: 311-321.

Aysel, V., B Dural.., A Gönüz.., E Ş Okudan. (1998). Marine flora of Kırklareli (Black Sea, Thrace, Turkey), (In Turkish). XIV Ulusal Biyoloji Kongresi, 7-10 Eylül 1998, Samsun. Bitki Fizyolojisi-Bitki Anatomisi ve Hidrobiyoloji Seksiyonları 2: 333-342.

Aysel, V., A. Şenkardeşler, F. Aysel. (2000). Marine flora of Ordu (Black Sea, Turkey). SBT 2000-Bildiriler: 61-69.

Aysel V., H Erduğan., B Dural Tarakçı., EŞ Okudan., A Şenkardeşler., F Aysel. (2004). Marine flora of Sinop (Black Sea, Turkey), *E.U.J. Fisheries and Aquatic Sciences* 21: 59-68

Ballantine D.L., N.E Aponte. (1997). A revised checklist of the benthic marine algae known to Puerto Rico. *Caribbean J. Science*, 33: 150-179.

Barbara I., J Crémades. (1996). Seaweeds of the Ria de a Coruna (NW Iberian Peninsula, Spain), *Bot. Mar.* 39: 371-388

Bavaru, A., S A Bologa., H. V Skolka. (1991). A Checklist of the benthic marine algae (Except the *Diatoms*) along the Romanian shore of the Black Sea. *Rev. Roum. Biol.-Biol. Végét*. 36: 7-22.

Bressan G, Babbini-Benussi L, 1995, Inventario delle *Corallinales* del Mar Mediterraneo: Considerazioni tassonomiche. *Giorn. Bot. Ital.,* 129: 367-390.

Celan, M. (1948). Sur la végétation algale a Agigea (Mer Noire) pendant les mois Septenbre-Novembre. *Bull. Inst. Polytechn. Iassy* 4: 340-351.

Celan, M., A Bavaru. (1967). Contribution a'la connaisance des Algues rouges (Rhodophycees) de la Meer Noire. *Revar. Rom. Biol. Ser. Bot*. 12: 350-361.

Cirik, Ş., B Cihangir. (1987). Preliminary notes on benthic marine plants of İnceburun (Sinop) and its environment. *Ege Üniversitesi Su Ürünleri Yüksek Okulu Su Ürünleri Dergisi.* 4: 106-111.

Dimitrova Konaklieva, D., M.I Konaklieva. (1992). *Colpomenia* (*Phaeophyta*), The new genus for the flora of the Black Sea. Ros. Akad. *Nauk, Bot. jurnal*. 77: 83-84.

Erduğan H., V Aysel., H Güner. (1996). Marine algae between Rize and Sarp. Black Sea Turkey . *Tr. J. Botany*, 20: 103-108.

Erduğan H., V Aysel., B Dural Tarakçı., E Ş Okudan., F Aysel. (2003). Marine algae and seagrasses of Düzce, Sakarya and Kocaeli (Black Sea, Turkey). SBT 05-07 Aralık 2003, Bursa: 20-29.

Fredericq, S., M.H Hommersand. (1989). Proposal of the *Gracilariales* ord. nov. (*Rhodophyta*) based on an analysis of the reproductive development of *Gracilaria verrucosa*, *J. Phycol.* 25: 213-227.

Firtsch, K., (1899). Beitrag zur Flora von Constantinopel I. Kyrptogamen. *Denkschr. math.- naturw. k. Akad. Wiss. Wien.* 68:219-248.

Gallardo, T., A Gomez Garreta., M. A Ribera., M Cormaci., G Furnari., G Giaccone., Ch. F Boudouresque. (1993). Check-list of Mediterranean Seaweeds. II. *Chlorophyceae* Wille s.I. *Bot. Mar.* 36: 399-421.

Gomez Garreta A., T Gallardo., MA Ribera., M Cormaci., G Furnari., G Giaccone., Ch F Boudouresque. (2001). Check-list of Mediterranean Seaweeds. III. *Rhodophyceae* Rabenh. I. *Ceramiales* Oltm. *Bot. Mar*., 44: 425-460.

Guiry M.D, E.N Dhonncha. (2005). Algaebase. World Wide Web electronic publication www.algaebase.org (April 2005).

Güner, H. (1970). Taxanomische und Ökologische Untersuchung über die Strand – algen der Agäischen Meeresküste. Ege Üniversitesi, Fen Fakültesi, İlmi raporlar serisi No: 76:4-77

Güven, K.C. (1970). Türkiye sahillerindeki deniz algleri hakkında. *Eczacılık Bülteni* 12:174-176

Hardy G, M.D Guiry. (2003). A Check-list and Atlas of the Seaweeds of Britain and Ireland. *Br. Phycol. Soc*.: 1-50.

Karamanoğlu,K. (1964). Marmaris ve Güllük sahillerinde bazı önemli deniz algleri. *Türk Biyoloji Dergisi* 14:32-39

Özer, N.P., G Köksal. (1994). A Study on the macroalgae of Trabzon seashore, Ege Univ., J. Fac. Sci. 16: 1687-1707.

Öztığ, F. (1957). Erdek sahillerinde deniz vegetasyonu hakkında. *Türk Bioloji Dergisi.* 7:12-13*,*

Öztığ, F. (1962) İstanbul Sahillerinin deniz vegetasyonu hakkında. *Türk Bioloji Dergisi*. 12:14-16

Öztığ, F. (1967) Über die formunterschiede bei *Corallina granifera* in Marmarameer. *İst. Üniv. Fen Fak. Mec. B*. 22 (1-2):131-133

Öztürk, M. (1988). An investigation on vegetable organisms in the upper infralitloral zone of Akliman and Hamsaroz gulfs, IX Ulusal Biyoloji Kongresi 21-23 Eylül 1988, Sivas, 3: 329-343.

Ribera, M. A., A Gomez Garreta., T Gallardo., M Cormaci., G Furnari., G Giaccone. (1992). Check-list of Mediterranean Seaweeds. I. *Fucophyceae* (Warming 1884). *Bot. Mar.* 36: 109-130.

Silva, P.C., P.W Basson., R..L Moe. (1996). Catalogue of the Benthic Marine Algae of the Indian Ocean, California pres., 1259 p.

Stegenga, H. (1985). The marine *Acrochaetiaceae (Rhodophyta*) of southern Africa, *S. Afr. J. Bot*. 51: 291-330.

Stockmayer S. (1909). Algae. III. Systematische Bearbeitung des gesammelten Materials (pp. 55-101). in H.F. Handel-Mazetti (ed.). Ergebnisse einer botanischen Reise in das pontische Randgebirge im Sandschak Trapezunt. *Ann. Naturh. Mus. Wien* 23: 6-212.

Van den Hoek C., D G Mann., H. M Jahns. (1997). Algae, an introduction to phycology, Camb. Univ. Pres., 627 p.

Vinogradova, K.L. (1974). Ulvoviye vodorosli (*Chlorophyta*) *CCCP Izdatel. "Nauka", Leningr. Otd.,L.* 1-166. morey.

Voronichin, N. N. (1908a). Buriyh vodorosli (*Phaeophyceae*), *Çerno More*: 1- 53.

Woronichin, N. N. (1908b). Phaeophyceen des Schwarzen Meeres. Travaux de la Soc. imp. de naturalistes des St. Peterboung: 37-45

Zeybek, N. (1966). Ege sahillerinde tesbit edilen bazı algler. Ege Üniv. Fen Fak. İlmi Raporlar Serisi No: 27.

Zeybek, N. (1973). Meeresalgen aus der Turkei. 1. Die Buchten von Edremit und Saros am Aegaeischen meer, 2. Die küste von Iğneada bis Şile am Schwarzen Meer, Verhandl. *Der Schweizerischen Naturf. Gesell*.: 95-100.

Zinova, A.D. (1964). Algae nonnullae e mari nigro e collectione Professoris Hausknechtii, Akad. Nauk CCCP. Bot.Inst.Var.L.Kom. Novar. Syst. *Plant. Non. Vasc*. 1: 127-132.

Zinova, A.D. (1967). Opredelitel zeleniyh, buriyh i krasniyh vadorosley yujniyh morey USSR,Bot.Inst."VAR.L.Komarova" Moskova. 400 p

Zinova, A.D., S Dimitrova Konaklieva. (1974). Algae in sinu Acthopolitanu (Bulgaria Austro-Orientalis) inventae, Akad.Hauk CCCP. Bot. Inst. VAR.L. Komarova. Novar. Syst. *Plant. Non Vasc*. 11: 125-129.

Zinova, A.D., S.D Dimitrova. (1975). Algae in sinu Achthopolitanu (Bulgaria Austro-Orientalis) inventae. II, Akad. Nauk CCCP. Bot. Inst. VAR.L.Komarova, Novar. Syst. *Plant.Non Vasc* 12: 119-123.

Zinova, A.D., S.D Dimitrova. (1976). Algae in sinu Achthopolitanu (Bulgaria Austro-Orientalis) inventae. III, Akad.Nauk CCCP.Bot. Inst. VAR.L. Komarova. Novar. Syst. *Plant. Non Vasc.* 13: 10-14.

Zinova, A.D., S.D Dimitrova. (1981). Algae in sinu Acthopolitanu (Bulgaria Austro-Orientalis) inventae. IV, Akad. Nauk CCCP. Bot. Inst. VAR.L. Komarova. Novar. Syst. *Plant. Non Vasc.* 8: 16-21.

Received: 16.06.2006

Accepted: 08.08.2006