

Coastal Dunes of East Mediterranean Features of Endemic *Ononidetum hispanicae* Association

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Abstract: *Ononidetum hispanicae* association is endemic on coastal dunes of East Mediterranean in Turkey. This association is identified in Çaltıcak1, Çaltıcak2, Göynük, Kemer of Antalya province, in Taşucu, Sazbaşı and Susanoğlu of Mersin province and Muğla province. The association consists of grasses whose length vary between 5 and 50 cm. The association's dominant species are *Ononis hispanicae*, *Cynodon dactylon*, *Echium plantagineum*, *Paronchia argentea*, *Pancremium maritimum*, *Cyperus capitatus*, *Polygonum equisetiforme* and *Euphorbia paralias*. It is an association of perennial vegetation on coastal dunes. The objectives of this study are investigation of the relationship between plant associations and the environment, especially the soil. Plant associations were found out to have displayed not only properties of soil, but also the way plant associations interact with it. The work area is coastal dunes as the type of land. Mediterranean floristic region of about 50 vascular plants have been identified within the study area. Most of the work place is filled with quaternary type of land. Stations in the study area, The central Mediterranean (WASS) and the Eastern Mediterranean I. Type (WSAS) precipitation regimes show and the work place has "Rainy Sub Soft, Rainy Sub Hot, A Little Rainy Warm, A little Rainy Soft" Mediterranean Bioclimate. Alluvial soils exist in the group's study field. Water saturation percentage is lower than of 36 % of the sand soils structure. % Water saturation ratio is high on Mersin-Silifke coastal dunes. Humidity percentage is high Antalya-Göynük coastal dunes. Obviously, distribution of grain sizes plays key roles on vegetation on coastal dunes. Coastal sand dunes range from small to large grain sizes. The rate of small sand is high. The soil samples taken from the group are very little salty, very highly calcareous (21,64-55,61) on Mersin-Silifke and Taşucu coastal dunes, pH (7,6-7,8) slightly alkaline on Mersin-Susanoğlu coastal dunes and other coastal dunes are strongly alkaline.

Keywords: *Ononidetum hispanicae* ass, Soil-vegetation relationship, Coastal ecosystems, Conservation area, Ecological tolerance limits

Introduction

The research area, which lies at C2, C3, C4 square according to Davis (1965-1985) flora of Turkey, is located within the boundary of the delta where rivers (in Turkey) flow into the Mediterranean (Fig. 1).

The relationship between coastal dunes vegetation and soil was investigated in East Mediterranean coastal dunes, Turkey. This study was conducted in order to find out the relationship between endemic *Ononidetum hispanicae* plant association and soil, which were discovered by Géhu and Uslu (1989) on coastal dunes of East Mediterranean in Turkey. Samples of soils, such as in Çaltıcak1, Çaltıcak2, Göynük, Kemer of Antalya province, in Taşucu, Sazbaşı and Susanoğlu of Mersin province and in Muğla province from coastal dunes were collected. *Ononidetum hispanicae* plant association is identified regarding Braun-Blanquet (1932) Method in the research areas. The association consists of grasses whose length vary in the range 5-50 cm. The association's dominant species are *Ononis hispanicae*, *Cynodon dactylon*, *Echium plantagineum*, *Paronchia argentea*, *Pancremium maritimum*, *Cyperus capitatus*, *Polygonum equisetiforme* and *Euphorbia paralias*. It is an association of perennial vegetation of the high beach.

Coastal dune habitats have diversity ecosystem and contain have high value habitat richness and vegetation (Serteser, 2002a, 2002b, 2004, 2015, 2016) (Fenu et al., 2012, 2013) (Ruocco et al., 2014). Coastal dune ecosystems have dynamic interactions between abiotic and biotic factors. Abiotic and biotic factors are changing

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with shoreline to the inland areas and also effect zonation of plant communities characteristic (Fenu et al., 2013) (Ruocco et al., 2014). The structure and composition of coastal dune plants communities are affected by ecological factors as climate, soil features, biotic and topographic factors (Maun et al., 2009).

The relationships between plant communities and soil in coastal dunes have studied by many researchers (Fenu et al., 2012) (Costa et al., 1996) (Kim et al., 2009). The coastal dunes have localized 110 various place with 845 lengths in Turkey (Uslu,1989). Several researchers focused on some characteristics of costal dunes such as dune-vegetation interaction and soil properties of sands (Serteser, 2002a, 2002b, 2004, 2015, 2016) (Özcan et al., 2010) (Avcioğlu, 2015).

The objectives of this research were identifying the relationship of *Ononidetum hispanicae* plant association with soil on Mediterranean coastal dunes in Turkey. Previous studies on Mediterranean coastal dunes were conducted environment and environmental management and possible measures against the problem have been identified by Rural Services General Directorate (Köy Hizmetleri Gn. Md., 1991, 1993, 1998), General Directorate of Meteorology (D.M.İ., 2015), General Directorate of Mineral Research and Exploration (M.T.A., 1963, 1981), Géhu and Uslu (1989), Uslu (1993), vegetation-soil relationship (Serteser, 2002a, 2015, 2016).

The geological structure of East Mediterranean Coastal is a quaternary field and contains alluvial substances. The climate of research area mainly has a rainfall regime as similar the Central Mediterranean climate type. It was collected about 50 plant species in the research area. These specimens of plants were mainly identified using the “Flora of Turkey” of Davis, (1965-1985), Davis et al., (1988), Güner et al., (2000) and Güner et al., (2012). Plant associations are identified regarding to Braun-Blanquet (1932) Method in the research area.

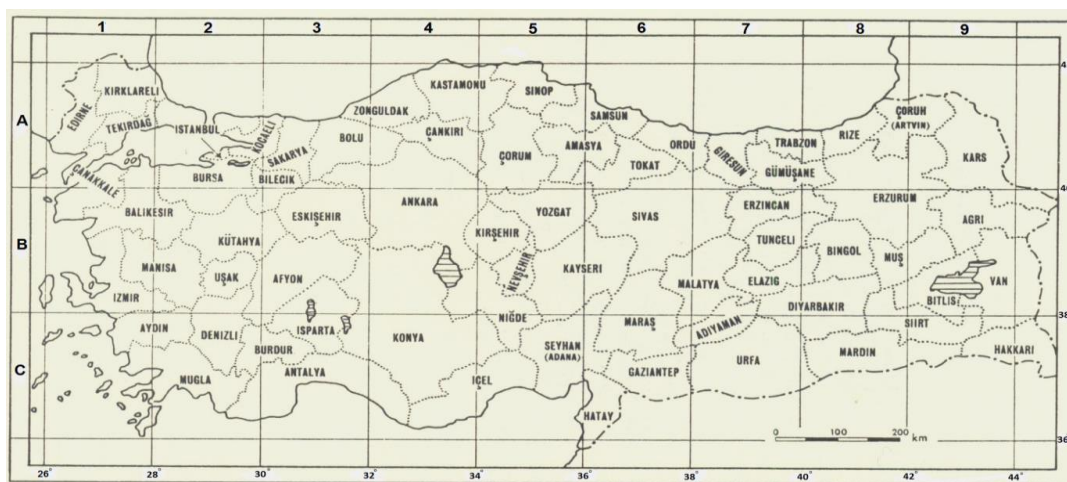


Figure 1. The research areas(C2,C3,C4) on Mediterranean coastal dunes according to gryd system (Davis,1965-1985)

The objectives of the study were investigated the relationship between plant associations, ecology, and especially soil characteristics.

Materials and Methods

“Flora of Turkey” of Davis (1965-1985) Davis et al., (1988), Güner et al., (2000) and Güner et al., (2012) are essentially used in the identification of the plants. The vegetation of the region has been categorized according to Braun-Blanquet (1932). Climate data supplied from General Directorate of Meteorology (D. M. İ., 2015 Ankara-Turkey) and geological information from General Directorate of Mineral Research and Exploration (M. T. A., Ankara-Turkey) (1963-1981). Map General Directorate (Harita Gn. Md. Ankara-Turkey) (1977) 1: 100 000 and 1: 25 000 scale topographic maps were used in field studies.

Samples of coastal sand dune were collected from 0-30 cm depts. The physical and chemical analysis of these samples was done with related method in Soil Fertilizer and Water Resources Central Research Institute Laboratories (Ankara-Turkey). Soil properties analyzed included pH (Richards et al., 1954), Total salt % (Avcioğlu et al., 2015), CaCO₃ % (Horvath et al., 2005). pH and EC were measured in a 1:5 soil:water extracts. CaCO₃ was determined using Scheibler calcimeter. The water saturation (%) and humidity (%) of soils were

determined according to Richards et al., (1954). The field capacity and wilting point of all samples were measured by pressure plate apparatus Richards et al., (1954). Grain-size distribution of sand determined by the hydrometer Bouyoucos et al., (1951).

Results and Discussion

The work area is coastal dunes as the type of land. Mediterranean floristic region of about 50 vascular plants have been identified within the study area. Most of the work place is filled with quaternary type of land. Stations in the study area, The central Mediterranean (WASS) and the Eastern Mediterranean I. Type (WSAS) precipitation regimes show and the work place has “Rainy Sub Soft, Rainy Sub Hot, A Little Rainy Warm, A little Rainy Soft” Mediterranean Bioclimate (Akman, 2011). Soil analysis results are given in Table 1.

Soil pHs were low alkali in coastal dunes samples, at between 8.40 and 8.78 which supports the results of Uslu (1993). Uslu (1993) reported alkali pH for soil localated in Göksu delta (İçel, Turkey) nearest Adana. However, Seyhan delta (Adana, Turkey) soil samples were found to be higher pH. In addition to Özcan et al. (2010), Avcıoğlu et al. (2015), Serteser (2015) and Serteser (2016), reported 7.07-7.67; 7.92-8.18; 7.80-8.80; 7.6-8.7 pH values for Saros Gulf (Turkey), Bozcaada (Turkey), and East Mediterranean coastal dunes, respectively.

The samples were measured from coastal dunes rich in calcium carbonate. CaCO₃ contents were between 15.90 % and 40.90 % (Serteser, 2016). Göksu delta (İçel-Turkey) had the highest CaCO₃ content (Serteser, 2016). Similarly, Uslu, (1977), Çakan et al. (2003) and Karaömerlioğlu (2007) reported various CaCO₃ content (medium to highly calcareous) for Göksu Delta (Silifke-İçel, Turkey). Contrary, Avcıoğlu et al. (2015) reported low CaCO₃ content on costal dunes Bozcaada (Turkey). The salt contents of soil were measured as trace. Similarly Serteser (2002a, 2015, 2016) reported very low salt content for Akyatan (Adana, Turkey) and coastal dunes of east mediterranean provinces' soil. However, high salt content was reported for Bozcaada, increase with depth of soil (Avcıoğlu et al. (2015).

Water saturation percentage was between 23 % and 34 % on East Mediterranean coastal dunes. % Water saturation ratio was the highest (35 %) on Anamur (İçel-Turkey) coastal dunes (Serteser, 2016). Serteser (2002a, 2015, 2016) concluded that the water saturation percentage of Seyhan Delta (Adana, Turkey) varied 25 % to 30 %. The humidity of costal dunes were changes from 1.66 % to 4.33 % (Table 1). The results of humidity contents of coastal dunes were similar to Uslu (1977) and Serteser (2002a, 2015, 2016).

It is important that grain sizes on vegetation on coastal dunes. The form of sand grain sizes were varied to 100-150 µm, 150-200 µm, 200-250 µm, 250-500 µm, 500-1000 µm, 1000-2000 µm, >2000 µm. Similarly, in their study Avcıoğlu et al. (2015) reported different grain size distribution for Bozcaada's (Turkey) coastal dunes. The researchers were measured more than 82 % of dune materials belong to grain sizes ranging between 0.5 mm and 0.163 mm.

Conclusions

The association consists of grasses whose lentgh vary between 5-50 cm. The association's dominant species are *Ononis hispanicae*, *Cynodon dactylon*, *Echium plantagineum*, *Paronchia argentea*, *Pancratium maritimum*, *Cyperus capitatus*, *Polygonum equisetiforme* and *Euphorbia paralias*. It is an association of perennial vegetation of the high beach. Alluvial soils exist in group's study field. Water saturation percentage is lower than of 34 % of the sand soils structure. % Water saturation ratio is high on Mersin-Susanoğlu coastal dunes. Humidity percentage is high Adana-Akyatan coastal dunes (Serteser, 2015).

The soil samples taken from the group are very little salty, very highly calcareous on Mersin-Taşucu and Sazbaşı coastal dunes, pH slightly alkaline on Mersin-Sazbaşı and Mersin-Susanoğlu coastal dunes and other coastal dunes are strongly alkaline.

Obviously, distribution of grain sizes plays key roles on vegetation on coastal dunes. The grain sizes are 100-150 µm on Muğla-Kumluova coastal dunes. The grain sizes on Antalya-Çaltıcak2 coastal dunes are 150-200 µm. It is between 200 and 250 µm on Antalya-Çaltıcak1 coastal dunes. The grain sizes on Antalya-Göynük and Antalya Kemer coastal dunes are 250-500 µm. Coastal dunes have no clay or silt. Sand grain sizes is 100-150, 150-200, 200-250 and 250-500 µm were found in higher rates in the localities from which our samples were

taken. Based on this fact, it can be concluded that fine, medium and coarse sand types predominate the distribution of vegetation.

Table 1. Soil analysis results on East Mediterranean coastal dunes

Localit y	Physical Analysis					Chemical Analysis										
						Sand Grain Sizes, μM										
	Wat er sat., %	Hu midi ty, %	Fiel d cap., %	Wilt . Poin t, %	Usabl e water, %	>20 00	2000 - 1000	1000 -500	500- 250	250- 200	200- 150	150- 100	<100	pH	CaC O ₃ %	Total Salt %
Muğla- Dalyan	31	2,33	1,99	1,46	0,53			0,99	11,0 1	9,01	11,2 2	65,9 9	1,78	8,4	35,61	Trace
Muğla- Kumlu o	27	3,21	1,24	1,13	0,11			0,10	7,39	8,11	13,4 7	67,7 1	3,22	8,4	45,24	Trace
Antalya - Çaltıca k1	29	1,96	2,16	1,98	0,18			0,01	1,48	59,56	11,0 8	24,5 7	3,30	8,7	25,56	Trace
Antalya - Çaltıca k2	28	1,66	2,06	1,95	0,11		0,01	1,30	40,8 9	10,41	41,0 7	4,77	1,55	8,5	28,60	Trace
Antalya - Göynük	30	3,00	1,29	1,07	0,22		0,11	9,44	62,6 6	13,79	11,0 0	1,01	1,99	8,5	40,64	Trace
Antalya -Kemer	31	3,11	1,95	1,13	0,82	0,15	3,19	9,99	53,0 8	17,21	11,3 9	1,17	3,82	8,5	40,90	Trace
Mersin- Taşucu	26	4,33	1,88	1,36	0,52				6,91	18,15	25,1 6	43,7 7	6,01	8,1	55,61	Trace
Mersin- Sazbaşı	27	4,22	1,90	1,01	0,89			1,44	38,1 1	23,09	16,6 6	18,9 0	1,80	7,6	47,02	Trace
Mersin- Susano ğlu	34	4,08	2,01	1,00	1,01		0,12	0,29	9,60	37,72	17,0 5	32,8 8	2,34	7,8	21,64	Trace

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