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Coastal Dunes Features of Endemic *Ipomoeo stoloniferae* – *Sporobolus virginicus* Association, East Mediterranean

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Abstract

Ipomoeo stoloniferae – *Sporobolus virginicus* association is endemic on coastal dunes of East Mediterranean in Turkey. This association is identified in Kumluova and Dalyan of Muğla province, in Çaltıcak, Kemer of Antalya province, in Anamur, Göksu delta of İçel province, in Akyatan, Seyhan delta of Adana province and in Dörtöl of Hatay province. The association consists of grasses whose length vary between 5 and 50 cm. The association's dominant species are *Sporobolus virginicus*, *Ipomoea stolonifera*, *Inula viscosa*, *Trachomitum venetum* and *Euphorbia paralias*. It is an association of perennial vegetation of the high beach. This study aims to examine the relationship between plant associations and the environment, specifically the soil. It was determined that plant associations display properties of soil and the way plant associations interact with it is also analyzed. This research also aims to identify the relationship between *Ipomoeo stoloniferae* – *Sporobolus virginicus* plant association and soil on Mediterranean coastal dunes in Turkey. The work area is coastal dunes as the type of land. Mediterranean floristic region of about 60 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 was lower than of 35% of the sand soils structure. % Water saturation ratio was high on İçel-Anamur coastal dunes. Humidity percentage was high Adana-Akyatan coastal dunes. Obviously, distribution of grain sizes plays key roles on vegetation on coastal dunes. Coastal dunes have no clay or silt. The soil samples were taken from research areas very little salty, very highly calcareous on İçel-Göksu delta and Anamur coastal dunes, pH slightly alkaline on Muğla-Dalyan and Kumluova coastal dunes and other coastal dunes were strongly alkaline.

1. Introduction

The research area, which lies at C2, C3, C4, C5, C6 square according to Davis [1] flora of Turkey, is located within the boundary of the delta where rivers (in Turkey) flow into the Mediterranean (Figure 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 *Ipomoeo stoloniferae* – *Sporobolus virginicus* plant association and soil, which were discovered by Géhu and Uslu [2] on coastal dunes of East Mediterranean in Turkey. Samples of soils, such as in Çaltıcak, Kemer of Antalya province, in Anamur and Göksu delta of İçel province, in Akyatan and Seyhan delta of Adana province, and in Dörtyol of Hatay province from coastal dunes were collected. *Ipomoeo stoloniferae* – *Sporobolus virginicus* plant association is identified regarding Braun-Blanquet [3] 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 *Sporobolus virginicus*, *Ipomoea stolonifera*, *Inula viscosa*, *Trachomitum venetum* 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 [4, 5, 6, 7, 8, 9, 10]. Coastal dune ecosystems have dynamic interactions between abiotic and biotic factors. Abiotic and biotic factors are changing with shoreline to the inland areas and also effect zonation of plant communities characteristic [9, 10]. The structure and composition of coastal dune plants communities are affected by ecological factors as climate, soil features, biotic and topographic factors [11]. Coastal zones are under the influence of both marine and terrestrial environments which makes them dynamic and complex systems and they are characterized by a number of different physical and biological components and anthropogenic activities; hence they present unique challenges with regards to sustainable use and development. Due to fast increases in population densities, housing and infrastructure developments, increased economic activities (e.g., agriculture, aquaculture, industry, trade, tourism and transport) and the upcoming climate change scenarios (e.g., increased droughts, extreme weather activities and the rise in sea level) [12].

The relationships between plant communities and soil in coastal dunes have studied by many researchers [8, 13, 14]. The coastal dunes have localized 110 various place with 845 lengths in Turkey [15]. Coastal dunes are cumulants which are formed by wave actions, winds and transgression activities immediately after the formation of shore creation processes which start at Pleistocene and they include various sand layers. They are formed in the shallow areas where large rivers flow into the sea. Coastal sand dune area includes strandline, fore dune, scrub dune, dune fields and dune slacks [6, 7]. Several researchers focused on some characteristics of coastal dunes such as dune-vegetation interaction and soil properties of sands [4, 5, 6, 7, 16, 17].

This research aims to identify the relationship between *Ipomoeo stoloniferae* and *Sporobolus virginicus* 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.) [18, 19, 20, 21, 22], General Directorate of Meteorology (D.M.İ.) [23], General Directorate of Mineral Research and Exploration (M.T.A.) [24], Géhu and Uslu [2], Uslu [25], vegetation-soil relationship (Serteser) [6, 7].

The geological structure of East Mediterranean Coastal is a quaternary field and contains alluvial substances. This coastal dunes towards places which spread inland from the coast mainly consists of quartz sand. The climate of research area mainly has a rainfall regime as similar the Central Mediterranean climate type. It was collected about 60 plant species in the research area. These specimens of plants were mainly identified using the "Flora of Turkey" [1, 26, 27]. Plant associations are identified regarding to Braun-Blanquet [3] Method in the research area.

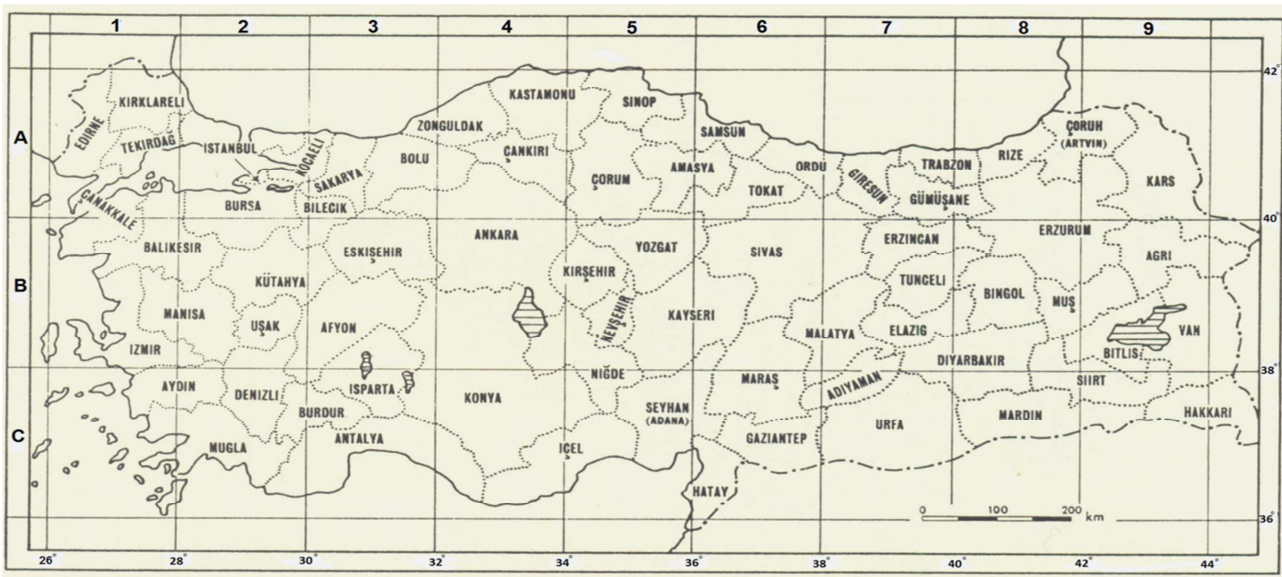


Fig. 1. The research areas (C2, C3, C4, C5, C6) on Mediterranean coastal dunes according to gryd system (Davis, [1]).

The formation of dune in an area depends on three factors: wind, sand and plant [28]. Plants pose a block to the sand which is dispersed by the wind and the sand is accumulated around this plant. Their ability to rise to the soil surface under the sand is the most important feature of sand plants. These plants form sand dunes by constantly accumulating sand in this way. The position of the coast is another important factor for the formation of dunes. If the coast is in a vertical position to the prevailing winds, this enables the formation. The structure of the sand is the key factor which affects the plant species and their coverage rate. The plant species of dunes are psammophytes which are able to harmonize with dunes. The plant species and plant cover differ, depending on a few factors such as distance from the sea, mobility of the dune, ground water level and structure of the sand.

This study aims to investigate the relationship between *Ipomoeo stoloniferae* – *Sporobolus virginicus* plant association, ecology, and especially soil characteristics on Mediterranean coastal dunes in Turkey.

2. Materials and Methods

“Flora of Turkey” of Davis [1] Davis et al., [26] and Güner et al., [27] are essentially used in the identification of the plants. The vegetation of the region has been categorized according to Braun-Blanquet [3]. Climate data supplied from General Directorate of Meteorology (D. M. İ., Ankara-Turkey) [23] and geological information from General Directorate of Mineral Research and Exploration (M. T. A., Ankara-Turkey) [24]. Map General Directorate (Harita Gn. Md. Ankara-Turkey) [29] 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 depths. 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 [30], Total salt % [17], CaCO_3 % [31].

pH and EC were measured in a 1:5 soil:water extracts. Percentage of total salt in saturation mud conductivity instrument utilized was calculated by measuring the electrical conductivity [32]. CaCO_3 was determined using Scheibler calcimeter [31]. Water saturation was found by adding distilled water until the soil is saturated and the results are displayed as a percentages. The water saturation (%) and humidity (%) of soils were determined according to Richards [30]. The field capacity and wilting point of all samples were measured by pressure plate apparatus [30]. Clay sand, silt and clay fractions have been identified by the Bouyoucos hydrometer method. Grain-size distribution of sand determined by the hydrometer [33].

3. Results and Discussion

The work area is coastal dunes as the type of land. Mediterranean floristic region of about 60 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 [34]. Mediterranean Sea controls the spatial and seasonal distributions of modern rainfall in the southern Levant (Syria, Lebanon, western Jordan and Israel). The Levant would be a part of the larger northern low middle-latitude warm dry desert extending from North Africa into Western Asia if there were not such moderating climatic influence on it. A narrow strip of Mediterranean climate along the coastal Levant is governed by winter rainfall and receives negligible summer rains [35].

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 [25]. Uslu [25] reported alkali pH for soil localatated 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. [16], Avcıoğlu et al. [17], Serteser [7] and Aytok et al., [12] reported 7.07-7.67; 7.92-8.18; 7.80-8.80; 7.02-8.69 pH values for Saros Gulf (Turkey), Bozcaada (Turkey), East Mediterranean coastal dunes and on Seyhan delta coastal dunes respectively.

The samples were measured from coastal dunes rich in calcium carbonate. CaCO_3 contents were between 15.90 % and 40.90%. Göksu delta (İçel-Turkey) had the highest CaCO_3 content. Similarly, Çakan [36] and Karaömerlioğlu [37] reported various CaCO_3 content (medium to highly calcareous) for Göksu Delta (Silifke-İçel, Turkey). Contrary, Avcıoğlu et al. [17] reported low CaCO_3 content on costal dunes Bozcaada (Turkey). The salt contents of soil were measured as trace. Similarly Serteser [6, 7] reported very low salt content for Akyatan (Adana, Turkey) provinces’ soil. However, high salt content was reported for Bozcaada, increase with depth of soil [17].

Water saturation percentage was between 24% and 35% on East Mediterranean coastal dunes. % Water saturation ratio was the highest on Anamur (İçel-Turkey) coastal dunes. Serteser [6, 7] concluded that the water saturation percentage of Seyhan Delta (Adana, Turkey) varied 20% to 30%. The humidity of coastal dunes were changes from 1.58% to 4.27% (Table 1). The results of humidity contents of coastal dunes were similar to Uslu [38] and Serteser [6, 7].

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. [15] 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. Güler et al., [39] determineted The soil textural classes of the area is located in the easternmost part of the Mersin province in SE

Turkey include: sand, sandy loam, sandy clay loam, loam, loamy sand, silty clay loam, clay loam, and clay.

4. Conclusions

The association consists of grasses whose length vary between 5-50 cm. The association's dominant species are *Sporobolus virginicus*, *Ipomoea stolonifera*, *Inula viscosa*, *Trachomitum venetum* 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 35% of the sand soils structure. % Water saturation ratio is high on İçel-Anamur coastal dunes. Humidity percentage is high Adana-Akyatan coastal dunes.

The soil samples taken from the group are very little salty,

very highly calcareous on İçel-Göksu delta and Anamur coastal dunes, pH slightly alkaline on Muğla-Dalyan and Kumluova 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. It is between 200 and 250 µm on Antalya-Kemer coastal dunes. The grain sizes on İçel-Anamur coastal dunes are 250-500 µm. The grain sizes on İçel-Göksu delta coastal dunes are 500-1000 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.

Locality	Physical Analysis						Chemical Analysis									
	Sand Grain Sizes, µm															
	Water sat., %	Humidity, %	Field cap., %	Wilt. Point, %	Usable water, %	>2000	2000-1000	1000-500	500-250	250-200	200-150	150-100	<100	pH	CaCO ₃ %	Total Salt %
Muğla-Dalyan	30	2,32	2,09	1,56	0,53			0,11	10,31	9,56	10,52	66,98	2,52	8,43	15,90	Trace
Muğla-Kumluova	29	2,21	1,44	1,23	0,21			0,11	6,48	8,10	13,37	68,71	3,23	8,40	22,24	Trace
Antalya-Kemer	28	1,98	2,36	2,08	0,28			0,01	1,50	56,88	10,98	24,67	3,28	8,68	22,56	Trace
Antalya-Çaltıcak	27	1,58	2,15	2,05	0,10		0,01	1,32	41,92	11,41	38,97	4,78	1,59	8,51	18,60	Trace
İçel-Anamur	35	3,02	1,30	1,03	0,27		0,12	9,84	63,76	12,24	11,04	1,00	2,00	8,53	40,64	Trace
İçel-Göksu d.	32	3,27	1,92	1,10	0,82	0,16	3,20	11,64	56,60	11,24	12,28	1,16	3,72	8,55	40,90	Trace
Adana-Akyatan	25	4,27	1,87	1,36	0,51				6,88	17,25	25,12	44,69	6,06	8,75	16,20	Trace
Adana-Seyhand	26	4,21	1,99	1,03	0,96			1,48	37,44	22,99	16,73	19,54	1,82	8,78	17,02	Trace
Hatay-Dörtöyl	24	3,98	2,55	1,40	1,15		0,14	0,28	9,52	37,20	16,65	33,90	2,31	8,66	18,40	Trace

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