J Inno Sci Eng 2017, 1(1): 17-24

Grassland Flora of Manisa Celal Bayar University Campus

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Abstract

In this study, the grassland flora of Şehit Prof. Dr. İlhan Varank Campus, Manisa Celal Bayar University were examined. The floral surveys were conducted in 2013 and 51 taxa belonging to 9 families were found. The distribution of taxa according to their phytogeographic associations are: Mediterranean (17.6%), Irano-Turanian (3.9%), Euro Siberian (2%), East Mediterranean (2%), and Multiregional or unknown (74.5%). In the field studies, endemic species were encountered. The most common families were *Poaceae* and *Fabaceae*, and overall species richness was found to be relatively high.

Keywords: B2, Flora, Manisa, Turkey

1. Introduction

Turkey, with 11,014 vascular plant species [1], is the richest country in terms of floral diversity in Europe which houses 13,638 species in total [2]. The diverse climatic, topographic, geological, and geomorphological conditions and associated variations in habitat types and soil characteristics are the most important drivers of biodiversity in Turkey [3]. The flora of Manisa Celal Bayar University campus and its surroundings were studied by Uğurlu and Altan [4]. There are also some floristic studies, which have been carried out in near locations [5-14]. Urban biodiversity is important for the maintenance of ecosystem services and human well-being [15]. Campus areas are subjected to urbanization because of the construction. Floristic surveys started in campus areas in 1975 [16] and many studies have been carried out so far in Turkey [16- 23]. Our study focused on flora of grassland vegetation inside Manisa Celal Bayar University campus. The aim of this study is to contribute to the knowledge of floristic characteristics of grassland vegetation in Manisa Celal Bayar University Şehit Prof. Dr. İlhan Varank Campus. Thus, the goal of our study is to enrich the floristic documentation of the region and contribute to regional and national floristic studies. The ArcGIS 10.2 program was used. The road sections located in areas with landslide risks were excluded during the network analysis to provide the safest route for truck traveling.

2. Material and Methods

2.1. Study Area

Manisa Celal Bayar University Şehit Prof. Dr. İlhan Varank Campus is located 15.3 km far from the northwestern part of Manisa city centre in the Aegean Region in Turkey (Figure 1). The campus is located in 38°67' latitude and 27°30' longitude. It is located approximately 40 km to İzmir, which is the third largest city in Turkey. The university campus is placed between Yunt mountain to the north, Spil mountain to the southeast and Yamanlar mountain to the southwest. The elevation of Manisa is 70 m. The university campus belongs to B2 Grid square according to Davis quadrature. Google Earth and QGIS 2.8.1 were used for the preparation of maps.

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Received 28 September 2017; Accepted 24 October 2017

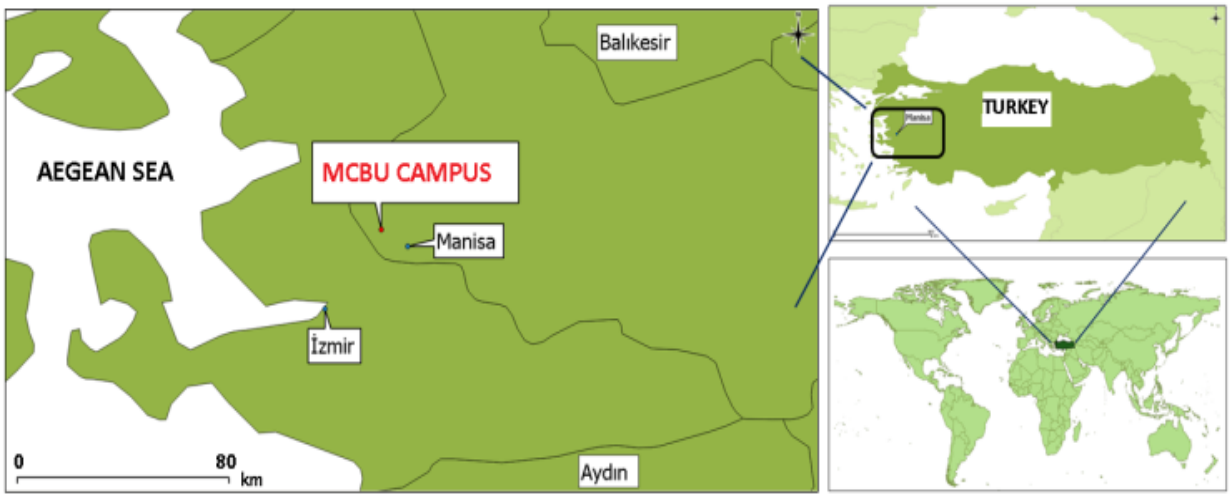

Figure 1. The location of Manisa Celal Bayar University Şehit Prof. Dr. İlhan Varank Campus

2.2. Geological structure and soil properties

The old metamorphic bedrock type based on palaeozoic substrate is common in Manisa and its surroundings. Bedrocks are called Menderes massive in the region and consist of inner core and outer mantle. The inner core has a gneiss origin while the outer occurs are schist [24]. Although various soil types are widely seen in Manisa, alluvial soils are common on grasslands. The soils of the grasslands are classified as type VI and VII [24].

2.3. Vegetation

Semi-natural grassland is mainly dominated by *Taeniatherum caput-medusae* (L.) Nevski subsp. *crinitum* (Schreber) Melderis. Grasses of *Bromus chrysopogon* Viv., *Cynodon dactylon* (L.) PERS. var. *dactylon*, *Poa timoleontis* Heldr. ex Boiss. and legumes of *Trifolium campestre* Schreb, *Medicago polymorpha* L. var. *polymorpha* are also common in the grassland system. The abundance of non-legume forbs *Plantago coronopus* L. subsp. *coronopus*, *Hypochoeris glabra* L. and *Leontodon tuberorus* L. is quite remarkable.

2.4. Climate

The climate in Manisa is warm in summers and mild and rainy in winters. The long term climate data (1926-2016) is obtained from the national meteorological station [25]. The climate diagram prepared according to Walter [26] is given on Figure 2. The average temperature is the highest in July and August and the lowest in January and February. The monthly average total rainfall is the highest in December and January while the lowest in July and August. The annual average temperature is 16.9 °C and the annual average total rainfall is 728.8 mm [25].

2.5. Field survey

Plant species were surveyed periodically from grassland vegetation of the campus in 2013. The location of collected plants is fixed as southwestern part of campus. The collected plant species were pressed and dried according to herbarium procedures and stored after plant identification in Manisa Celal Bayar University Herbarium. “The flora of Turkey and East Aegean Islands” was used for the plant identification [27-29]. “The Author of Plant Names” was utilized for writing authors’ names [30].

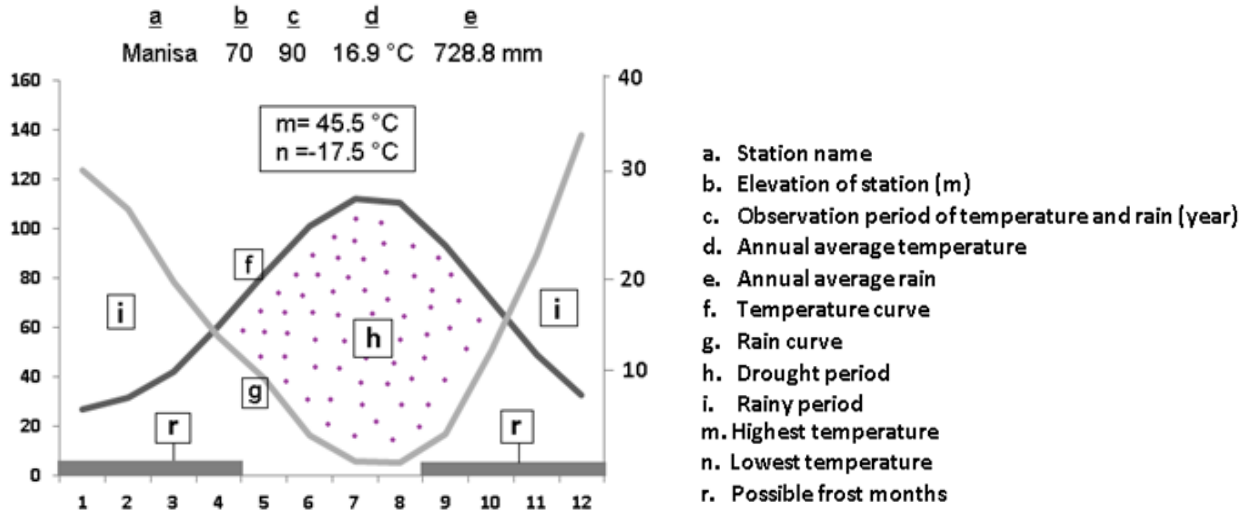

Figure 2. The Bioclimatic diagram of Manisa prepared by Walter [26].

The Plant List of Turkey (Vascular Plants) [31] and English-Turkish translation guide book [32] were utilized for plant identification. The correction of plant names was checked using with www.theplantlist.org. Family, genus and taxa names are given in an alphabetical order on the floristic list. The exact location name of study area is as follows: "B2: Manisa, Yunusemre, Manisa Celal Bayar University, Şehit Prof. Dr. İlhan Varank Campus, semi-natural dry grassland vegetation, between dormitories and printing house, southwestern part of campus". The address of location is not repeated in the floristic list.

2.6. *Symbols and Abbreviations*

Symbols: °C: centigrade degree, m: meter, mm: milimeter
Abbreviations: Mu/Un: Multiregional or Unknown, Medit: Mediterranean, E.Medit: East Mediterranean, Ir-Tur: Irano-Turanian, Eu-Sib: Euro Siberian, B.G: Behlül Güler

3. Results and Discussion

The floristic list is given in Table 1. Fifty one plant taxa belongs to 26 genus and 9 families were found in our study (Table 2). All of the taxa consist of angiospermae. 29 taxa are dicotyledones belonging to 8 families and the 22 of them are monocotyledones belonging to sole family of Poaceae. The most common families were *Poaceae* and *Fabaceae*. These families also have maximum number of genus. *Asteraceae* and *Geraniaceae* were the second most common families. *Apiaceae, Caryophyllaceae, Euphorbaceae, Plantaginaceae* and *Rosaceae* were also represented with one species for each. High amount of legumes and graminoids were found.

The distribution of taxa by their phytogeographic associations is as follows: Mediterranean (17.6%), Irano-Turanian (3.9%), Euro Siberian (2%), East Mediterranean (2%) and Multiregional or unknown (74.5%) (Table 3). The most common genus was *Trifolium* L. in our study. It has 12 taxa and this makes 23.5% of overall richness. *Bromus* L. also made a large contribution to species richness with 8 (15.7%) taxa. *Medicago* L. had 3 taxa (5.9%). *Aegilops* L., *Hordeum* L., *Poa* L., *Rostraria* Trin. and *Vulpia* C.C. Gmelin genus have 2 (3.9%) species for each. The rest of genus has one species for each.

Table 1. Floristic list of study area

Family / Taxa, Phytogeographic region, Number
APIACEAE
Eryngium campestre L. var. ***campestre,*** Mu/Un**,** B.G. 816
ASTERACEAE
Hypochoeris glabra L.**,** Mu/Un**,** B.G. 769
Leontodon tuberosus L., Medit, B.G. 827
CARYOPHYLLACEAE
Petrorhagia velutina (Guss.) Ball et Heywood, Mu/Un, B.G. 829
EUPHORBIACEAE
Euphorbia chamaesyce L.**,** Mu/Un**,** B.G. 821
FABACEAE
Biserrula pelecinus L.**,** Medit**,** B.G. 783
Hippocrepis unisiliquosa L., Mu/Un, B.G. 770
Hymenocarpus circinnatus (L.) Savi, Medit, B.G. 761
Medicago minima (L.) Bart var. ***minima,*** Mu/Un, B.G. 767
Medicago orbicularis (L.) Bart, Mu/Un, B.G. 825
Medicago polymorpha L. var. ***polymorpha,*** Mu/Un**,** B.G. 771
Scorpiurus muricatus L. var. ***subvillosus*** (L.) Fiori., Medit, B.G. 774
Trifolium balansae Boiss, Mu/Un, B.G. 776
Trifolium bullatum Boiss et Hausskn, Mu/Un, B.G. 757
Trifolium campestre Schreb, Mu/Un, B.G. 752
Trifolium cherleri L., Medit, B.G. 763
Trifolium clusii Gord. et Gren, Mu/Un, B.G. 756
Trifolium globosum L., Mu/Un, B.G. 778
Trifolium hirtum All, Medit, B.G. 785
Trifolium lucanicum Gasp, Medit, B.G. 784
Trifolium pilulare Boiss, Mu/Un, B.G. 759
Trifolium scabrum L., Mu/Un, B.G. 777
Trifolium spumosum L., Medit, B.G. 762
Trifolium subterraneum L., Mu/Un, B.G. 787
Vicia hybrida L., Mu/Un, B.G. 765
GERANIACEAE
Erodium hoefftianum C. A. Meyer, Mu/Un, B.G. 753
Geranium molle L. subsp. ***molle*** , Mu/Un, B.G. 754
PLANTAGINACEAE
Plantago coronopus L. subsp. ***coronopus***, Eu-Sib, B.G. 828
POACEAE
Aegilops biuncialis Vis., Mu/Un, B.G. 791
Aegilops columnaris Zhukovsky, Ir-Tur, B.G. 792
Bromus chrysopogon Viv., Medit, B.G. 823
Bromus hordeaceus L. subsp. ***hordeaceus***, Mu/Un, B.G. 819
Bromus lanceolatus Roth, Mu/Un, B.G. 799
Bromus madritensis L., Mu/Un, B.G. 793
Bromus rigidus Roth, Mu/Un, B.G. 796
Bromus rubens L., Mu/Un, B.G. 780
Bromus scoparius L., Mu/Un, B.G. 801
Bromus squarrosus L., Mu/Un, B.G. 803
Cynodon dactylon (L.) PERS. var**.** ***dactylon***, Mu/Un, B.G. 818
Dactylis glomerata L. subsp. ***hispanica*** (Roth) Nyman, Mu/Un, B.G. 814
Hordeum bulbosum L., Mu/Un, B.G. 804
Hordeum murinum L. subsp. ***glaucum*** (Steudel) Tzvelev, Mu/Un, B.G. 798
Lolium rigidum Gaudin, Mu/Un, B.G. 800
Poa bulbosa L., Mu/Un, B.G. 805
Poa timoleontis Heldr. ex Boiss., E.Medit, B.G. 790
Rostraria cristata (L.) Tzvelev var. ***cristata***, Mu/Un, B.G. 797
Rostraria cristata (L.) Tzvelev var. ***glabriflora*** (Trautv.) M. Doğan, Mu/Un, B.G. 811
Taeniatherum caput-medusae (L.) Nevski subsp. ***crinitum*** (Schreber) Melderis, Ir-Tur, B.G. 826
Vulpia ciliata Dumort subsp. ***ciliata***, Mu/Un, B.G. 812
Vulpia myuros (L.) C. C. Gmelin, Mu/Un, B.G. 789
ROSACEAE
Sanguisorba minor SCOP. subsp. ***minor***, Mu/Un, B.G. 830

Table 2. Number of taxa and genus in conformity with families

	Number of genus	Number of taxa	Rate of taxa (%)
Poaceae	10	22	43.1
Fabaceae	7	20	39.2
Asteraceae	2	2	3.9
Geraniaceae	2	2	3.9
Apiaceae	1	1	2.0
Caryophyllaceae	1	1	2.0
Euphorbiaceae	1	1	2.0
Plantaginaceae	1	1	2.0
Rosaceae	1	1	2.0
Total	26	51	

Table 3. Phytogeographic regions of species

Phytogeographic region	Number of taxa	Rate (%)
Mediterranean	9	17.6
Irano-Turanian	2	3.9
Euro Siberian	1	2.0
East Mediterranean	1	2.0
Multiregional or unknown	38	74.5

Poaceae and *Fabaceae* familes were the most common in our study while *Fabaceae* and *Asteraceae* families were the most common in the other studies [4-7] conducted in study region (Table 4). *Poaceae* and *Fabaceae* were highly dominant comprising 43.1% and 39.2% of species, respectively. These families comprised only 10% to 15% of species in other studies [4-7]. In contrast, *Asteraceae* comprised only 3.9% in our study while comprising between 10% to 14% in the other studies [4-7]. This can be explained by the fact that our study only focused on grassland vegetation in a limited area. The other studies [4-7] covered more landscape area and have different vegetation types, and thus observed more species than our study. The other families such as *Apiaceae*, *Rosaceae* and *Caryophyllaceae* displayed similar species richness between our study and the others, between 2-6% [4-7].

A comparison of species richness of families and their phytogeographical origins across several university campuses are presented in Table 5. We chose universities near our study area for comparison in order to avoid increasing dissimilarities of climatic and geographic conditions. Our campus with its cumulative richness had remarkable species richness in our region. Akdeniz university campus [33] had the highest richness while Buca [42] had the lowest. The Campuses of Anadolu [34], Uludağ [35, 36] and Osmangazi [37] had species richness above the mean ($SR_{mean} = 289.4$). A positive correlation (Pearson) trend is found between family and species richness ($r = 0.64$). In Figure 3, the species richness is based on total taxa, which includes subspecies and varieties and linear regression model was used for the line display. Multiregional species are widely seen in most of the studies while Euro-Siberian elements are relatively low. Mediterranean elements are high in Muğla [38], Akdeniz [33] and Manisa Celal Bayar [4, our study] campuses.

Table 4. The most common families in study region

Our study	MCBU Campus [4]	Uçpınar Town [6]	Maldan Village [7]	Gürle Village [5]
Poaceae	*Fabaceae*	*Fabaceae*	*Fabaceae*	*Asteraceae*
Fabaceae	*Asteraceae*	*Asteraceae*	*Asteraceae*	*Fabaceae*
Asteraceae	*Poaceae*	*Poaceae*	*Poaceae*	*Poaceae*
Apiaceae	*Apiaceae*	*Apiaceae*	*Apiaceae*	*Apiaceae*
Rosaceae	*Rosaceae*	*Rosaceae*	*Rosaceae*	*Rosaceae*

Table 5. General overview of species richness with families as well as phytogeographical regions in near university campuses

University Campus	Family	Taxa	Iran-Turan (%)	Euro-Sib (%)	Mediterranean (%)	Multiregional or unknown (%)
Akdeniz [33]	-	452	2.7	1.5	41.6	46.7
Manisa Celal Bayar [4, our study]	62	366	2.2	4.4	33.1	60.4
Anadolu [34]	74	363	7.7	8.8	3.3	80.2
Uludağ [35, 36]	56	356	1.1	11.0	21.9	66.0
Osmangazi [37]	53	343	18.4	5.0	6.4	70.3
Muğla [38]	62	285	5.3	3.9	66.3	-
Balıkesir [39]	62	246	3.3	8.9	21.5	66.3
Dumlupınar [40]	44	214	-	-	-	-
Süleyman Demirel [41]	38	161	15.5	3.7	18.6	42.2
Buca (Dokuz Eylül) [42]	52	108	-	-	-	-

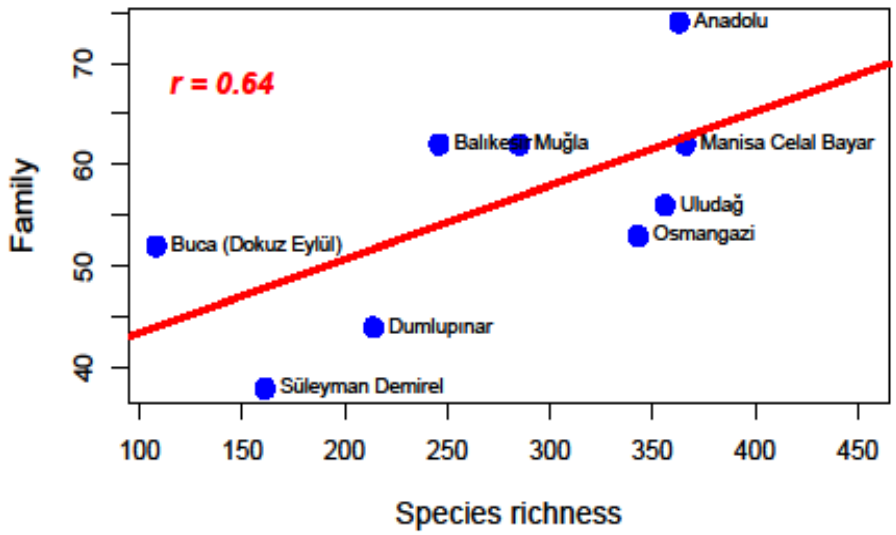

Figure 3. Species and family richness of the university campus located geographically close to our study region.

4. Conclusion

This study aimed to contribute to the floristic composition of semi-natural dry grassland vegetation in the Manisa area. Graminoids and legumes had the highest number of species. *Trifolium* L. and *Bromus* L. genus in particular displayed high richness of taxa in compared to other genus. Mediterranean is the most common phytogeographic element in the vegetation. The endemic species in Turkey were not present in grassland flora in the scope of our study.

Acknowledgements

We are grateful to Dr. Burak K. Pekin for his valuable comments and linguistic contributions.

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