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Contributions to the flora of Anatolian sweetgum (*Liquidambar orientalis* Mill.) forest nature protection area (Kargı Village/Bucak/Burdur)

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Abstract

This study deals with the vascular plant diversity of Anatolian sweetgum (*Liquidambar orientalis* Mill.) forest which is one of the important natural areas of Burdur province. The research area is located in the Bucak district of Burdur province, which is placed in the C3 square according to Davis' grid system. In the study, 123 genera belonging to 61 families, 134 species and subspecies taxa belonging to these genera were determined. The majority of the taxa are phytogeographically Mediterranean element (14.92%), and their endemism rate is 2.98%. Among the taxa, the family containing the highest number of species is *Asteraceae* (10.44%), and it is followed by *Lamiaeae* (8.95%) and *Poaceae* (7.46%). The aim of this study is to contribute to the studies which have intended to determine the biodiversity in Turkey and to protect important natural areas.

Keywords: *Liquidambar orientalis*, flora, Burdur, Bucak, Kargı Village

Introduction

While *Liquidambar orientalis* Mill. had a wider distribution area on earth in the geological period, but it became a residual endemic species specific to the Eastern Mediterranean basin as these wider areas gradually narrowed after the ice age (Akman et al. 1992, Günal 1994, Ketenoğlu et al. 2003, Öztürk et al. 2008, Şekercioğlu et al. 2011). Anatolia, which is a shelter for most tertiary species, has also brought the *L. orientalis* species to the present day. This species is known to spread in South-West Anatolia, in areas showing Mediterranean climate characteristics and in habitats having high ground water (Efe 1987, Bozkurt et al. 1989, Acar et al. 1992, Arslan and Şahin 2016). The Anatolian sweetgum tree, which is naturally distributed in Turkey, makes its widest spread in the coastal districts of Muğla province such as Marmaris, Fethiye, Köyceğiz, Dalaman, Ortaca, and it is also observed in smaller pieces in Denizli-Acıpayam-Gölcük villages and Antalya-Sütçüler-Çandır and Burdur-Bucak-Melli regions. However, nowadays, it has been reported in various studies that these areas are getting smaller (the area is approximately 2000 hectares now) due to both ecological and anthropogenic reasons (Huş 1949, İktüeren and Acar 1987, Ketenoğlu and Kurt 2008, Ürker and Lise 2018). Genç (1999) reports that the forest area of Anatolian sweetgum, which was 6312 hectares in the year of 1949, decreased to 4316 hectares in 1955, 1337 hectares in 1980 and 1215 hectares in 1988.

The word Liquidambar used for sweetgum tree means "fragrant liquid" (Arslan and Şahin 2016). *L. orientalis* is known as "oriental sweetgum" or "stirace" in English, and it is called "sığla, günlük ağacı, amber ağacı" in Turkish due to its beautiful scent and the balsam it produces (Acatay 1963, Bozkurt et al. 1989, Ozturk et al. 2008). *L. orientalis* are tall (15-35 m) and broad-crown trees which grow in warm

and hot regions under the influence of the sea, which spread in moist-rich soils and riparian habitats, which prefer abundant light, and which prefer to coexist with other forest trees such as *Platanus orientalis* L., *Quercus coccifera* L., *Pinus brutia* Ten., *Ceratonia siliqua* L., *Alnus orientalis* Decne. and *Ulmus minor* Mill. (Acatay 1963, Günal 1994). *L. orientalis,* which can reach up to 100 cm in diameter, develops a large number of roots and lenticels. The leaves of this species are similar to the leaves of plane tree and maple, but they are larger than those of plane tree and maple. These leaves, falling in autumn and smelling good when grinded, generally have 5-lobes, palmatilobed, bright green upper surface and long petioled (Günal 1994, Alan and Kaya 2003, Arslan and Şahin 2016). The female flowers are on spherical spikes and the male flowers are on drooping spikes. The trees are bisexual and monoecious. They have a potential of producing plenty of seeds every year (Istek and Hafızoglu 2005).

Sweetgum leaves are generally used in ethnic cuisine due to their fragrance and flavor (Acatay 1963). However, the main importance of sweetgum tree comes from the balsam obtained from the trunk by wounding (Acatay 1963, Bozkurt et al. 1990). Sweetgum oil, known as styrax storax, oriental sweetgum, styrax liquids, Turkish sweetgum and Levant styrax (Baytop 1999), can also be obtained from *L. styraciflua* species (American sweetgum) other than Anatolian sweetgum tree. The gum resin extracted from the wounded bark of this tree is called "American storax" (Aydıngöz and Bulut 2014). This viscous and sticky sap has brownish-yellow colour. And it contains various phenolics and volatile compounds, which differ according to the growing environment, in its structure (Arslan and Şahin 2016). Sweetgum oil is an important non-wood forest product, and it is in high demand both in the national and international markets in many industrial areas, especially in the pharmaceutical and cosmetic industry (Alan and Kaya 2003, Öztürk et al. 2008, Velioğlu 2008). Duru et al. (2002) report in their study, determining volatile oil compositions of *L. orientalis* leaves, that the leaves of this species can also be used in the cosmetic industry as well as sweetgum oil. Değirmentepe et al. (2015) report that approximately 2000 tons of sweetgum balsam are produced in Turkey every year. But, the decrease in sweetgum forests due to various reasons also causes a decrease in sweetgum oil and its by-products (gum, frankincense, incense, etc.).

As Turkish sweetgum balsam is in great demand in pharmaceutical industries and cosmetics industry, it has also common use in general treatment (expectorant, parasiticide etc.). Therefore, it can be come across with many biological activity studies on *L. orientalis* in the literature. Sıcak and Eliuz (2018) show that the essential oils obtained from sweetgum leaves have antimicrobial potential. And, in line with that, Saraç and Şen (2014) report that ethanol extracts of *L. orientalis* leaves indicate high antioxidant activity. Sağdıç et al. (2005) reveal that the resin of *L. orientalis* has a high antibacterial effect on many bacteria such as *Bacillus cereus*, *Corynebacterium xerosis*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Micrococcus luteus*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Sweetgum tree is a high value asset in terms of landscape. In a study, which intends to determine the potential uses of sweetgum tree in urban landscape architecture, Çorbacı et al. (2019) show that these trees can be grown at altitudes between 0-800 m in Mediterranean, Blacksea and Central Anatolian regions under suitable temperature and humidity conditions. Selim and Sönmez (2015) indicate in their study, which is on the protection and sustainability of sweetgum communities in Muğla-Köycegiz region, that the pattern and structure of a landscape also have direct effects on biological diversity, and they report that the habitat quality of sweetgum forests is low and its structure is fragmented.

L. orientalis is a relict endemic species belonging to the tertiary period and the forests formed by them are one of the special forest types contributing to forest diversity in Turkey. And, due to its ecological and economic importance, this species was included in the group of valuable leafy trees (Noble Hardwoods) by EUFORGEN (European Forest Genetic Resources Program) in 2001 (Alan and Kaya

2003). However, nowadays, it is common that protection and improvement studies should be urgently carried out for these forests, which are reported to be decreasing day by day (Ürker 2014).

Forests and their floristic compositions are the most important elements that reveal the ecological richness of a country. Because floristic studies deal with herbaceous species as well as woody species, such studies also provide detailed information about the subforest flora. In this respect, it is important to specify the plant diversity in *L. orientalis* forests having economic and ecological value, and especially designate of their forest floristic composition. For this purpose, in this study, the floristic diversity of "Kargı Village Sweetgum Forest Nature Protection Area" within the borders of Burdur province is discussed. More than that, it is also aimed to contribute to the studies dealing with the protection and improvement of *L. orientalis* areas in Turkey.

Materials and Methods

The research area is located in the C3 square according to Davis' grid system (Donner, 1990), and the protected area is 8.5 hectares (Figure 1). The lowest altitude of the study area is the edge of Aksu Stream (180 m), and the highest altitude is the skirts of Gökyatak Hill (550 m). After the first feasibility study in the area, the stations were determined and the work was commenced. In the year of 2015, field studies were periodically carried out from the spring months when the vegetation started to develop in the area until the autumn months when it ended, and plant taxa were collected. Plant samples not less than two were collected, which contain organs such as roots, leaves, flowers and fruits. The specimen samples pressed in a plant press were recorded by the collector, and the plants were left in the press until they were thoroughly dry in accordance with standard herbarium techniques. The drying process was carried out in an airy environment where the presses did not receive direct sunlight. In order to identify the species and subspecies categories of plant specimens converted into herbarium material, "Flora of Turkey and the Aegean Islands" (Davis 1965-1985, Davis et al. 1988, Güner et al. 2000) and "English-Turkish Botanical Guide" (Baytop 1998) was used. "Turkey Plant Red Data Book" (Ekim et al. 2000) and "International Union for Conservation of Nature" criteria" were utilized (IUCN 2016) in determining the IUCN Red List hazard categories of endemic taxa. In this scope, all names of family, genus and species are given in alphabetical order by taking into account the work "Türkiye Damarlı Bitkileri Listesi (List of Veined Plants of Turkey)" by Güner et al. (2012). Regarding the taxa, the information such as collector name, collector number, height, date of collection, endemism, threat category and phytogeographic region have been included to the systematic index. The plant taxa converted into herbarium specimens are preserved in the Botanical Research Laboratories of Burdur Mehmet Akif Ersoy University, Faculty of Arts and Sciences, Department of Biology.

The Climatic Conditions in the Study Area

The research area is located in the Mediterranean Region, and the Mediterranean climate is dominant in the south of the basin. In the Aksu Stream basin, the characteristics of continental climate are observed in line with the increase in height towards the north (Atayeter 2005). In winter, most of the precipitation is in the form of snow in the mountains and plateaus, and in the form of rain in the other parts. The annual precipitation in the research area is 1052 mm, and the annual average temperature is 18.48 ºC. The driest and the hottest month is August, with an average temperature of 28 ºC. Akman et al. (1993) report that November, December, January and February are the highest precipitation months. In the same study, Akman et al. (1993) perform the bioclimatic synthesis of the study area and record Q (precipitation-temperature equivalent) value of 135.7. Based on this value, they suggest that the area can be evaluated in the "Rainy Mediterranean Bioclimate Level (mild winter)".

COORDINATE TABLE ED50_6 DEGREES.

Station Number	Y	X
ST. 1	308162.341	4137537.967
ST. 2	308308.086	4137400.778
ST. 3	308207.338	4137409.413
ST. 4	308207.199	4137275.045
ST. 5	308275.075	4137281.919
ST. 6	308346.644	4137229.690

Figure 1. Map showing the study area

The Geological Structure of the Study Area

The research area is located at the intersection of Burdur-Isparta-Antalya provincial borders, in the Aksu Stream basin, downstream of Karacaören I Dam Lake and HES (Hidroelectric power plant) section. And, it is administratively located at the intersection of the borders of Kızıllı, Karacaören, Çobanpınar and Kargı villages and within the borders of Kargı Village. The research area is 88.5 hectares. It is surrounded by Karacaören I Dam from the north, Aksu Stream from the west and Gökyatak Hill from the east. The leaking water flows coming from the changes in the water level of the Karacaören I Dam, which was built on the Aksu River, infiltrate through the limestones of the Aksu Formation and feed the study area. The distance of the area to Burdur province is about 100 km. The research area is located in the Isparta Bend tectonic belt, and Aksu Formation has been reported as the dominant lithology (Anonymous 2016). The Aksu River Valley in the area is bounded by karst limestone elevations from the east and the west, and the dominant geological environment consists of karst limestones (Soyaslan 2020). The areas of sweetgum forests are generally alluvial lands, and whether the land is sloping or flat is among the factors affecting its distribution (Akman et al. 1993). In the research area, it is observed that the slope approximately varies between 0º and 55-60º. Red Mediterranean Soils, Red-Brown Mediterranean Soils, Chestnut Soils, Brown Forest Soils, Colluvial Soils, Alluvial Soils, Regosols and Rendzinas are the major soil groups of the research area (Atayeter 2005). It is reported that the soil depth is shallow at the top of the slopes in the area while it increases towards the bottom of the valley.

Results and Discussion

The Anatolian sweetgum (*Liquidambar orientalis* Mill.) forest which is one of the important natural riches of Burdur Province has the characteristics of the Mediterranean phytogeographic region. The research area is located on a generally sloping land, at an altitude of approximately 200-500 m. It exhibits a homogeneous floristic structure that is not too rich and dense in terms of habitat characteristics (slope,

topographic structure, soil structure etc.). For similar reasons, the distribution of sweetgum trees is relatively irregular. The large and small streams flow into Aksu Stream effect the mentioned irregular distribution. The trees can reach up to 30 m in height and 1 m in diameter. Fakir (2005) identified 15 monumental trees in the research area, the largest of which (Çatal Sweetgum Tree) was 130.6 cm in diameter. The flora of *L. orientalis* forests, which spread and develop in wetlands, generally consists of species that prefer shade and moisture. Since the development of the tree is in wetlands, the forest flora includes taxa that prefer moisture and shade in both shrub and grass layers. It was determined that the coverage ratios of taxa belonging to *Juncaceae* and *Cyperaceae* families were especially high. This finding is compatible with those reported in Akbaş and Varol (2015). In addition, *Hedera helix* L., *Smilax aspera* L., *Dioscorea communis* (L.) Caddick & Wilkin species, which are among the climbing taxa generally seen in sweetgum forests, were frequently encountered in the research area.

In this study, which deals with the floristic structure of the area, 123 genera belonging to 61 families and 134 species and subspecies taxa belonging to these genera were determined (Figure 2). Most of these taxa are phytogeographically Mediterranean element (14.92%) and endemism rate of the taxa is 2.98%.

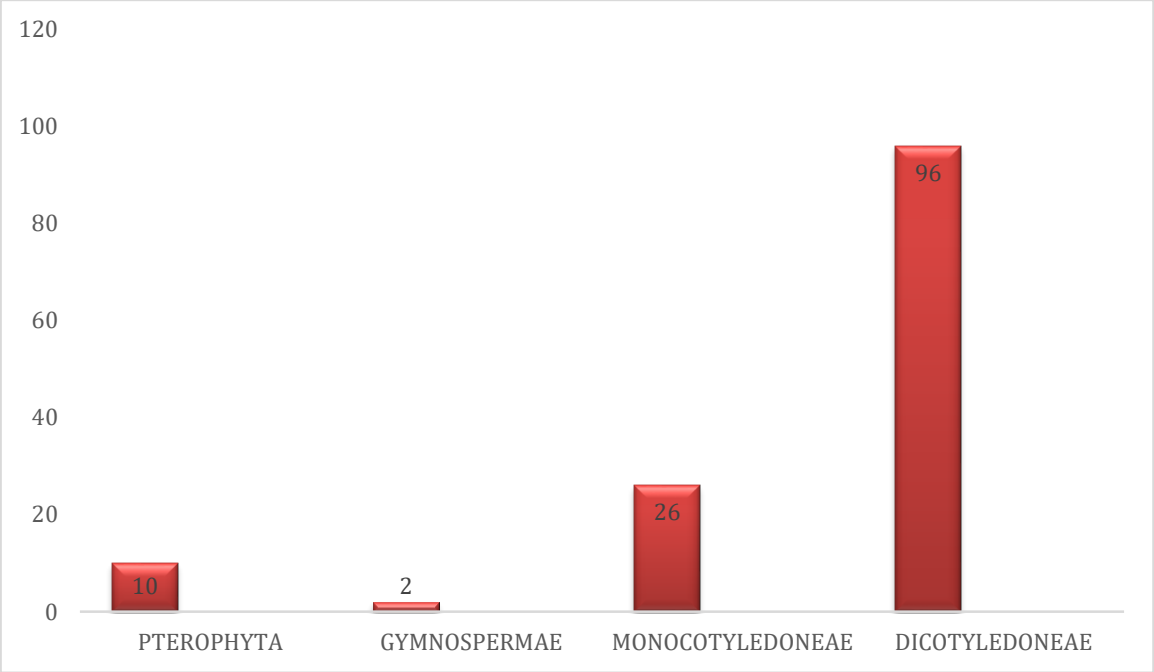

Figure 2. Rates of the taxa in the upper taxonomic categories (%)

The distribution of the taxa according to the phytogeographic regions is shown in Figure 2 below. In line with this, the most common taxa can be included to Pluriregional phytogeographic region, which constitute the widely distributed and unknown group (80 taxa; 60%). This is followed by the Mediterranean (20 taxa; 14.92%), Eastern Mediterranean (18 taxa; 13.43%), Euro-Siberian (13 taxa; 9.70%), Irano-Turanian (2 taxa; 1.49%) and Euxine (1 taxon; 0.74%) phytogeographic regions, respectively (Figure 3). Such a distribution is an expected result for the research area located in the Mediterranean phytogeographic region, and it clarifies the dominance of the taxa belonging to this region.

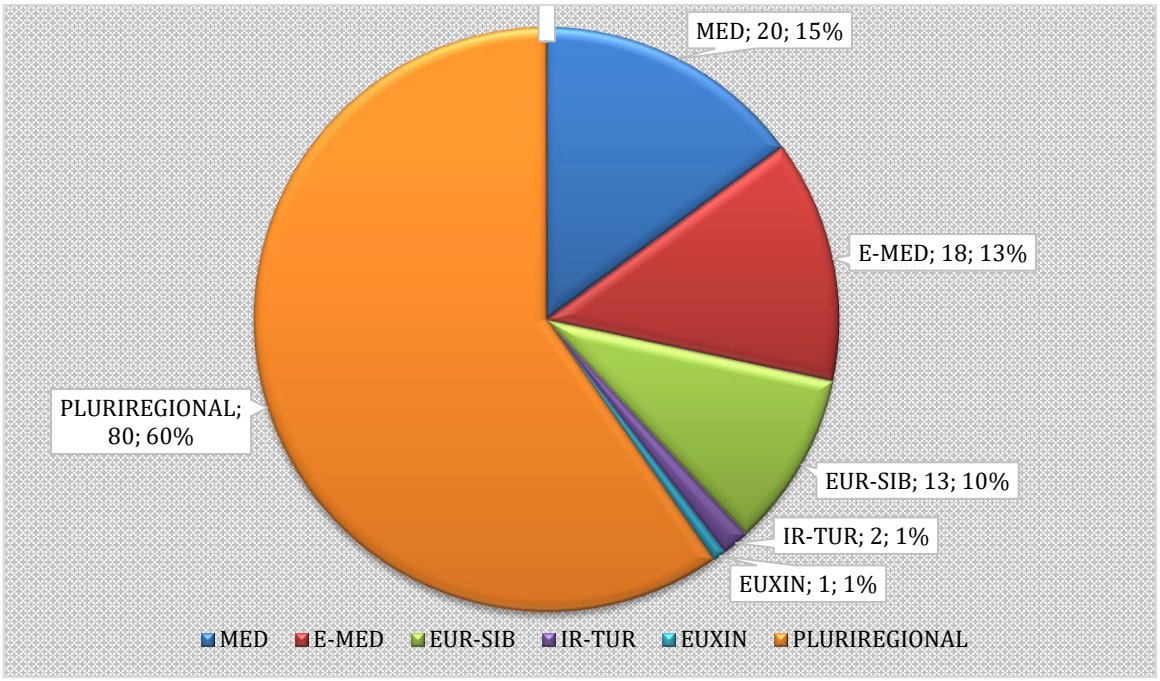

Figure 3. The distribution of the taxa according to phytogeographical regions

Among the taxa determined in the study area, the first 6 families with the highest number of taxa and their percentages are shown in Figure 3. Accordingly, the *Asteraceae* family takes the first place with the percentage of 10.44, and it is followed by the *Lamiaceae* (8.95%) and *Poaceae* (7.46%) families, respectively (Figure 4). This result is compatible with the previous results regarding *Asteraceae* family; it takes place on the first rank in "The Flora of Turkey" in terms of the number of species it contains. In fact, the fruits of this family, which have high ecological tolerance, can spread easily. The genus with the highest number of species in the area is *Carex*. It is an expected result that there are taxa preferring water and moisture in the area.

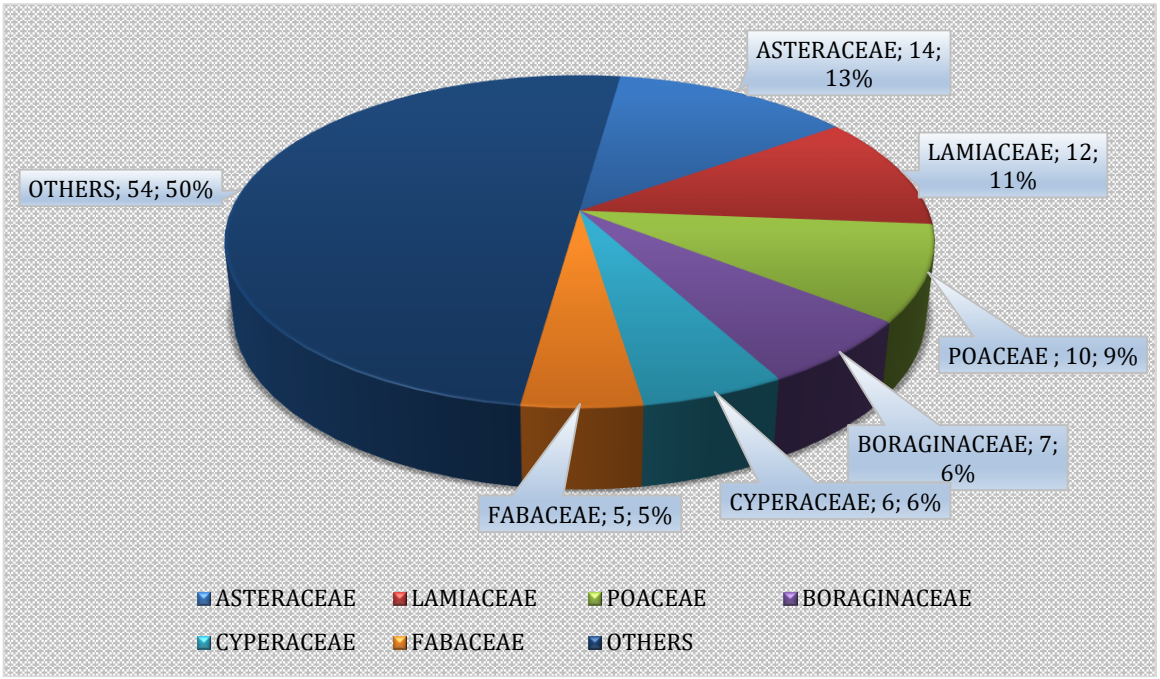

Figure 4. Top 6 families with the most dominant taxa

The endemism rate in the research area is 2.98%. The lowness of this rate can be explained by the fact that the research area, which is surrounded by barb wire, is a woodland and narrow (8.5 hectares only). The distribution of the endemic taxa according to their IUCN endangerment status is as follows: One taxon in VU category (*L. orientalis*), one taxon in EN category (*Linum pamphylicum* Boiss. & Heldr. ex Planch.), two taxa in LC category (*Carduus rechingeranus* Kazmi and *Picris campylocarpa* Boiss. & Heldr.). It is expected that the floristic structures of sweetgum forests are relatively poor since they spread on lands with a high slope. The number of the endemic taxa identified in the research area and their comparison with the previous studies are given below (Table 1).

Table 1. Comparison of phytogeographical regions and endemism rates with the other studies

	FLORISTIC REGION (TAXON NUMBER/%)							
Other studies in the same area	Mediterranean	East Mediterranean	Euro-Siberian	Irano-Turanian	Unknown	Total Taxon Number	Endemic Taxon Number	Endemism Percentages (%)
Balpınar (present work)	20/14.92	18/13.43	13/9.70	2/1.49	80/59.70	134	4	% 2.98
Fakir and Doğanoğlu (2003)	20/25.64	9/11.54	-	2/2.56	47/60.26	78	3	% 3.84
Akman et al. (1992)	16/14.41	14/12.61	14/12.61	1/0.90	66/59.46	111	4	% 3.60

In a floristic study regarding sweetgum communities spread around Fethiye, Marmaris and Bucak, Akman et al. (1992) determined a total of 111 plant taxa, 4 of which were endemic. The number of common plant taxa in Akman et al. (1992) and the current study is 33. Fakir and Doğanoğlu (2003) identified a total of 78 taxa, 4 of which were endemic, in their study in the same area. However, *Gladiolus anatolicus*, which was among these endemics, was later dropped from the endemism category (Güner et al. 2012). The common number of plant taxa between Fakir and Doğanoğlu (2003) and the current study is 51.

In the literature, there are two previous studies conducted in the same research area. Akman et al. (1992) report in their study that according to the number of taxa, the richest family is *Poaceae* family. Fakir and Doğanoğlu (2003) report that *Poaceae* and *Fabaceae* are the families containing the highest number of taxa. In the current study, it has been determined that the richest family having the highest number of taxa is *Asteraceae* family (Table 2). When considering its unique floristic structure and its surface area, it can be said that the research area has floristic richness. Changes in the water level of Aksu Stream, other streams and Karacaören I dam keep the ground of the research area constantly moist.

Conclusion

L. orientalis, one of Turkey's most distinctive forest trees, is a genetic heritage that is extremely important for sustainability of wetlands. However, in the areas where these trees grow, it is generally seen that the trunks seriously damaged by humans in order to obtain balsam. These damages may cause crown of the tree to die and the damaged parts are vulnerable to fungis and pests. In this respect, the research field is fortunately in a good condition, the trees are tall and smooth-bodied since they are not damaged.

Table 2. Comparison of surveys according to the largest 5 families (taxa numbers-percentages)

	OTHER STUDIES IN THE SAME AREA (TAXON NUMBER/%)		
Family	Balpınar (present work)	Akman et al. (1992)	Fakir and Doğanoğlu (2003)
Asteraceae	14/10.45	9/8.11	4/5.13
Lamiaceae	12/8.95	9/8.11	7/8.97
Poaceae	10/7.46	11/9.91	4/5.13
Boraginaceae	7/5.22	1/0.90	1/1.28
Cyperaceae	6/4.48	7/6.31	1/1.28
Fabaceae	5/3.73	7/6.31	7/8.97
Juncaceae	2/1.49	6/.41	2/2.56

In Turkey, there are many biotic problems such as urbanization, some changes in land use (further expansion of agricultural land), grazing and destruction of the areas where these forests are distributed for industrial and economic purposes. When various natural causes such as habitat fragmentation and drought caused by global warming are added to these problems, forest areas are getting smaller (Efe 1987, Ketenoğlu et al. 2003). In fact, there are studies which have pointed to this decrease since the 1950s (Alan and Kaya 2003, Ketenoğlu et al. 2003). Öztürk et al. (2008) report that the areas covered by sweetgum forests in Turkey has approximately decreased 5300 hectares in the last 200 years. It is an undeniable fact that the economic return of sweetgum is also effective in this decrease. But, the developments in technology seem to have reduced the need and interest in sweetgum tree to some extent. The fact that sweetgum tree habitats are primarily used as agricultural areas can be interpreted as an indication that the interest in the conservation of these trees has decreased. When it comes to necessity of Turkey, these forests having sensitive ecosystem characteristics need to be monitored, examined and protected in all areas where they develop in Turkey. In this respect, we believe that more support should be provided to public and private collaborations in areas where they can develop in order to protect this asset and increase its ecological, economic and sociological impact.

In this study, the floristic structure of the Anatolian sweetgum forest, which is one of the important areas of Burdur province, was revealed. 123 genera belonging to 61 families and 134 species and subspecies taxa belonging to these genera were determined. The endemism rate in the research area is 2.98%. It is possible to explain the low rate of endemism with the small size of the research area. However, it is known that endemic species play an important role in species richness. By this study carried out in the "Sığla Nature Conservation Area" of the Bucak district of Burdur province, it has been aimed at creating an informative source for future researches on the biodiversity of sweetgum forests in Turkey and contributing to the studies to be made for the protection of these important natural areas.

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APPENDIX 1. Localities of the collected specimens

LOCALITIES			
STATION NO	LOCATIONS	DATE	ALTITUDE
1	B3; Sweetgum forest 37° 21' 47.145" N 30° 50' 0.3474" E	24.05.2015	355 m
2	B3; Sweetgum forest 37° 21' 42.807" N 30° 50' 6.396" E	04.06.2015	340 m
3	B3; Sweetgum forest 37° 21' 43.0122" N 30° 50' 2.295" E	16.06.2015	250 m
4	B3; Sweetgum forest 37° 21' 38.6532" N 30° 50' 2.4144" E	21.06.2015	320 m
5	B3; Sweetgum forest 37° 21' 38.9268"N 30° 50' 5.1648" E	15.07.2015	300 m
6	B3; Sweetgum forest 37° 21' 37.2882" N 30° 50' 8.1198" E	15.08.2015	275 m

APPENDIX 2. The list of taxa

ALTINGIACEAE
Liquidambar orientalis Miller, ST1, N.Balpınar, 1256
AMARYLLIDACEAE
Narcissus tazetta L. subsp. *tazetta*, ST1, N.Balpınar, 1174
ANACARDIACEAE
Cotinus coggygria Scop., ST2, N.Balpınar, 1254
Pistacia palaestina Boiss., ST1, N.Balpınar, 1229
APIACEAE
Caucalis platycarpos L., ST4, N.Balpınar, 1039
Lagoecia cuminoides L., ST3, N.Balpınar, 1063
Pimpinella cretica Poiret var. *cretica*, ST5, N.Balpınar, 1059
APOCYNACEAE
Nerium oleander L., ST6, N.Balpınar, 1188
ARACEAE
Arum dioscoridis SM. var. dioscoridis, ST1, N.Balpınar 1097
ARALIACEAE
Hedera helix L., ST6, N.Balpınar, 1002
ASPARAGACEAE
Asparagus acutifolius L., ST5, N.Balpınar, 1007
Prospero autumnale (L.) Speta, ST5, N.Balpınar, 1295
Ruscus aculeatus L., ST1, N.Balpınar, 1200
ASPLENIACEAE
Asplenium ceterach L., ST3, N.Balpınar, 1023
ASTERACEAE
Bellis perennis L., ST6, N.Balpınar, 1030
Carduus rechingeranus Kazmi, ST2, N.Balpınar 1061
Cirsium vulgare (Savi) Ten., ST7, N.Balpınar, 1186
Erigeron acer L. var. *acer*, ST1, N.Balpınar, 1028
Helichrysum plicatum DC. subsp. *plicatum*, ST1, N.Balpınar, 1258
Inula heterolepis Boiss., ST6, N.Balpınar, 1115
Lactuca serriola L., ST6, N.Balpınar, 1296
Lapsana communis subsp. *intermedia* (M.Bieb.) Hayek var. *intermedia*, ST2, N.Balpınar, 1107
Micropus supinus L., ST1, N.Balpınar, 1048
Picris campylocarpa Boiss & Heldr., ST4, N.Balpınar, 1082
Ptilostemon chamaepeuce (L.) Less., ST1, N.Balpınar, 1193
Pulicaria dysenterica (L.) Bernh. subsp. *dysenterica*, ST6, N.Balpınar, 1231
Tragopogon porrifolius L. subsp. *longirostris* (Sch.Bip.) Greuter, ST3, N.Balpınar, 1127
Urospermum picroides (L.) F.W. Schmidt, ST2, N.Balpınar, 1076
BETULACEAE
Alnus orientalis Decne. var. *orientalis*, ST2, N.Balpınar, 1172
BORAGINACEAE
Alkanna aerolata Boiss. var. *aerolata*, ST4, N.Balpınar, 1249
Anchusa azurea Mill. var. *azurea*, ST1, N.Balpınar, 1032
Anchusa stylosa M. Bieb., ST6, N.Balpınar, 1220
Cynoglossum creticum Mill., ST1, ST4, N.Balpınar, 1037
Lappula barbata (M.Bieb.) Gürke, ST5, N.Balpınar, 1074
Lithospermum arvense L., ST2, N.Balpınar, 1084
Onosma oreodoxa Boiss. & Heldr., ST1, N.Balpınar, 1191
CAMPANULACEAE
Campanula lyrata Lam. subsp. *lyrata*, ST2, N.Balpınar, 1034

C. peregrina L., ST4, N.Balpınar, 1119
CANNABACEAE
Celtis planchoniana K.I.Chr., ST3, N.Balpınar, 1227
CARYOPHYLLACEAE
Silene dichotoma Ehrh. subsp. *racemosa* (Otth) Graebn.& P.Graebn., ST4, N.Balpınar, 1129
CISTACEAE
Cistus creticus L., ST3, N.Balpınar, 1233
Cistus salviifolius L., ST1, N.Balpınar, 1153
COLCHICACEAE
Colchicum variegatum L., ST6, N.Balpınar, 1113
CUPRESSACEAE
Juniperus oxycedrus L. subsp. *oxycedrus* var. oxycedrus, ST6, N.Balpınar, 1170
CYPERACEAE
Carex distans L. subsp. distans, ST3, N.Balpınar, 1211
C. muricata L. subsp. *muricata*, ST1, N.Balpınar, 1091
C. pendula Hudson, ST3, N.Balpınar, 1215
Cladium mariscus (L.) Pohl subsp. *mariscus*, ST1, N.Balpınar, 1242
Cyperus fuscus L., ST3, N.Balpınar, 1247
Schoenus nigricans L., ST6, N.Balpınar, 1298
CYSTOPTERIDACEAE
Cystopteris fragilis (L.) Bernh., ST1, ST3, N.Balpınar, 1161
DENNSTAEDTIACEAE
Pteridium aquilinum (L.) Kuhn, ST1, N.Balpınar, 1204
DIOSCORACEAE
Dioscorae communis (L.) Caddick & Wilkin, ST5, N.Balpınar, 1260
DRYOPTERIDACEAE
Dryopteris pallida (Bory) Fomin., ST2, N.Balpınar, 1197
D. filix-mas (L.) Schott, ST2, N.Balpınar, 1222
EQUISETACEAE
Equisetum telmateia Ehrh., ST3, N.Balpınar, 1117
ERICACEAE
Erica manipuliflora Salisb., ST6, N.Balpınar, 1168
EUPHORBIACEAE
Euphorbia characias L. subsp. *wulfenii* (Hoppe ex W.D.J. Koch) Radcl.-Sm., ST1, N.Balpınar, 1176
E. falcata L. subsp. *macrostegia* (Bornm.) O.Schwartz, ST2, N.Balpınar, 1066
Mercurialis annua L., ST4, N.Balpınar
FABACEAE
Cercis siliquastrum L. subsp. *siliquastrum*, ST1, N.Balpınar, 1151
Lotus corniculatus L. var. *corniculatus* Ser., ST5, N.Balpınar, 1236
Securigera parviflora (Desv.) Lassen, ST3, N.Balpınar, 1240
Trifolium campestre Schreb. subsp. *campestre* var. *campestre*, ST1, N.Balpınar, 1123
Trigonella spicata Sibth. et Sm, N.Balpınar, ST3, 1057
FAGACEAE
Quercus cerris L. var. cerris, ST4, N.Balpınar, 1224
Quercus coccifera L., ST6, N.Balpınar, 1159
GENTIANACEAE
Blackstonia perfoliata (L.) Hudson subsp. *perfoliata*, ST4, N.Balpınar, 1078
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch subsp. *tenuiflorum*, ST4, N.Balpınar, 1103
GERANIACEAE
Erodium cicutarium (L.) L'Herit. subsp. cicutarium, ST1, N.Balpınar, 1155
Geranium purpureum Vill., ST1, N.Balpınar, 1121
G. rotundifolium L., ST1, N.Balpınar, 1125

HALORAGACEAE
Myriophyllum spicatum L., ST5, N.Balpınar, 1184
HYPERICACEAE
Hypericum atomarium Boiss., ST2, N.Balpınar, 1068
IRIDACEAE
Gladiolus anatolicus L., ST1, N.Balpınar, 1208
JUNCACEAE
Juncus acutus L. subsp. *acutus*, ST1, N.Balpınar, 1149
J. maritimus Lam., ST2, N.Balpınar, 1163
LAMIACEAE
Ajuga chamaepitys subsp. *palaestina* (Boiss.) Bornm, N.Balpınar, ST5, 1053
Calamintha nepeta subsp. *nepeta*, ST4, ST5, N.Balpınar, 1051, 1050
Clinopodium alpinum (L.) Cuntze, ST1, N.Balpınar, 1055
C. vulgare L. subsp. vulgare, ST1, ST5, N.Balpınar, 1045
Melissa officinalis L. subsp. *officinalis*, ST3, N.Balpınar, 1217
Mentha pulegium L., ST5, N.Balpınar, 1213
Micromeria myrtifolia Boiss. & Hohen., ST6, N.Balpınar, 1072, 1070
Phlomis fruticosa L., ST5, N.Balpınar, 1238
Prunella vulgaris L., ST2, N.Balpınar, 1157
Salvia viridis L., ST4, N.Balpınar, 1131
Sideritis romana subsp. *curvidens* (Stapf) Holmboe, ST5, N.Balpınar, 1133
Vitex agnus-castus L., ST3, N.Balpınar, 1179
LAURACEAE
Laurus nobilis L., ST1, N.Balpınar, 1147
LINACEAE
Linum pamphylicum Boiss. & Heldr. ex Planch subsp. pamphylicum, ST4, N.Balpınar, 1202
MORACEAE
Ficus carica L. subsp. *carica*, ST3, N.Balpınar, 1245
MYRTACEAE
Myrtus communis L. subsp. *communis*, ST5, N.Balpınar, 1250
OLEACEAE
Jasminum fruticans L., ST3, N.Balpınar, 1263
Phillyrea latifolia L., ST6, N.Balpınar, 1165
OXALIDACEAE
Oxalis corniculata L., ST6, N.Balpınar, 1252
PHYLLANTHACEAE
Andrachne telephioides L., ST1, N.Balpınar, 1025
PINACEAE
Pinus brutia Ten. var. Brutia, ST6, N.Balpınar, 1265
PLANTAGINACEAE
Kickxia commutata (Rchb.) Fritsch subsp. *graeca* (Bory et Chaub.) R. Fernandes, ST2, ST3, N.Balpınar, 1041
Plantago major L. subsp. *major*, ST3, N.Balpınar, 1292
Veronica anagallis-aquatica L., ST4, N.Balpınar, 1001
PLATANACEAE
Platanus orientalis L., ST2, N.Balpınar, 1141
POACEAE
Agrostis stolonifera L., ST4, N.Balpınar 1109
Brachypodium sylvaticum (Hudson) P. Beauv, ST1, N.Balpınar, 1095
Briza maxima L., ST1, N.Balpınar, 1087
Bromus danthoniae Trin. subsp. *danthoniae*, ST6, N.Balpınar, 1181
Cynodon dactylon (L.) Pers. var. *dactylon*, ST5, N.Balpınar, 1206
Dactylis glomerata L. subsp. *hispanica* (Roth) Nyman, ST5, ST6, N.Balpınar, 1099, 1093

Hordeum bulbosum L., ST6, N.Balpınar, 1139
Lolium perenne L., ST6, N.Balpınar, 1218
Pennisetum orientale L.C.M. Richard, ST5, N.Balpınar, 1267
Sorghum halepense (L.) Pers. var. *muticum* (Hackel) Grossh., ST6, N.Balpınar, 1288
POLYGONACEAE
Polygonum persicaria L., ST6, N.Balpınar, 1010
POTAMOGETONACEAE
Potamogeton crispus L., ST6, N.Balpınar, 1286
Stuckenia pectinata L., ST5, N.Balpınar, 1137
PRIMULACEAE
Samolus valerandi L., ST5, N.Balpınar, 1111
PTERIDACEAE
Adiantum capillus-veneris L., ST1, ST3, ST4, N.Balpınar, 1017, 1021, 1020,
Anogramma leptophylla L. Link, ST1, N.Balpınar, 1195
Cheilanthes pteridioides (Reich.) C.Chr., ST1, N.Balpınar, 1269
RANUNCULACEAE
Anemone coronaria L., ST3, N.Balpınar, 1278
RHAMNACEAE
Paliurus spina-christi P. Mill., ST5, N.Balpınar, 1080
ROSACEAE
Crataegus monogyna Jacq. var. *monogyna*, ST3, N.Balpınar, 1284
Rubus sanctus Screber, ST5, N.Balpınar, 1271
Sanguisorba minor L. subsp. Minör, ST3, N.Balpınar, 1135
RUBIACEAE
Crucianella L. *angustifolia* L., ST3, N.Balpınar, 1089
Galium aparine L., ST2, N.Balpınar, 1143
SALICACEAE
Salix alba L. subsp. *alba*, ST2, N.Balpınar, 1273
SCROPHULARIACEAE
Scrophularia scopolii Hoppe ex Pers. var. *scopolii,* ST5, N.Balpınar, 1279
Verbascum blattaria L., ST6, N.Balpınar, ST6, 1290
SELAGINELLACEAE
Selaginella denticulata (L.) A.Braun, ST1, ST2, N.Balpınar, 1014, 1012,
SMILACACEAE
Smilax excelsa L., ST1, N.Balpınar 1004
STYRACACEAE
Styrax officinalis L., ST5, N.Balpınar, 1276
TAMARICACEAE
Tamarix tetrandra Pallas ex M. Bieb., N.Balpınar, ST6, 1282
VIOLACEAE
Viola odorata L., ST3, N.Balpınar, 1145

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