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Full Length Research Paper

Urban flora and ecological characteristics of the Kartal District (Istanbul): A contribution to urban ecology in Turkey

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For years, ecologists who have been trying to understand the relationship between the organisms with each other and/or their environments, have carried out their researches sometimes far from civilization, sometimes on a desolate island or in a tropical rainforest. Today, about half of the world's population lives in urban areas. Therefore, most of the ecological problems have been brought to these areas. Nevertheless, in cities, preserving and maintaining natural habitats, providing a place not only to live but also to enjoy and to relax, are possible only by applying the principles and concepts of urban ecology in planning. This study presents the outcomes of unplanned urbanization and possible preventive measures, which could be taken in the Kartal District, Istanbul-Turkey. Moreover, in this study, different kinds of urban habitats within the frontiers of Kartal were described and an inventorial study containing native, exotic and cultivated plant taxa were realized. For this plant inventory of the Kartal District, all the greenery in the area were explored in different seasons. Plant samples were collected, dried, labelled and then determined according to standard herbarium procedures. In the present study, totally 576 plant taxa were determined, whereas 477 (395 species, 51 subspecies and 31 varieties) of them were natural and 99 were exotic and cultivated. The most native taxa were in the *Asteraceae* family (50 species), while the most found kind of exotic plant family was *Rosaceae* (16 species). The archaeophyte and neophyte plants in these taxa, endemic, rare, endangered, medicinal and poisonous species were also mentioned. Furthermore, the necessity of having ecological studies become widespread in urban areas, initially in Istanbul and later in other places was emphasized in the study.

Key words: Urban flora, urban habitat, urban ecology, Kartal, Istanbul.

INTRODUCTION

Istanbul is one of the biggest metropolitans of both Europe and Asia, and Turkey's cultural and financial center. The city is located in the north- west part of Turkey (41° 01.2' N, 28° 58.2' E) and it extends both on European (Thrace) and Asian (Anatolia) sides of Bosphorus. (www.ibb.gov.tr). In its long history, Istanbul served as a capital city of Roman, Byzantine, Latin and Ottoman Empires (Bayrak, 1996). Therefore, it has been experiencing the pressure of a high level of population increase. Technological improvements in the 20th century changed Istanbul's social, cultural and economic structures. These changes created more effective migration rate of Turkey's Anatolian population into Istanbul, especially at the beginning of the 1950s. That migration rate also increased after 1980s, and led to the enlargement of the city's boundaries. State policies also influenced the enlargement of the city and changed the use of its land (Karakuyu, 2006). As a result, human activities, such as building, traffic or industrial production affected the quality of air, water and soil, which influence the ecosystem in many ways like other fast-developed cities (Sukopp and Starfinger, 1999). Plants were destroyed and their spontaneous productions reduced.

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Figure 1. The satellite view of Istanbul (upper left corner) and the Kartal District (above). The white bars indicated 10 miles (upper left) and 2.5 miles (right down corner). The studied area was circled. (SGA: Sabiha Gökcen Airport, F1: Formula-1 Area, OD: Ömerli Dam). The picture was prepared by using Google Earth Programme.

The results altered population dynamics, species composition, and altered energy and matter fluxes in urban ecosystem (Sukopp, 2004). However, there are some basic information about urban ecosystems, which are required for the ecological analysis. The most important of them include abiotic components like geology, topography, soil and climate and biotic components as vegetation, flora and fauna, the human land uses and their changes (farming, livestock, forestry, settlements, and infrastructure). Finally, there are also some cultural factors e.g. archaeological, historical, traditional features, aesthetics etc., which are occasionally integrated in a landscape analysis (Phillips, 1995; Shaltout and El-Sheikh, 2002; Antipina, 2003; Amanatidou, 2005).

In this study, the Kartal District was carried out as a model with its fast development and urbanization in Istanbul to exhibit the negative effects of urbanization on natural environment. Kartal also has the most destroyed habitats compared to other areas in Istanbul. It is obviously known that, the Kartal District faced to unplanned buildings, unconsciously constructed parks, local industrial zones, coastal roads, widening and extension of motorways. Today, the negative effects of Formula 1, Sabiha Gökcen Airport, some stone query activities and motorways on natural flora and vegetation are still present.

This study aimed at mentioning urban flora of the Kartal District; native (indigenous), exotic and cultivated plants, which existed in these urban habitats. Endemic, rare and endangered plant species and their habitats were given in Appendix 1-2 at the end of this paper. It was also pointed out that the negative effects of unplanned urbanization and industrialization, which have been made without observing ecologic necessities on natural habitats and the precautions on these subjects.

GENERAL INFORMATION

Location

The Kartal District is located on the Asian (Anatolia) side of Istanbul (40° 50 N, 29° 11 E), on the north coast of Marmara Sea. Total land area is 147.000 m^2, which includes some countryside areas inland (Figure 1). Her neighbor districts are Maltepe in the west, Ümraniye and

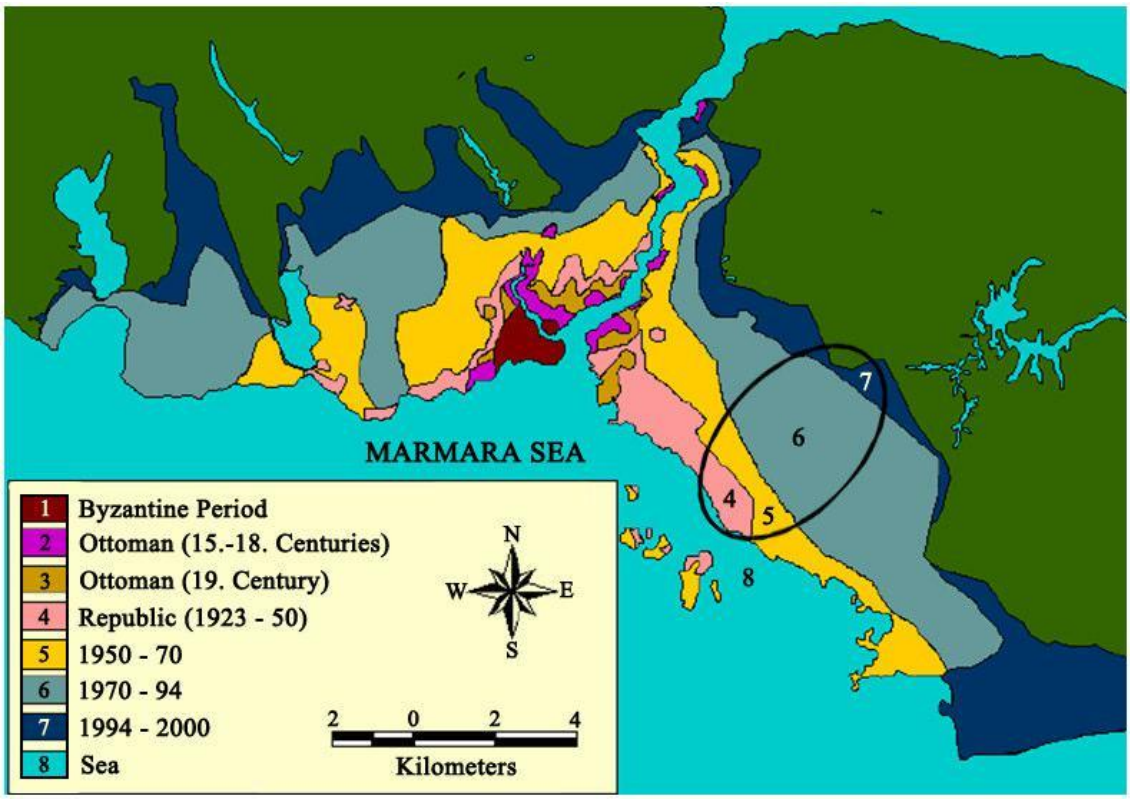

Figure 2. The physical growth of Istanbul in its history (Modified from Karakuyu, 2006). The study area is circled.

Kadıköy in the northwest (due to Ferhatpa a quarter passed from Maltepe to Samandıra in 2004), Sultanbeyli in the north, Pendik and the Prince Islands in the south (www.kartal-bld.gov.tr).

History

The center of Kartal was a fishing village on the Marmara shore during the Byzantine Empire, which called Kartalimen, and was found at the beginning of the 6th century. In the 11th century, the town was conquered by the ruler of the Seljuks, Suleyman Shah, and then in 1329, Kartal became a part of Ottoman Empire (Karakuyu, 2006). Kartal was an industrial area with the introduction of commuter trains from Gebze to Haydarpa a Terminal in 1947. After 1980s, Kartal became a more important industrial area of Istanbul (Figure 2). Today, there are about 400 large and middle-sized factories, 1,300 workshops and over 1,200 shops and offices in central Kartal and more than 40,000 people are employed. Lately, the current trend in Kartal is housing near the coast and building factories inland. For example, a large cement factory on the shore was closed and converted into a cultural center in 2003. Kartal is projected to be a major urban and industrial area by the 2020s (www.kartal-bld.gov.tr).

Population

The population of Kartal increased rapidly in the last 35 years. Total population values were as follows; 281,867 in 1975, 572,546 in 1985, 611,532 in 1990, 410,000 in 2000. The decrease of population in Kartal after 1990 was the result of separation of the Kartal District into other new districts (Pendik, Maltepe and Sultanbeyli). Today, total population of Kartal is 541,209 and it is a heavily populated district, although located far from the city center (tuikapp.gov.tr).

Topography

Kartal has a rough relief and it lies at an elevation from 1 m to 537 m above the sea level. The land area turns into the hills through the north side while it is flat at the seacoasts. Behind the coast, the land rises sharply up to Yakacık Hill (420 m), which is called “the balcony of Istanbul” and Aydos Hill (537 m). The land is fertile and has a mild climate on these hills. There is not a big river in the district, but there are some seasonal small brooks. The level of water in these brooks increases or decreases depending on the rain flow (www.kartal-bld.gov.tr).

The topographic gradient (slope) of the Kartal District is variable. The center and its surrounding, (70% of the district)

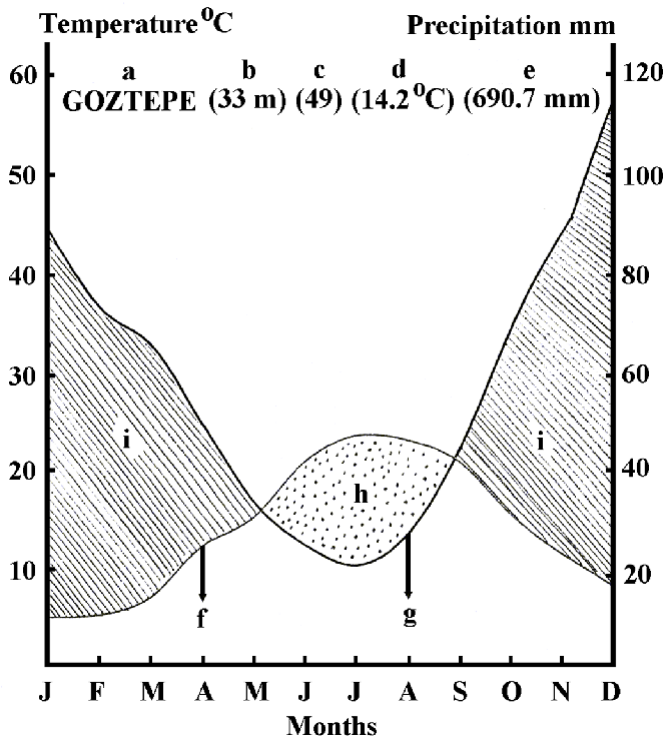

Figure 3. Ombrothermic diagram of the research area a: Name of the meteorological station, b: Altitude of the meteorological station, c: Meteorological observation time (year) d: Average temperature (annual), e: Average precipitation (annual), f: Temperature curve, g: Precipitation curve, h: Drought period, i: Precipitated period. (Altay, 2004).

have a gradient of 0 to 15%. In Yakacık area, it is more than 15% (in general) and in bottom of Aydos Hill, it reaches 45% (Anonymous, 2000, 2001).

Geology

Geologists mentioned that in research area, there were epirogenic movements until the end of Paleozoic era, and then the research area was in active tectonic influences from end of the Paleozoic to end of upper Miocene eras. Because of the tectonic effects, the layers turned into curved, broken or partially pressed structures. The directions of the layers are southwest-northeast. Gradients are in northwest and southwest dimensions and between 14ë and 60ë degrees. The Paleozoic older units are generally younger from north to south (Anonymous, 2000, 2001).

Soil

Parent rock along with topography, local climate, vegetation and land use are the main factors determining the soil characteristics of an area (Amanatidou, 2005). As it is known, soils of urban areas usually show very heterogeneous qualities, because the human impact in cities adds changes in soil qualities to the natural variation before the city was built (Sukopp, 2004). The 33,293 ha of the study area are consisted of brownish forest soil without lime (generally formed under the forests), 1,247 ha are alluvial soil, and 503 ha are brownish soil without lime. The 7,238 ha of area are covered with other land types and settlements. In addition, seacoast has partially sandy and clay soils, and there are limestone and quartz deposits on the Yakacık Hill (Anonymous, 1987).

Climate

The climate of research area is typical four-season continental climate of the Mediterranean Region. The Mediterranean character is associated with the annual distribution of precipitation, being high during the winter months and having a drought period of 3 or 4 months in summer (Figure 3). The continental climatic element is attributed to the high amplitude of annual temperature that exceeds 40^{o}C. January and February are the coldest months (mean low -3.2^{o}C) while July and August are the warmest (mean high 28.5^{o}C). Annual precipitation is about 690.7 mm per year; the most precipitation occurs in winter (Anonymous, 2004). Information about the climate of the study area was derived from the meteorological station of Göztepe-Kadıköy, which is sited near the study area. For the period 1963-2004, the mean annual temperature and the mean annual precipitation were 14.2^{o}C and 690.7 mm respectively. Extreme winter temperature (< 0^{o}C) is usual in the area and the late frost danger is generally present. In relation to the Mediterranean bioclimatic divisions, the area belongs to the humid zone with cold winter (Anonimous, 2004).

Urban habitats

Urban ecosystems and the composition of urban plant and animal communities are greatly dependent on human activities, which cause impacts on them (Aey, 1990; Shaltout and El-Sheikh, 2002; Antipina, 2003; Sukopp, 2004). Cities generally show a mosaic of habitats with their increasing degrees of human impact along a gradient from the outskirts to city centers. The organisms and communities in these habitats show reaction to human influences in various ways and are consequently different for each structural unit of the city. The distribution of habitat types in cities is an important prerequisite for nature protection and town planning (Starfinger and Sukopp, 1994; Sukopp, 2004). Cities usually consist of a mixture of densely settled areas in the historic centers, remnants of agro-ecosystems, and even near-natural areas in urban forests, parks, nature reserves (Sukopp, 2004). Furthermore, cities also consist

Table 1. The archaeophyte and neophyte plants list.

Archaeophytes (Before 1500 A.D.)	Neophytes (After1500 A.D.)
Lamium purpureum (Lamiaceae)	*Conyza canadensis (Asteraceae)*
Lamium amplexicaule	*Datura stromanium (Solanaceae)*
Euphorbia helioscopia (Euphorbiaceae)	*Veronica persica (Scrophulariaceae)*
Euphorbia peplus	*Cymbalaria muralis*
Sinapis arvensis (Brassicaceae)	*Ailanthus altissima (Simaroubaceae)*
Capsella bursa – pastoris	*Aesculus hippocastanum (Hippocastaneae)*
Fumaria officinalis (Papaveraceae)	*Oxalis corniculata (Oxalidaceae)*
Papaver rhoeas	
Stellaria media (Caryophyllaceae)	*Diplotaxis tenuifolia (Brassicaceae)*
Cerastium glomeratum	*Raphanistrum Raphanus*
Cichorium intybus (Asteraceae)	*Robinia pseudoacacia (Fabaceae)*
Bellis perennis	
Solanum nigrum (Solanaceae)	*Amaranthus retroflexus (Amaranthaceae)*
Chenopodium album (Chenopodiaceae)	*Syringia vulgaris (Oleaceae)*
Setaria viridis (Poaceae)	
Bromus sterilis	
Echinochloa crus - galli	
Plantago lanceolata (Plantaginaceae)	
Melilotus alba (Fabaceae)	
Melilotus officinalis	
Geranium pusillum (Geraniaceae)	
Geranium dissectum	
Geranium molle	
Echium vulgare (Boraginaceae)	
Anagallis arvensis (Primulaceae)	
Malva neglecta (Malvaceae)	

of cemeteries, industrial areas, railways and watery areas in their habitats and the plants representing these habitats, show varieties because of the effects of the different structures (Altay, 2004).

In the study area, natural, exotic and cultivated plant taxa, which dominantly distributed especially in parks, gardens, meadows, forests, refuges, squares, small green lands and cemeteries were also collected and emphasized in this paper.

MATERIALS AND METHODS

The plant taxa collected in the Kartal District are the materials of this study. The inventory of the flora was conducted from March to July of the years 2002- 2006. Each year the grasslands, rocky sites and shrub lands (open vegetation) and forests (woody vegetation) were inventoried between March and July. Two extra visits at the study area, once early in spring and a second late in autumn in each year, contributed to the identification of early and late growing species respectively, which have been registered at the plots, but remained unidentified due to missing floral parts. During these visits, all new plant species encountered in the area were also registered.

The plant specimens were identified by using “Flora of Turkey and the East Aegean Islands” (Davis, 1965-2001) and were preserved in MÜFE Herbarium (Marmara University, Science and Arts Faculty Herbarium). The flora was listed in the Appendix 1-2 and the floristic list was arranged in alphabetical order of genera and species. Life forms [phanerophytes (Ph); chaemaphytes (Ch); hemicryptophytes (H); therophytes (Th); geophytes (G); helophytes (He)] were determined according to Raunkier system (Braun-Blanquet, 1964) and phytogeographical origins [Euro-Siberian (Euro.-Sib), Irano-Turanian (Ir.-Tur.), Mediterranean (Medit.), East Mediterranean (E. Medit.)] were mentioned near the scientific names of collected species.

The archaeophyte and neophyte plants in these taxa were listed in Table 1. An archaeophyte is a plant taxon, which is non-native to a geographical region and it was introduced in "ancient" times, rather than having been introduced in modern time (Schepker and Kowarik, 2002). A neophyte is a plant taxon, which was recently introduced to an area (in contrast to archaeophyte, a long-established introduced species). The high proportion of non-native species in cities is partly due to the fact that cities are centers of spread, because new species arrive at railway stations or ports or are cultivated for the first time in (botanical) gardens (Sukopp, 2004). Archaeophytes are considered to be those species first introduced prior to 1500 A.D., while neophytes first introduced after 1500 A.D. (Schepker and Kowarik, 2002; Kowarik, 2003).

In this study, exotic and cultivated plants were also listed by using “Manual of Cultivated Plants” at the end of the paper (Bailey, 1949). Endemic, rare, endangered, medicinal and poisonous species were given in Appendix 1-2. The categories and criteria of the rare and endangered species were mentioned according to “Red Data List” of International Union for the Conservation of Nature and Natural Resources (IUCN) and “Red Data Book of

Turkish Plants" (Ekim et al., 2000). The IUCN Red List of Threatened Species created in 1963, is the world's most comprehensive inventory of the global conservation status of plant and animal species. IUCN is also the world's main authority on the conservation status of species (Mrosovsky, 1997). The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction (Mrosovsky, 1997; Boitani et al., 2008).

We also mentioned the poisonous and medicinal plants of both native and exotic taxa which were collected in the Kartal District as marking (*) for poisonous and (**) for medicinal in Appendix 1-2. The poisonous plants were arranged according to (Seçmen and Leblebici, 1987; Baytop, 1989), while medicinal plants were arranged according to (Baytop, 1984; Baytop and Kadıo lu, 2002).

RESULTS

After identification of collected plant samples, we fixed totally 576 vascular plant taxa growing in the research area. The 477 of them were native (395 species, 51 subspecies and 31 varieties) belonged to 268 genera and 76 families, and 99 were exotic and cultivated (98 species) belonged to 83 genera and 47 families (Appendix 1-2). It was determined that, 316 native species (80.00%) belonged to *Dicotyledones* while 69 native species (17.46%) to *Monocotyledones*. Three native species (0.75%) belonged to *Pteridophyta* and 7 native species (1.77%) to *Gymnospermae*. Furthermore, there were 215 perennial, 170 annual and 10 biennial species in native flora.

The following families were represented by the largest number of native species respectively are as follows: *Asteraceae* (50 species, 12.65%), *Fabaceae* (44 species, 11.14%), *Poaceae* (34 species, 8.60%), *Lamiaceae* (25 species, 6.32%) and *Liliaceae* (18 species, 4.55%). Literature indicates, *Asteraceae* species have higher proportion among species membered to the other families (Brandes, 1992). Pavlova and Tonkov (2005) emphasized *Asteraceae* has a wide range with its high species number in Central Europe and the remarkable success of this family in terms of dispersal and establishment. Davis (1965-2001) also mentioned that *Asteraceae* family represents large number of species in whole flora of Turkey too. The most found species containing genera were *Trifolium* (14 species 3.54%), *Ranunculus* (7 species 1.77%), *Geranium* (6 species 1.51%), *Medicago*, *Plantago* and *Euphorbia* (5 species 1.26%).

In this study, the determinations of life forms showed that the largest groups were therophytes (42.78%) and hemicryptophytes (30.38%) for native plants. The percentages of other life forms were as follows; phanerophytes (12.16%), geophytes (11.64%), chamaephytes (1.78%) and helophytes (1.26%). As it is known, therophytes and hemicryptophytes are widespread in the areas where Mediterranean climate is predominant (Akman and Keteno lu, 1987).

In the Kartal District, the most common phytogeographical elements were found as Medit. El. (48 species, 12.15%), Euro-Sib. El. (34 species 8.60%) and E. Medit. El. (14 species, 3.54%) for native plants. This can be attributed that the research area is mostly affected by Mediterranean climate. In addition, the northern side of Istanbul is partly affected by the oceanic climate and this situation can be the result of growing plant taxa belonged to Euro-Sib. El. in the Kartal District (Altay, 2004). Our study also showed that 10 taxa (2.53%) were cosmopolitan and 79 taxa (20.00%) were widespread. In the study area, 6 endemic taxa (1.52%) were observed.

The most common native plant species were *Sonchus asper* (L.) Hill subsp. *glaucescens* (Jordan) Ball *(Asteraceae)*, *Rapistrum rugosum* (L.) All. (*Brassicaceae*), *Chenopodium album* L. (*Chenopodiaceae*), *Lolium perenne* L., *Cynodon dactylon* (L.) Pers var. *dactylon* (*Poaceae*) and *Parietaria judaica* L. (*Urticaceae*). In these taxa, *Parietaria judaica* were distributed on walls.

In this study, we collected some archaeophyte and neophyte taxa, which were listed in Table 1. In our research area, 6 endemic (5 of them are endangered) and 2 rare species were collected. Endangered, medicinal and poisonous species were given in the Appendix 1-2. In this study, we collected 88 poisonous plant taxa. 71 of them were in the group of natural plants while 17 of them were in the group of exotic and cultivated plants (Appendix 1-2).

Although the specified poisonous plants in the Appendix 1-2 were mostly chosen from the species, which are poisonous for human, the following species; *Equisetum* (*Equisetaceae*), *Linum* (*Linaceae*), *Lotus* (*Fabaceae*), *Pteridium* (*Hypolepidaceae*) are mostly poisonous for animals. In addition, the following poisonous plants which written below are not poisonous when eaten less amount by human or animals, but they can be toxic depended on their high amounts. They are *Nerium oleander* (*Apocynaceae*); *Euphorbia* spp., *Mercurialis annua* (*Euphorbiaceae*); *Colchicum* spp. (*Liliaceae*); *Prunus* spp. (*Rosaceae*); *Datura stramonium*, *Solanum* spp. (*Solanaceae*); *Conium maculatum* (*Apiaceae*).

In this study, we collected 103 medicinal plant taxa. 90 of them were in the group of natural plants while 13 of them were in the group of exotic and cultivated plants (Appendix 1-2).

DISCUSSION

As all data showed above, the Kartal District has a great number of rich plant taxa today, although its fast development and unplanned urbanization in Istanbul. In Mediterranean ecosystems, the floristic diversity increases with temperature and water availability up to an optimum and thereafter it decreases, depending also on the geomorphology and the extent of the territory (Amanatidou, 2005). The more diversified the topography of a land, the

more niches are created and thus the more species can be hosted (Naveh and Whittaker, 1979; Houssard et al., 1980; Pignatti and Pignatti, 1999).

Especially, temperature (four-season climate), water availability (rain regime, many seasonal brooks and the Marmara Sea in south) and topography (from sea level to the Aydos Hill), seem to be also related with the high richness of the study area, along with the human influence that has created a variety of habitat types through the traditional land use practices (Altay, 2004; Amanatidou, 2005). Moreover, morphological and physiological adaptations of the plants, for instance to the climatic variation (seasonal, annual or periodical), the livestock preferences and the various stress factors resulted to high niche differentiation among the plant species and thus to a high floristic diversity in urban ecosystems (Altay, 2004; Amanatidou, 2005). Furthermore, wild-growing plant species, especially crop and garden weeds and spontaneously occurring ornamental plant species, which escaped from original cultivation areas and established themselves on other areas, contribute the richness of species (Zerbe et al., 2003).

Although the flora could be rich in urban habitats, the fast growing and urbanization can cause some problems to the survival of some species. In the Kartal District, while *Centaurea hermanni* F. Hermann (*Asteraceae*), *Lemna minor* L. (*Lemnaceae*), *Iris sintenisii* Janka (*Iridaceae*), *Cephalanthera longifolia* (L.) Fritsch., *Neotinea masculata* (Desf.) Steam, *Orchis papilionacea* L., *Orchis tridentate* Scop. subsp. *lactea* (Poir.) Rouy (*Orchidaceae*) were present in 1960s, unfortunately today, they cannot be seen in the District (Baytop, 1962). In addition, *Trifolium pachycalyx* Zoh. (*Fabaceae*), *Crocus pestalozzae* Boiss. (*Iridaceae*), *Colchicum micranthum* Boiss. (*Liliaceae*), *Verbascum bugulifolium* Lam. (*Scrophulariaceae*), *Sternbergia lutea* (L.) Ker - Gawl. ex Sprengel, *Galanthus gracilis* Celak. (*Amaryllidaceae*), *Typha latifolia* L. (*Typhaceae*) and *Olea europaea* (*Oleaceae*) are decreasing rapidly today, compared to the studies realized in 1960s (Baytop, 1962). However, alteration of the natural barrier-beach and water level regulation caused a dramatic decrease in wetland vegetation and wildlife diversity in the Kartal District too.

In the study area, we also observed an increase of non-native plants, ruderals, cultivated and annuals. With an increasing number of inhabitants, increasing trade and traffic causes the proportion of non-native species in the urban flora to increase (Pysek, 1998; Altay, 2009). The species, which are directly or indirectly imported to an area tough human activity, sometimes cover more frequently than native plants (Zerbe et al., 2003). The plants below are good samples for this situation; *Hyacinthus orientalis, Tulipa species* (*Liliaceae*), *Cydonia oblonga, Eriobotrya japonica, Prunus avium, Prunus cerasus, Prunus domestica, Prunus persica, Pyrus communis* (*Rosaceae*), *Acer campestre, Acer negundo, Acer platanoides, Acer pseudoplatanus* (*Aceraceae*), *Robinia pseudoacacia* (*Fabaceae*), *Ailanthus altissima* (*Simaroubaceae*), *Celtis australis* (*Ulmaceae*), *Platanus orientalis* (*Platanaceae*) and *Juglans regia* (*Juglandaceae*) in the Kartal District. Similar to these results, Kowarik (1992) gave the most successful non-native tree species, which occurred spontaneously in different habitats in Berlin, Germany. He mentioned that the most frequent non-native species on wasteland, built up areas, green spaces, forests and wetlands were *R. pseudoacacia* (*Fabaceae*), *A. negundo* (*Aceraceae*) and *Prunus serotina* (*Rosaceae*). Those trees had been introduced to the Europe from North America in the 18th and 19th centuries and had been taken from less than 50 to 180 years for them to spread over a wide range of areas and habitats within and outside the settlements (Kowarik, 1992; Zerbe et al., 2003).

Introduction and establishment of non-native plants can be risky for the natural habitats. For instance, *Ambrosia artemisiifolia*, which was introduced from North America and occurred on fields and wastelands in Europe, is known to be a threat to human health, and the pollen of this species causes not only widespread high fever, but also asthma and bronchitis (Zerbe et al., 2003). In Kartal, *Populus tremula* (*Salicaceae*), which is in native flora, caused the same side effects to the allergic people for many years. The Kartal District Municipality cut all the *P. tremula* in the inner side of the city and planted with *Platanus orient*alis, *Platanus acerifolia* (*Platanaceae*), *Robinia pseudoacacia (Fabaceae)* and *Catalpa bignonioides* (*Bignoniaceae*). Furthermore, plantation of limited variety of a non-native plant species could be harmful for the urban ecosystem. In the future, a plant disease for some of these species could destroy all the specimen or one of non- native species could substitute or suppress other species.

Like many other fast developing metropolitans, Istanbul and the Kartal District are under the threads of civilization. Sometimes for the sake of some yields, municipality or the government sign very big projects without thinking much the ecological results of them. The advantages and disadvantages of these big projects are always arguable. In Istanbul, the Ömerli Dam, Sabiha Gökcen Airport and Formula 1 Area (Istanbul Park) which are so close to the Kartal District have affected the flora and vegetation. Especially some endemic plants such as *Lathyrus undulatus*, *Trifolium pachycalyx* (*Fabaceae*), *Colchicum micranthum* (*Liliaceae*) and *Crocus pestalozzae* (*Iridaceae*) were decreased as the result of these projects.

In city planning studies, the main principle must be the conservation of the natural habitats. Today, in many cities, wrong plantation with exotic and non-native plants negatively changes the natural habitats. Furthermore, especially the people who migrate into big cities like Istanbul from rural areas of the country bring their old area's plants to the city and after plantation of those

plants, the flora becomes richer but the natural flora becomes affected negatively from those plants. The following plant taxa can be given as good samples of this situation; *Thuja orientalis*, *Chamaecyparis lawsoniana* (*Cupressaceae*), *Chamaerops excelsa* (*Arecaceae*), *Agave americana* (*Agavaceae*), *Kerria japonica* "Pleniflora" (*Rosaceae*), *Eucalyptus camaldulensis* (*Myrtaceae*), *Lantana camara* "Aulanche" (*Verbenaceae*), *Diospyros lotus* (*Ebenacea*e) and *Opuntia ficus-indica* (*Cactaceae*). Furthermore, in the inner sides of the city, temporary wastelands can provide spaces for a large number of species and communities such as *Phragmites australis* (*Poaceae*) and *Thypha latifolia* (*Thypaceae*).

For urban nature conservation, we should avoid uniformity when managing traditional land use structures and creating new open species. To avoid reduction in urban biodiversity on a global level, the use of seed material or plant species indigenous for the region for artificially created garden greenery in the city is recommended as far as possible. Today, with tissue culture systems, a high-level regeneration for many plant species can be obtained and from one branch of a tree, thousands of seedlings with the similar genetic characteristics can be produced in a year. Especially widest, rare or endemic plants can be multiplied by the tissue culture systems and those new plantlets can be used for conservation of the natural habitats in cities.

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Appendix 1

LIST OF NATURAL PLANTS

PTERIDOPHYTA

Equisetaceae

Equisetum ramosissimum Desf. (*), G, Widespread

Hypolepidaceae

Pteridium aquilinum (L.) Kuhn (*), G

Polypodiaceae

Polypodium vulgare L. subsp*. vulgare* (**), G

SPERMATOPHYTA

Gymnospermae

Pinaceae

Abies nordmanniana (Stev.) Spach subsp*. bornmuellerianaLepidium graminifolium* L. H (Mattf.) Coode *&* Cullen (**) Endemic (LR), Ph, Euxine El. *Cedrus libani* A Rich. Ph
Pinus sylvestris L. Ph, Euro-Sib. El.
P. pinea L. (**), Ph

Cupressaceae

Cupressus sempervirens L. (**), Ph
Juniperus oxycedrus L. subsp. *oxycedrus* (**), Ph, Widespread

Ephedraceae

Ephedra campylopoda C. A. Meyer (**), Ph

Angiospermae

Magnoliopsida / Dicotyledoneae

Ranunculaceae

Anemone coronaria L. (*), G, Medit. El.
Clematis vitalba L. Ph
Nigella damascena L. (**), Th
Ranunculus constantinopolitanus (DC.) d'Urv. (*), H, Widespread
R. ficaria L. subsp. *ficariiformis* Rovy & Fouc. (*), (**), G
R. ficaria L. subsp*. calthifolius* (Reichb.) Arc. (*), (**), G
R. marginatus d'Urv. var. *trachycarpus* (Fisch. & Mey.) Azn. (*), Th
R. marginatus d'Urv. var*. marginatus* (*), Th
R. muricatus L. (*), Th
R. paludosus Poiret (*), G

Papaveraceae

Chelidonium majus L. (*), H, Euro-Sib. El.
Fumaria officinalis L. (*), (**), Th
Glaucium flavum Crantz H, Widespread
Papaver dubium L. Th
P. rhoeas L. (**), Th, Widespread

Brassicaceae

Alyssum minus (L.) Rothm. var. *minus* Th, Widespread
Arabidopsis thaliana (L.) Heynhold Th
Calepina irregularis (Asso) Thellung Th
Capsella bursa- pastoris (L.) Medik. Th, Cosmopolitan
Cardaria draba (L.) Desv. subsp. *draba* H, Widespread
Cardemine hirsuta L. Th, Cosmopolitan
Diplotaxis tenuifolia (L.) DC. (*), H.
Erophila verna (L.) Chevall. Th
Neslia apiculata Fisch. Th, Widespread
Raphanus raphanistrum L. (**), Th
Rapistrum rugosum (L.) All. Th *Sinapis arvensis* L. Th, Widespread *Sisymbrium altissimum* L. Th, Widespread *Thlaspi perfoliatum* L. Th, Widespread

Resedaceae

Reseda lutea L. var*. lutea* Th, Widespread

Cistaceae

Cistus creticus L. (**), Ph, Medit. El.
C. salviifolius L. Ph

Violaceae

Viola kitaibeliana Roem. & Schult H
V. sieheana Becker Th

Polygalaceae

Polygala vulgaris L. (**), H, Euro-Sib. El.

Portulacaceae

Portulaca oleracea L. Th

Illecebraceae

Scleranthus perennis L. H

Caryophyllaceae

Cerastium glomeratum Thuill. Th., Cosmopolitan
C. *gracile* Duf. Th
Dianthus leptopetalus Willd. H.
Moenchia mantica (L.) Bartl. subsp. *mantica* Th.
Petrorhagia prolifera (L.) Ball. & Heywood Th.
Sagina maritima Don Th.
Silene vulgaris (Moench) Garcke var. *vulgaris* (**), H.
S. nocturna L. Th, Medit. El.
S. dichotoma Ehrh. Th.
Spergularia bocconii (Scheele) Aschers. & Graebn. Th, Medit. El.
Stellaria holostea L. H, Euro-Sib. El.
S. media (L.) Vill. subsp*. media* (**), Th.
S. media (L.) Vill. subsp*. pallida* (Dumort.) Aschers. & Graebn. (**), Th.
Telephium imperati L. subsp. *orientale* (Boiss.) Nyman H.

Polygonaceae

Polygonum arenastrum Bor. Th.
P. aviculare L. Th., Cosmopolitan
P. lapathifolium L. Th.
Rumex acetosella L. (**), H., Cosmopolitan
R. conglomeratus Murray H.
R. crispus L. (**), H
R. pulcher L. H.

Chenopodiaceae

Atriplex hastate L. Th.
Chenopodium album L. subsp. *album* var. *album* Th.
C. botrys L. Th.
Salsola ruthenica L. Th.

Amaranthaceae

Amaranthus albus L. Th.
A. blitoides S. Wats. Th
A. deflexus L. H.
A. retroflexus L. Th.

Hypericaceae

Hypericum bithynicum Boiss. (*), H, Euxine El.
H. cerastoides (Spach) Robson (*), Ch.
H. calycinum L. (*), Ch.
H. perforatum L. (*), (**), H.

Malvaceae

Alcea pallida Waldst. & Kit. H.
Lavatera punctata All. Th.
Malva neglecta Wallr. Th.
M. nicaeensis All. Th.
M. sylvestris L. (**), H.

Tiliaceae

Tilia argentea Desf. ex DC. (**), Ph.

Linaceae

Linum bienne Miller (*), Th., Medit. El.
L. trigynum L. (*), Th., Medit. El.

Geraniaceae

Erodium cicutarium (L.) L'Hérit subsp. *cicutarium* Th.
E. malacoides (L.) L'Herit. Th., Medit. El.
Geranium dissectum L. Th.
G. molle L. subsp. *molle* Th.
G. purpureum Vill. Th.
G. pusillum Burm. fil. Th.
G. robertianum L. Th.
G. rotundifolium L. Th.

Oxalidaceae

Oxalis corniculata L. Th., Cosmopolitan

Zygophyllaceae

Tribulus terrestris L. (*), (**), Th.

Rutaceae

Ruta montana (L.) L. (*), H

Simaroubaceae

Ailanthus altissima (Miller) Swingle (*), H.

Rhamnaceae

Paliurus spina- christi Miller (**), Ph.

Anacardiaceae

Pistacia terebinthus L. subsp. *terebinthus* (**), Ph.

Fabaceae

Calicotome villosa (Poiret) Link Ph, Medit. El.
Cercis siliquastrum L. var. *siliquastrum* Ph
Genista tinctoria L. (*), (**), Ch, Euro-Sib. El.
Gleditsia triacanthos L. Ph.
Dorycnium pentaphyllum Scop. subsp. *herbaceum* (Vill.) Rouy H
Hippocrepis unisiliquosa L. Th.
Lathyrus digitatus (Bieb.) Fiori H, E. Medit. El.
L. undulatus Boiss. Endemic (VU), H.
Lotus corniculatus L. var. *corniculatus* (*), H., Widespread *L. ornithopodioides* L. (*), Th., Medit. El.
Lupinus angustifolius L. subsp. *angustifolius* (*), Th. *Medicago lupulina* L. Th., Widespread
M. minima (L.) Bart. var. *minima* Th, Widespread
M. orbicularis (L.) Bart. Th.
M. polymorpha L. var. *vulgaris* (Benth.) Shinners Th., Widespread
M. *sativa* L. H.
Melilotus alba Desr. (*), Th., Widespread
M. officinalis (L.) Desr. (*), Th., Widespread
Onobrychis caput – galli (L.) Lam. Th., Widespread, Medit. El.
O. oxydonta Boiss. H., Widespread
Ononis spinosa L. H., Widespread
O. viscosa L. subsp. *breviflora* (DC.) Nyman Th.
Ornithopus compressus L. Th., Medit. El.
Robinia pseudacacia L. (*), (**), Ph.
Psoralea bituminosa L. H, Medit. El.
Scorpiurus muricatus L. Th.
Spartium junceum L. (*), (**), Ph., Medit. El.
Trifolium angustifolium L. var. *angustifolium* Th.
T. campestre Schreb. Th., Widespread
T. constantinopolitanum Ser. Th., Widespread
T. glomeratum L. Th.
T. *nigrescens* Viv. subsp. *petrisavii* (Clem.) Holmboe Th., Widespread
T. *pachycalyx* Zoh. Endemic (DD), Th.
T. pratense L. H.
T. repens L. var. *repens* H.
T. *resupinatum* L. var. *resupinatum* Th.
T. tomentosum L. Th.
T. uniflorum L. G
T. scabrum L. Th., Widespread
T. stellatum L. var. *stellatum* Th.
T. subterraneum L. Th.
Vicia cracca L. subsp. *cracca* H., Euro-Sib. El.
V. hybrida L. Th., Widespread
V. sativa L. Th.

Rosaceae

Agrimonia eupatoria L. G., Widespread
Crataegus monogyna Jacq. subsp. *monogyna* (**), Ph.
Potentilla inclinata Vill. H.
P. reptans L. H., Widespread
Rosa canina L. (**), Ph.
Rubus canescens DC. var. *canescens* Ph, Widespread
Sanguisorba minor Scop. H.
Sarcopoterium spinosum (L.) Spach (**), Ph., E. Medit. El.

Lythraceae

Lythrum salicaria L. H., Widespread, Euro-Sib. El.

Onagraceae

Epilobium angustifolium L. H., Widespread

Cucurbitaceae

Ecballium elaterium (L.) A. Rich. (*), (**), H., Medit. El.

Crassulaceae

Sedum hispanicum L. Ch.
Umbilicus rupestris (Salisb.) Dandy Ch.

Apiaceae

Ammi visnaga (L.) Lam. (**), Th.
Berula erecta (Huds.) Coville H.
Conium maculatum L. (*), Th.
Daucus guttatus Sm. Th.
Eryngium campestre L. var. *virens* Link (**), H., Widespread
Ferulago confusa Velen. H., Euro-Sib. El.
Foeniculum vulgare Miller (**), H.
Scandix pecten-veneris L. Th., Widespread
Tordylium apulum L. Th., Medit. El.
Torilis nodosa (L.) Gaertner Th.

Araliaceae

Hedera helix L. (*), (**), Ph

Cornaceae

Cornus mas L. (**), Ph

Caprifoliaceae

Lonicera etrusca Santi var. *etrusca* Ph., Medit. El.
Sambucus ebulus L. (**), H., Euro-Sib. El.

Valerianaceae

Centranthus ruber (L.) DC. (**), G

Dipsacaceae

Scabiosa columbaria L. subsp. *columbaria* var. *columbaria* H.
S.columbaria L. subsp. *ochroleuca* (L.) Celak. var. *ochroleuca* (L.) Coulter H.

Asteraceae

Achillea millefolium L. (**), H.
Anthemis cf. c*hia* L. Th.
A. cretica L. H.
A. tinctoria L. var*. tinctoria* H., Widespread
Bellis perennis L. H., Euro-Sib. El.
Calendula arvensis L. Th.
Cardopatium corymbosum (L.) Pers. H., E. Medit. El.
Carduus nutans L. H.
Carlina corymbosa L. H., Medit. El. *Carthamus lanatus* L. (**), Th., Widespread *Centaurea diffusa* Lam. Th., Widespread, Medit. El. *C. iberica* Trev. ex Sprengel Th., Widespread
C. solstitialis L. subsp*. solstitialis* Th., Widespread
C. virgata Lam. H.
Cichorium intybus L. (**), H., Widespread
Cirsium creticum (Lam.) d'Urv. subsp. *creticum* H., E. Medit. El.
C. cf. *lappaceum* (Bieb.) Fischer H.
C. polycephalum DC. Endemic (CR), H.
Cnicus benedictus L. var*. benedictus* Th.
Conyza canadensis (L.) Cronguist Th.
Crepis foetida L. Th.
C. sancta (L.) Babcock Th., Widespread
C. zacintha (L.) Babcock Th., Medit. El.
Crupina crupinastrum (Moris) Vis. Th., Widespread
Doronicum orientale L. G.
Echinops microcephalus Sm. H., Medit. El.
E. ritro L. H.
Erigeron acer L. H.
Filago vulgaris Lam. Th.
Helminthotheca echioides (L.) Holub Th.
Hypochoeris glabra L. Th.
Inula oculus – christi L. (*), G.
I. viscosa (L.) Aiton (*), (**), H., Medit. El.
Lactuca saligna L. (*), Th.
Lapsana communis L. Th.
Leontodon tuberosus L. G., Medit. El.
Matricaria chamomilla L. (**), Th.
Pallenis spinosa (L.) Cass. Th.
Picnomon acarna (L.) Cass. Th., Widespread, Medit. El.
Scariola viminea (L.) F. W. Schmiat H., Widespread
Scolymus hispanicus L. (**), H., Medit. El.
Sonchus asper (L.) Hill subsp. *glaucescens* (Jordan) Ball Th, Widespread
Senecio vulgaris L. (*), (**), Th.
Silybum marianum (L.) Gaertner (**), H., Medit. El.
Taraxacum officinale Weber (**), Ch.
Tragopogon longirostris Bisch. ex. Schultz H.
Tussilago farfara L. (**), G., Widespread, Euro-Sib. El.
Urospermum picroides (L.) F.W. Schmidt Th., Medit. El.
Xanthium spinosum L. (**), Th.
X. strumarium L. subsp. *cavanillesii* (Scouw) D. Löve & P. Dansereau (**), Th

Ericaceae

Arbutus unedo L. (**), Ph.
Erica arborea L. Ph.
E. manupuliflora Salisb. Ph.

Primulaceae

Anagallis arvensis L. var. *arvensis* (*), Th.
A. arvensis L. var. *caerulea* (L.) Gouan (*), Th.
Primula vulgaris Huds. subsp. *sibthorpi* (Hoffmanns.) W. W. Sm. & Forrest (*), H., Euro-Sib. El.

Oleaceae

Jasminum fruticans L. (**), Ph., Medit.El.
Ligustrum vulgare L. (*), Ph., Euro-Sib. El.
Olea europaea L. var. *europaea* (**), Ph.
Phillyrea latifolia L. Ph., Medit. El.

Apocynaceae

Nerium oleander L. (*), (**), Ph., Medit. El.

Asclepiadaceae

Cionura erecta (L.) Griseb. (*), Th., Widespread, E. Medit. El.

Convolvulaceae

Calystegia sepium (L.) R. Br. G.
Convolvulus arvensis L. (**), H.
C. cantabrica L. H.

Boraginaceae

Anchusa azurea Miller H.

Borago officinalis L. (**), Th.
Echium italicum L. (*), H.
E. plantagineum L. (*), Th.
E. vulgare L. (*), H.
Heliotropium europaeum L. (*), Th.
Myosotis ramosissima Rochel ex Schultes Th.
Onosma cf. aucheranum DC. H., E. Medit. El.
Trachystemon orientalis (L.) G. Don (**), G., Euxine El.

SOLANACEAE

Datura stramonium L. (*), (**), Th, Cosmoplitan
Solanum dulcamara L. (*), (**), H, Widespread, Euro-Sib. El.
S. nigrum L. subsp. *nigrum* (*), (**), Th, Cosmopolitan

Gentianaceae

Blackstonia perfoliata (L.) Hudson Th.
Centaurium erythraea Rafn. H.

Scrophulariaceae

Antirrhinum majus L. subsp. *majus* H.
Cymbalaria muralis Gaertner Rare (VU), Th.
Kickxia commutata (Bernh. ex Reichb.) Fritsch Th.
Linaria genistifolia (L.) Miller H.
Parentucellia latifolia (L.) Caruel subsp. *latifolia* Th.
Verbascum bugulifolium Lam. H., Euro-Sib. El.
Veronica cymbalaria Bodard Th., Medit. El.
V. hederifolia L. Th., Widespread
V. persica Poiret Th.
V. polita Fries Th., Widespread

Lamiaceae

Ajuga chamaepitys (L.) Schreber Th.
Ballota nigra L. subsp. *anatolica* P. H. Davis Endemic (LR), H., Ir.-Tur. El.
Calamintha nepeta (L.) Savi H.
Lamium amplexicaule L. Th., Widespread, Euro-Sib. El.
L. purpureum L. Th., Euro-Sib. El.
Lavandula stoechas L. subsp. *stoechas* (**), Ph., Medit. El.
Lycopus europaeus L. H.
Marrubium vulgare L. H.
Mentha longifolia (L.) Hudson subsp. *typhoides* (Brig.) Harley var. *typhoides* H, Widespread
M. pulegium L. (**), H.
Origanum vulgare L. (**), H.
Prunella laciniata (L.) L. H., Euro-Sib. El.
P. vulgaris L. H., Widespread, Euro-Sib. El.
Rosmarinus officinalis L. Ph., Medit. El.
Salvia frigida Boiss. H., Ir.-Tur. El.
S. forskahlei L. H., Euxine El.
S. verbenaca L. Ch.
Scutellaria albida L. subsp. *albida* H, Medit. El.
Sideritis montana L. Th., Widespread, Medit. El.
Stachys arvensis (L.) L. Th.
S. byzantina C. Koch H., Euro-Sib. El.
S. officinalis (L.) Trevisan subsp. *balkanica* H
Teucrium chamaedrys L. (**), G.
T. polium L. H., Widespread
Thymus longicaulis C. Presl subsp. *longicaulis* var. *longicaulis* (**), Ch.

Plantaginaceae

Plantago coronopus L. Th., Euro-Sib. El.
P. lagopus L. Th., Medit. El.
P. lanceolata L. (**), H.
P. major L. subsp. *intermedia* (Gilib.) Lange (**), H., Widespread
P. scabra Moench Th., Widespread

Elaeagnaceae

Elaeagnus angustifolia L. (**), Ph, Widespread

Lauraceae

Laurus nobilis L. (**), Ph, Medit. El.

Santalaceae

Osyris alba L. H, Medit. El.

Aristolochiaceae

Aristolochia clematitis L. (**), G, Euro-Sib. El.

Euphorbiaceae

Chrozophora tinctoria (L.) Rafin. Th, Widespread
Euphorbia exiqua L. (*), Th.
E. helioscopia L. (*), (**), Th.
E. peplus L. var. *peplus* (*), Th.
E. peplus L. var. *minima* DC. (*), Th.
E. segueriana Necker subsp. *niciciana* (Borbas ex Novak) Rech. fil. (*), H.
Mercurialis annua L. (*), Th.

Urticaceae

Parietaria judaica L. (**), H, Widespread
Urtica pilulifera L. (*), Th, Medit. El.

Ulmaceae

Celtis australis L. (**), Ph, Medit. El.

Platanaceae

Platanus orientalis L. (**), Ph, Widespread

Fagaceae

Quercus cerris L. var*. cerris* (*), Ph
Q. coccifera L. (*), (**), Ph, Medit. El.
Q. pubescens Willd. (*), Ph
Q. robur L. subsp. *robur* (*), (**), Ph, Euro-Sib. El.

Corylaceae

Carpinus orientalis Miller subsp. *orientalis* Ph, Euro-Sib. El.

Salicaceae

Populus alba L. Ph., Euro-Sib. El.
P. tremula L. (**), Ph., Widespread, Euro-Sib. El.
Salix alba L. (**), Ph., Widespread, Euro-Sib. El.
S. babylonica L. Ph.

Rubiaceae

Cruciata taurica (Palas ex Willd.) Ehrend H., Widespread
Galium aparine L. Th.
Rubia tinctorum L. (**), H., Widespread, Ir.-Tur. El.
Sherardia arvensis L. Th.

Liliopsida / Monocotyledoneae

Liliaceae

Asparagus acutifolius L. (**), H., Medit. El.
Allium neapolitanum Cyr. G., Medit. El.
A. paniculatum L. subsp. *paniculatum* G., Medit. El.
A. scorodoprasum L. subsp. *rotundum* (L.) Stearn G, Widespread, Medit. El.
Asphodelus aestivus Brot. (**), G., Medit. El.
A. fistulosus L. G., Medit. El.
Colchicum lingulanthum Boiss. & Spruner ex Boiss. (*), G, E. Medit. El.
C. micranthum Boiss. (*), Endemic (EN), G.
Gagea bohemica (Zauschn) Schultes & Schultes fil. G.
Muscari comosum (L.) Miller G., Widespread *M. neglectum* Guss. G., Widespread
Ruscus aculeatus L. var. *angustifolius* Boiss. (*), (**), H
Ornithogalum fimbriatum Willd. (*), G., E. Medit. El.
O. sigmoideum Freyn & Sint. (*), G., Euro-Sib. El.
O. pyrenaicum L. (*), G.
O. umbellatum L. (**), G.
Scilla autumnalis L. G., Medit. El.
Smilax excelsa L. (**), H.

Amaryllidaceae

Galanthus gracilis Celak (*), G, E. Medit. El.
Sternbergia lutea (L.) Ker-Gawl. ex Sprengel (*), G, Widespread

Iridaceae

Crocus biflorus Miller G
C. pestalozzae Boiss. Endemic (VU), G, E. Medit. El.
Iris germanica L. G
I. suaveolens Boiss. & Reuter G, E. Medit. El.
Romulea columnae Seb. & Mauri subsp. *columnae* G, Medit. El.
R. linaresii Parl. subsp. *graeca* Bég. G, E. Medit. El.

Orchidaceae

Orchis mascula (L.) L. subsp. *pinetorum* (Boiss. &Kotschy) G. Camus G, Widespread, E. Medit. El.
Serapias vomeracea (Burnm.fil.) Brig . subsp*. orientalis* Greuter G, E. Medit. El.

Dioscoreaceae

Tamus communis L. (*), (**), H

Typhaceae

Typha domingensis Pers. He, Widespread
T. latifolia L. He

Juncaceae

Juncus conglomeratus L. He
J. heldreichianus Marsson ex Parl. He
Luzula multiflora (Ehrh. ex Retz.) Lej. H., Widespread, Euro-Sib. El.

Cyperaceae

Carex flacca Schreber G

Poaceae

Agrostis capillaris L. var. *capillaris* H
A. stolonifera L. H, Widespread, Euro-Sib. El.

Aira caryophyllea L. Th, Euro-Sib. El.
Alopecurus myosuroides Hudson Th
Anthoxanthum odoratum L. H
Avena barbata Pott ex Link Th
A. sterilis L. subsp. *sterilis* Th
A. wiestii Steudel Th
Bothriochloa ischaemum (L.) Keng H
Briza maxima L. Th
Bromus hordeaceus L. Th
B. madritensis L. Th
B. sterilis L. Th, Widespread
Catapodium rigidum (L.) C. E. Hubbard ex Dony Th
Chrysopogon gryllus (L.) Trin. subsp. *gryllus* H, Widespread
Cynodon dactylon (L.) Pers var*. dactylon* (**), H *Cynosurus cristatus* L. H, Euro-Sib. El.
C. echinatus L. Th, Medit. El.
Dactylis glomerata L. subsp. *hispanica* (Roth) Nyman H
Dasypyrum villosum (L.) Cand. Th, Medit. El.
Digitaria sanguinalis (L.) Scop. Th
Echinochloa crus – galli (L.) P. Beauv. Th
Holcus lanatus L. H, Euro-Sib. El.
Hordeum bulbosum L. G, Widespread
H. murinum L. subsp. *leporinum* (Link) Arc. var. *leporinum* Th
Lolium perenne L. H, Euro-Sib. El.
Melica ciliata L. subsp*. ciliata* G, Widespread
Paspalum paspalodes (Michx.) Scribner G
Phalaris paradoxa L. H
Phragmites australis (Cav.) Trin. ex Steudel (**), He, Widespread, Euro-Sib. El.
Poa annua L. Th, Cosmoplitan
P. bulbosa L. G
Setaria verticillata (L.) P. Beauv. Th
S. viridis (L.) P. Beauv. Th, Widespread

Appendix 2

LIST OF EXOTIC AND CULTIVATED PLANTS

Taxaceae

Taxus baccata L. (*)

Pinaceae

Cedrus libani A. Richard
Picea orientalis (L.) Link
Pinus pinaster Ait
P. pinea L.
P. sylvestris L.

Cupressaceae

Chamaecyparis lawsoniana (Murr.) Parl.
Cupressus arizonica Grene. *Juniperus horizontalis* (Pers.) Moench *Thuja occidentalis* L. var. *globosa* Gord. *Thuja orientalis* L.

Arecaceae

Chamaerops excelsa Thunb.
Phoenix canariensis Chabaud.

Liliaceae

Hyacinthus orientalis L. (*)
Tulipa species L.

Iridaceae

Iris germanica L.

Agavaceae

Agave americana L.
A. americana L. "Marginata"
Yucca flamentosa L.

Amaryllidaceae

*Narcissus "*Dutch Master*"*

Moraceae

Ficus carica L. (**)
Maclura pomifera (Rafin) Schneider
Morus alba L. Pendula*'*

Berberidaceae

Berberis thunbergii (Koch) DC. var. *atropurpurea* Chenault

Magnoliaceae

Magnolia grandiflora L.

Saxifragaceae

Hydrangea macrophylla (Thunb.) Ser. (*)
Philadelphus coronarius L.

Rosaceae

Chaenomeles japonica (Thunb.) Spack
Cotoneaster franchetii Boiss.
Cydonia oblonga Miller
Eriobotrya japonica (Thunb.) Lindl. (**)
Fragaria vesca L. (**)
Kerria japonica (L.) DC.
"Pleniflora" *Prunus avium* L**.** (*)
P. cerasus L. (*), (**)
P. domestica L. (*), (**)
P. laurocerasus (Roem.) L. (*),
(**) *P. persica* Batsch (*), (**)
Pyracantha coccinea Roemer
Pyrus communis L.
Rosa damascena Miller (**) *R. multiflora* Thunb. and in.
Spiraea x vanhouttei (Briot) Zab.

Fabaceae

Acacia dealbata Link
Albizzia julibrissin (Willd.) Durazz. Rare (VU)
Caesalpinia gilliesii Wall. (*)
Robinia hispida L.
Robinia pseudoacacia L.*"*Umbraculifera"
Sophora japonica L. var. *pendula* Loud.
Wisteria sinensis (Sims.) DC. (*)

Geraniaceae

Pelargonium zonale L.

Oxalidaceae

Oxalis floribunda L.

Buxaceae

Buxus sempervirens L. (*)

Celastraceae

Euonymus japonicus L. var. *aureo-variegatus* Regel

Aceraceae

Acer campestre L.
A. negundo L.
A. platanoides L.
A. pseudoplatanus L.

Hippocastanaceae

Aesculus x carnea Briottii
A. hippocastaneum L. (*), (**)

Tiliaceae

Tilia tomentosa (DC.) Moench

Malvaceae

Hibiscus syriacus L.

Tamaricaceae

Tamarix tetrandra Pallas

Violaceae

Viola x wittrockiana Gams.

Lythraceae

Lagerstromia indica L.

Punicaceae

Punica granatum L. (**)

Myrtaceae

Eucalyptus camaldulensis Dehnh.

Araliaceae

Fatsia japonica (Thunb.) Decne. & Planch

Primulaceae

Primula vulgaris Huds.

Oleaceae

Forsythia x intermedia Zabel
Fraxinus excelsior L. (**)
Syringa vulgaris L.

Apocynaceae

Vinca major L. (*)

Verbenaceae

Lantana camara L. “Aulanche” (*)
Vitex agnus-castus L.

Bignoniaceae

Catalpa bignonioides Walt.
Campsis radicans (L.) Seem.

Caprifoliaceae

Lonicera japonica Thunb.
Viburnum opulus L. “Sterile”
V. tinus L.

Asteraceae

Bellis perennis L. “Pompenette Red”
Calendula officinalis L.
Chrysanthemum maximum Ramond.
Senecio cineraria DC.

Meliaceae

Melia azaderach L. (*)

Nyctaginaceae

Mirabilis jalaba L. (*)

Aizoaceae

Carpobrotus acinaciformis Folia

Cactaceae

Opuntia ficus-indica Mill.

Passifloraceae

Passiflora coerulea L.

Sapindaceae

Koelreuteria paniculata Laxm.

Vitaceae

Parthenocissus quinquefolia (L.) Planch. (*)
Vitis vinifera L. (**)

Ebenaceae

Diospyros lotus L.

Buddleiaceae

Buddleia davidii Franch.

Pittosporaceae

Pittosporum tobira Ait.

Brassicaceae

Brassica oleracea L. var. *acephala* DC.

Convolvulaceae

Ipomea tricolor Cav.

Juglandaceae

Juglans regia L. (**)

* Poisonous plant, ** Medicinal plant, LR; Lower risk, CR; critically endangered, VU; vulnerable, DD; data deficient (The LR, CR, VU and DD values are written according to IUCN). (Baytop, 1984; Seçmen and Leblebici, 1987; Baytop, 1989; Ekim et al., 2000; Baytop and Kadıo lu, 2002).