Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Maejo International Journal of Science and Technology

ISSN 1905-7873

Available online at www.mijst.mju.ac.th

Full Paper

Urban vascular flora and ecological characteristics of Kadıköy district, Istanbul, Turkey

Etem Osma[1], İbrahim İ. Özyiğit[1,*], Volkan Altay[2] and Memduh Serin[1]

[1] Department of Biology, Science and Arts Faculty, Marmara University, 34722, Göztepe, Kadıköy, Istanbul, Turkey

[2] Department of Biology, Science and Arts Faculty, Mustafa Kemal University, 31040, Hatay, Turkey

[*]Corresponding author, e-mail: ilkozyigit@marmara.edu.tr ; phone: +90 216 346 45 33; fax: +90 0 216 347 87 83

Received: 28 October 2009 / Accepted: 11 January 2010 / Published: 10 March 2010

Abstract: Cities are usually considered unnatural places lacking ecological benefits. Many ecological studies have been done in suburban or rural areas and have excluded the city. However, urban ecology has become increasingly important. Today, it is well known that rapid and uncontrolled urbanisation accompanied by insufficient infrastructure has resulted in the degradation of many forests and grasslands in metropolitan areas. Land use changes due to urbanisation during the second half of the 20th century have caused widespread decline of biodiversity of many animal and plant taxa, especially in densely populated regions such as Kadıköy district, Istanbul, Turkey. In this study, different kinds of urban habitats within the boundaries of Kadıköy are described. Plant samples were collected, dried, labelled and identified according to standard herbarium procedures and all the greenery in the district was explored during vegetation seasons. A total of 561 vascular plant taxa were determined, wherein 412 (337 species, 44 subspecies and 31 varieties) were native and 149 (143 species and 6 varieties) were exotic and cultivated. The major native taxa were Asteraceae (46 species) while Rosaceae had the most exotics (22 species). Archaeophytes and neophytes, endemics, rare, endangered, medicinal, and poisonous species are also reported. In addition, the requirements of making ecological studies in other urban areas are mentioned.

Keywords: urban flora, urban habitats, urban ecology, Kadıköy, Istanbul

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Introduction

Over the last 50 years, the world has witnessed a dramatic growth in urban populations and today approximately 50% of the world's people live in urban areas. A recent United Nation's report notes that the present world urban population of 3 billion is expected to reach 5 billion by 2030. Although the rate of urbanisation is declining in many regions of the world, most cities, metropolitan regions and urban areas continue to grow. Monitoring these developments and creating sustainable urban environments remain as crucial issues on the international development agenda [1].

Cities are the most important naturally and/or anthropogenically influenced ecosystems in which millions of people live [2-3]. Natural disturbances include storms, floods, drought, and diseases. Anthropogenic disturbances include ploughing, mowing, burning, grazing and soil compaction by livestock [2]. In addition, the construction and use of tracks, roads, canals, railways and airports have involved many direct and indirect changes on ecosystems [2, 4]. Because of these anthropogenic activities, plant and animal species are estimated to go extinct worldwide at a rate of 0.5% per year, mainly due to habitat loss and fragmentation [5-6]. Land use changes due to urbanisation and agricultural intensification have caused widespread decline of biodiversity for many organisms such as butterflies, birds and plants in populated regions of Western Europe during the second half of the 20th century [6-9].

The improvement of the natural environment is a challenge for cities with adverse natural conditions. Flora and vegetation are very important components of urban ecosystems. The urban flora consists of plants that naturally grow there [3, 10]. This also reflects different historical phases of urban development and land use. Species occur which are directly linked to the economic and cultural life of cities. In addition, the value of the flora and vegetation for nature conservation, urban recreation, and nature enjoyment in the city is enhanced [11].

Istanbul, which is located in the north-west part of Turkey, is one of the biggest metropolitan areas of the world. It has an area of around 5,750 km^2, a population of 11,008,790 (2007), and is Turkey's cultural and financial centre [12-14]. The city provides around 40 % of the country's tax revenue and is home to around 38% of the country's industrial companies and around 55% of the country's commercial companies [12]. The city has experienced more pressure from high increase in population, mostly from eastern Turkey, and rapid increase in urban areas with consequent decrease in green areas [15]. In Istanbul, 99% of the population live in the city centre or in suburban zones [14]. This rapid, uncontrolled and illegal urbanisation has caused degradation of forest and open land in the city, especially during the last two decades [15].

In this study, the urban flora and ecological characteristics of Kadıköy district, which is an old settlement on the Anatolian side of Istanbul, is presented. In addition, native, exotic, and cultivated plants are mentioned. Endemic, rare, and endangered plant species and their habitats are listed in the appendix. The negative effects of unplanned urbanisation and industrialisation which were made without ecological consideration are also pointed out.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

General Information

Location: Kadıköy district is located on the Asian (Anatolia) side of Istanbul (N 40° 59' 08" , E 29° 01' 45") on the north coast of the Marmara Sea. The district covers 34 km^2 and has the typical physical characteristics of coastal cities in the region (Figure 1). Neighbouring districts are Üsküdar and Ümraniye to the north, Maltepe to the south-east, and Bostancı to the east. The coast extends through the Bosphorus Strait, which extends to Europe and Asia. Thus, Kadıköy has the most important ecological aspects compared to any other district in Istanbul [16].

Figure 1. Satellite view of Istanbul (upper left corner) and Kadıköy district. The study area is circled. (This picture was prepared by using The Google Earth Programme.)

History: The establishment date of Kadıköy (Chalcedon) is accepted as 675 BC and it was the first settlement which the Greeks from Megara established on the Bosphorus. Byzantium was later established on the other side of the strait in 667 BC (Figure 2). In its history, Chalcedon had changed hands many times as Persians, Bithynians, Romans, Byzantines, Arabs, Crusaders and Turks passed through the area, and was finally under the Ottomans in 1353. In 1453, Istanbul was conquered by Fatih Sultan Mehmet and Kadıköy was given to Hıdır Bey, who was the first Otoman judge (Kadı) for the Sultan of Istanbul. The name Kadıköy, which means "village of the judges", comes from Kadı Hıdır Bey. After that, Kadıköy became a popular market for many goods and in time, developed into a residential area for people commuting to the city [16].

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

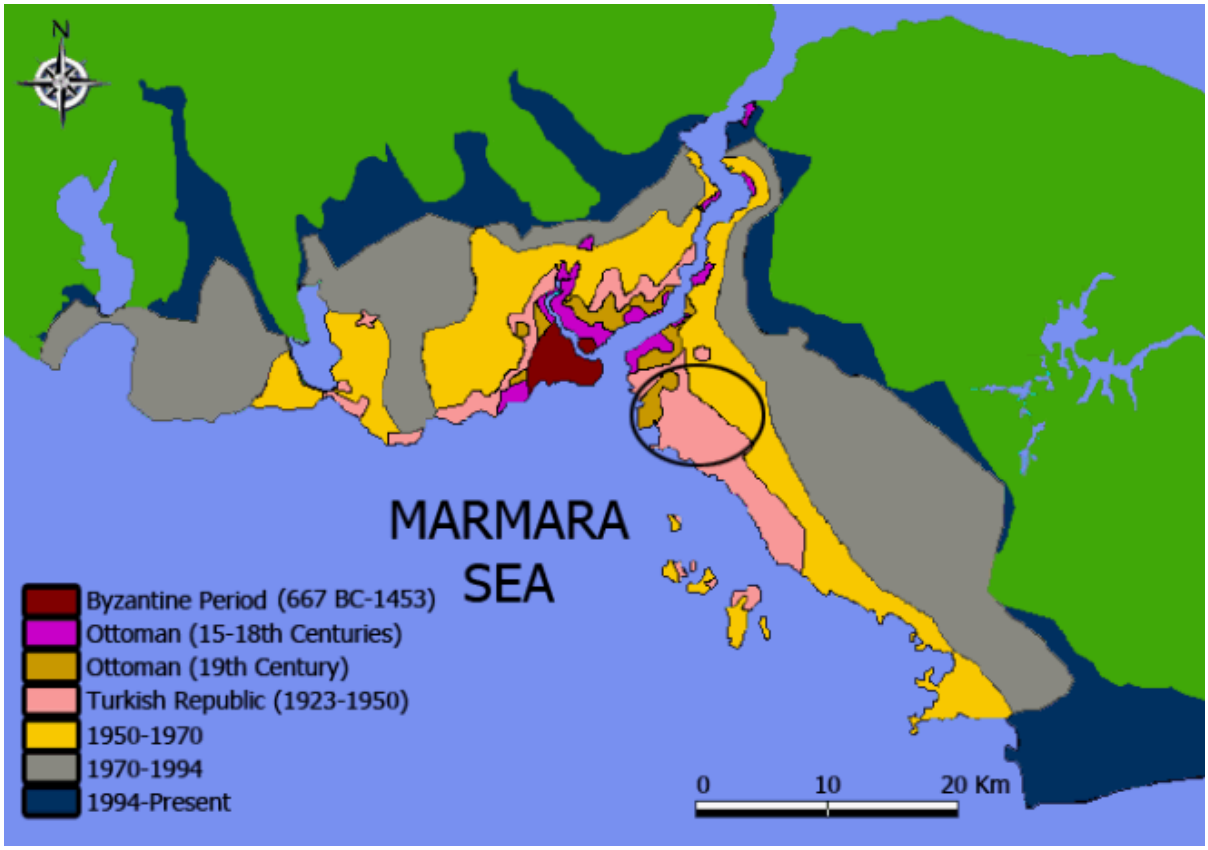

Figure 2. The historical growth of Istanbul (modified from Karakuyu [13])**.** The study area is circled.

Population: The population of Kadıköy has increased rapidly in the last 35 years. While the population was 57,901 in 1940, it reached 241,593 in 1970 and 744,670 in 2007 [14, 16].

Topography: The topography of Kadıköy is similar to those of many other coastal districts on the Anatolian side of Istanbul. It has an elevation range of 1-600 m above sea level. Kadıköy District, which has lower elevation on the shore of the Marmara Sea, is also the west end of the Kocaeli Plateau where it is bounded by the Bosphorus Strait [16-17]. There are also seven hills in Kadıköy, namely (from west to east) Kayışdağı (partially), Göztepe, Fikirtepe, Acıbadem, Altıyol, Cevizlik and Koşuyolu. The ground between these hills is slightly slanted. The coastal areas between Kadıköy and Bostancı are flat. Kurbağalıdere is the only stream, which has its source in Kayışdağı and flows into the Marmara Sea [16].

Climate: Kadıköy has a slightly cooler Mediterranean climate, which is associated with the climate of the Black Sea [17-18]. January and February are the coldest months while July and August are the warmest. Annual precipitation is about 690.7 mm, most occurring in winter. In the summer, low precipitation and high temperatures prevail with an annual mean temperature of 14.5^{o}C for the past two decades. Between May and September, the temperature is generally above 30^{o}C and between November and April it is rarely below 0^{o}C. In the growing period, the daily mean temperature is 8^{o}C with about 280 days (between 15 March-20 December). The relative humidity is about 75% and this value decreases to 65% in summer despite of the effect of the sea. Information about the climate of the study area was derived from the meteorological station at Göztepe-Kadıköy [18-19].

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Urban habitats: In the study area, vascular plants were found in parks, gardens, meadows, forests, refuges, civic squares, abandoned land and cemeteries.

Materials and Methods

Collection of the flora was conducted from March to July during 2002-2008. Each year the grasslands, rocky sites, shrub lands and forests were inventoried between March and July. The identification of plant specimens was made by using Davis [20]. The collected plant samples were deposited in MÜFE Herbarium (Faculty of Science and Arts Herbarium, Marmara University). The flora is listed in Appendix 1 (Native plant list) and Appendix 2 (Exotic and cultivated plant list). The family order is according to Davis. The genera and species are arranged alphabetically. Life forms [phanerophytes (Ph), chamaephytes (Ch), hemicryptophytes (H), therophytes (Th), geophytes (G), helophytes (He)] and phytogeographical origins [Euro-Siberian (Euro.-Sib), Irano-Turanian (Ir.-Tur.), Mediterranean (Medit.), East Mediterranean (E. Medit.)] are noted with the scientific names of collected species and they were determined according to Raunkier system [21].

Archaeophyte and neophyte plants are also emphasised. Exotic and cultivated plants were alphabetically listed by using Bailey [22] (Appendix 2). Endemic, rare, endangered, medicinal, and poisonous species are noted in the lists. The categories and criteria of rare and endangered species are according to Ekim et al.[23] and "Red Data List" of International Union for the Conservation of Nature and Natural Resources (IUCN) [24]. Poisonous plants were noted according to Seçmen and Leblebici [25] and Baytop [26] while medicinal plants are according to Baytop [27] and Baytop and Kadıoğlu [28].

Results and Discussion

A total of 561 vascular plant taxa were found with 412 native (337 species, 44 subspecies and 31 varieties) belonging to 68 families and 239 genera, and 149 exotic and cultivated (143 species) belonging to 61 families and 112 genera (Appendices 1 and 2). While 268 native species (70.20%) were dicots, 62 native species (18.40 %) were monocots. Only one native species (0.30%) was a pteridophyte and 6 native species (1.78 %) were gymnosperms. There were 173 perennial, 152 annual and 12 biennial species in the native flora.

The following families have the most native species: Asteraceae (46 species, 13.65%), Poaceae (39 species, 11.57%), Fabaceae (33 species, 9.79%), Lamiaceae (16 species, 4.75%) and Liliaceae (14 species, 4.15%). Asteraceae, as it is known, has the most species in the whole flora of Turkey [20]. In fact, it is also a very large cosmopolitan family represented by 13 tribes, 84 genera and over 240 species distributed all over the world [2-4, 11, 29-33]. The most common genera were *Trifolium* (11 species, 3.26%), *Ranunculus* (5 species, 1.48%), *Quercus* (5 species, 1.48 %), *Rumex*, *Geranium*, *Medicago*, *Plantago* and *Veronica* (4 species, 1.19%).

For native plants, the largest groups of life forms were therophytes (44.81%) and hemicryptophytes (30.56%). The percentages of other life forms were as follows: phanerophytes (13.65%), geophytes (8.31%), chamaephytes (1.48%) and helophytes (1.19%). The significant therophytic and hemicryptophytic components of the flora correlate with the submediterranean climate

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

of Kadıköy district and demonstrate an intermediate position between Mediterranean and temperate ecosystems [33-34].

The most common phytogeographical elements found were Medit. El. (44 species, 13.06%), Euro-Sib. El. (31 species 9.20%) and E. Medit. El. (7 species, 2.08%) for native plants. This is because the research area is mostly affected by a Mediterranean climate. In addition, the northern side of Istanbul is partly affected by the oceanic climate and this situation can result in plants belonging to Euro-Sib. El. in Kadıköy district [17, 34].

In the research area, 8 taxa (2.37%) were cosmopolitan and 59 taxa (18.00%) were widespread. The most common native plants are *Sonchus asper* (L.) Hill ssp. *glaucescens* (Jordan) Ball (Asteraceae), *Rapistrum rugosum* (L.) All. (Brassicaceae), *Chenopodium album* L. (Chenopodiaceae), *Lolium perenne* L. (Poaceae), *Cynodon dactylon* (L.) Pers. var. *dactylon* (Poaceae), *Stellaria media* (L.) Vill. subsp. *media* (Caryophyllaceae), *Lamium purpureum* L. var. *purpureum* (Lamiaceae) and *Parietaria judaica* L. (Urticaceae)-especially on walls.

Because Kadıköy district has mostly completed its urbanisation process, perennial habitats have decreased. Present habitats are represented by annual taxa, e.g. *Stellaria media* (L.) Vill. ssp. *media* (Caryophyllaceae) and *Lamium purpureum* L. var. *purpureum* (Lamiaceae), *Euphorbia helioscopia* (Euphorbiaceae), *Capsella bursapastoris* L. (Brassicaceae), *Veronica persica* Poir. (Scrophulariaceae).

Archaeophyte (28 species) and neophyte (15 species) species were found (Table 1) [34-36]. In addition, 2 endemic (0.48 %) and 2 rare taxa (0.71 %) were collected. The endemics were *Ballota nigra* L. subsp. *anatolica* P. H. Davis (0.24 %) and *Cirsium polycephalum* DC. (0.24 %). The rare species were *Cymbalaria muralis* Gaertner and *Albizzia julibrissin* (Willd.) Durazz. [23]. We also determined the poisonous (83 species) and medicinal (119 species) plants for both native and exotic plants.

Kadıköy still has a rich flora even with millennia of urbanisation. It reflects a Mediterranean ecosystem and shows increased floristic diversity with temperature, water availability, and topography. These relate to the richness of the area along with the human influence which has created a variety of habitat types through traditional land use practices [17-18, 34].

It is obvious that rapid urbanisation has created problems for the survival of some species [6, 37]. In urbanised areas, therophytes increased while rare species and wasteland plants decreased from the suburbs to the centre [11]. *Lemna minor* L. (Lemnaceae), *Iris sintenisii* Janka (Iridaceae), *Cephalanthera longifolia* (L.) Fritsch., *Neotinea masculata* (Desf.) Steam, *Orchis papilionacea* L., *Orchis laxiflora* Lam., *Orchis tridentate* Scop. subsp. *lactea* (Poir.) Rouy (Orchidaceae) were present in the 1960s. Unfortunately, they have now been extirpated [38]. In addition, populations of *Phragmites australis* (Cav.) Trin. *ex* Steudel (Poaceae), *Typha latifolia* L. (Typhaceae), *Juncus heldreichianus* Marsson *ex* Parl. and *J. conglomeratus* L. (Juncaceae) have been greatly reduced. Additionally, an increase of non-native plants, ruderals, cultivated species and annuals has occurred.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Table 1. List of archaeophyte and neophyte plants

Archaeophytes (before 1500 AD)	Neophytes (after1500 AD)
Lamium purpureum L. (Lamiaceae)	*Conyza canadensis* (L.) Cronquist (Asteraceae)
Lamium amplexicaule L.	*Datura stromanium* L. (Solanaceae)
Ballota nigra L.	*Veronica persica* Poiret (Scrophulariaceae)
Euphorbia helioscopia L. (Euphorbiaceae)	*Cymbalaria muralis* Gaertner
Euphorbia peplus L.	*Ailanthus altissima* (Miller) Swingle (Simaroubaceae)
Sinapis arvensis L. (Brassicaceae)	*Aesculus hippocastanum* L. (Hippocastaneae)
Capsella bursa pastoris (L.) Medik.	*Oxalis corniculata* L. (Oxalidaceae)
Sisymbrium officinale (L.) Shop.	*Diplotaxis tenuifolia* (L.) DC. (Brassicaceae)
Fumaria officinalis L. (Papaveraceae)	*Cardaria draba* (L.) Desv.
Papaver rhoeas L.	*Sisymbrium altissimum*L.
Stellaria media (L.) Vill. (Caryophyllaceae)	*Raphanus raphanistrum* L.
Cerastium glomeratum Thuill	*Robinia pseudoacacia* L. (Fabaceae)
Cichorium intybus L. (Asteraceae)	*Amaranthus retroflexus* L. (Amaranthaceae)
Bellis perennis L.	*Syringia vulgaris* L. (Oleaceae)
Solanum nigrum L. (Solanaceae)	*Lolium multiflorum* Lam. (Poaceae)
Chenopodium album L. (Chenopodiaceae)	
Setaria viridis (L.) P. Beauv. (Poaceae)	
Bromus sterilis L.	
Echinochloa crus - galli (L.) P. Beauv.	
Plantago lanceolata L. (Plantaginaceae)	
Melilotus alba Desr. (Fabaceae)	
Melilotus officinalis (L.) Desr.	
Geranium pusillum Burm. fil. (Geraniaceae)	
Geranium dissectum L.	
Geranium molle L.	
Echium vulgare L. (Boraginaceae)	
Anagallis arvensis L. (Primulaceae)	
Malva neglecta Wallr. (Malvaceae)	

The changes in environmental conditions in human-altered sites provide specific niches, which are often colonised by aliens rather than by native species. Higher temperatures and limited soil moisture are characteristic factors in rural to urban gradients. Many alien species in temperate zones originating from warmer areas easily adapt to disturbed urban conditions [39]. These species, which are imported to an area due to anthropogenic activities, sometimes cover the area more frequently than native plants [40-41]. Some of those invasive alien species are: *Hyacinthus orientalis* L. and *Tulipa species* L. (Liliaceae), *Acer negundo* L. (Aceraceae), *Robinia pseudoacacia* L. (Fabaceae), *Ailanthus altissima* (Miller) Swingle (Simaroubaceae), *Celtis australis* L. (Ulmaceae), *Platanus orientalis* L. (Platanaceae), and *Viola x wittrockiana* Gams. (Violaceae). *Robinia pseudoacacia* L. and *Acer negundo* L. are the most successful non-native tree species which also appear spontaneously in different habitats in Berlin, Germany [34, 40-41].

The effects of urbanisation are more intense in the inner city and this can support specialised urban plant communities. This study has demonstrated the decrease in indigenous species, the immigration of alien species, and the establishment of new ecotypes in an old urban area.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Acknowledgements

We express our gratitude to Professor Dr. Munir Ozturk from Ege University (Biology Department) for his valuable suggestions in the completion of this study and Ms Sedef Çakır for rechecking the English.

References

1. http://www.unis.unvienna.org (The website of United Nations Information Service), last access: September **2009**.
2. K. H. Shaltout and M. A. El-Sheikh, "Vegetation of the urban habitats in the Nile Delta region, Egypt", *Urban Ecosyst.*, **2002**, *6*, 205-221.
3. G. S. Antipina, **"**Urban flora as a component of the urban ecosystems in the Taiga Zone: An example of Karelian Cities", *Russian J. Ecol.*, **2003**, *34*, 215-218.
4. D. Lausi and P. L. Nimis, "Roadside vegetation in boreal South Yukon and adjacent Alaska", *Phytocoenologia*, **1985**, *13*, 103-138.
5. P. M. Vitousek, H. A Mooney, J. Lubchenco and J. M. Melillo, "Human domination of earth's ecosystems", *Science*, **1997**, *277***,** 494-499.
6. S. Van der Veken, K. Verheyen and M. Hermy, "Plant species loss in an urban area (Turnhout, Belgium) from 1880 to 1999 and its environmental determinants", *Flora*, **2004**, *199*, 516-523.
7. D. Maes and H. Van Dyck, "Butterfly diversity loss in Flanders (north Belgium): Europe's worst case scenario?", *Biol. Conserv.*, **2001**, *99***,** 263-276.
8. P. F. Donald, R. E. Green and M. F. Heath, "Agricultural intensification and the collapse of Europe's farmland bird populations", *Proc. R. Soc. London Ser.B*, **2001**, *268*, 25-29.
9. K. Thompson and A. Jones, "Human population density and prediction of local plant extinction in Britain", *Conserv. Biol.*, **1999**, *13*, 185-189.
10. N. G. Il'minskikh, "Ecotopological structure of the urban flora", Proceedings of Third Workshop on Comparative Floristics, **1998**, Kunkur, Russia, pp. 269-276.
11. U. Maurer, T. Peschel and S. Schmitz "The flora of selected urban land-use types in Berlin and Potsdam with regard to nature conservation in cities", *Landscape Urban Plan.*, **2000**, *46,* 209-215.
12. S. Kaya and P. J. Curran "Monitoring urban growth on the European side of the Istanbul metropolitan area: A case study", *Int. J. Appl. Earth Observ. Geoinform.*, **2006**, *8*, 18-25.
13. M. Karakuyu, "Istanbul'un mekansal gelişiminin analizi (The urban development analysis of Istanbul)", 4th GIS Days in Türkiye, September 13-16, **2006**, Fatih University, Istanbul,Turkey, pp.1-8.
14. http://tuikapp.gov.tr (The official website of Turkish Republic Office of Prime Ministry Statistics Institution), last access: September **2009**.
15. A. Geymen and I. Baz, "Monitoring urban growth and detecting land-cover changes on the Istanbul metropolitan area", *Environ. Monit. Assess.*, **2008**, *136*, 449-459.
16. http://www.Kadıköy-bld.gov.tr (The official website of Kadıköy district municipality), last access: September **2009**.

17. E. Osma, "Kadıköy İlçesi (Istanbul) Kentsel Ekolojisi (Urban ecology of Kadıköy District-Istanbul)", *MSc. Thesis*, **2003**, Marmara University, Turkey.
18. V. Altay, "Kartal (Istanbul)'nin Kentsel Ekolojisi (Urban ecology of Kartal- Istanbul)", *MSc. Thesis*, **2004**, Marmara University, Turkey.
19. http://www.dmi.gov.tr (The official website of Turkish State Meteorological Service), last access: September **2009**.
20. P. H. Davis, "Flora of Turkey and the East Aegean Islands", Vols: 1-11, Edinburgh University Press, Edinburgh, **1965-2001**.
21. C. Raunkier, "The Life Forms of Plants and Statistical Plant Geography", Clarendon Press, Oxrford, **1934**.
22. L. H. Bailey, "Manual of Cultivated Plants", McMillan, New York, **1949**.
23. T. Ekim, M. Koyuncu, M. Vural, H. Duman, Z. Aytaç and N. Adıgüzel, "Türkiye Bitkileri Kırmızı Kitabı (Red Data Book of Turkish Plants) Pteridophyta and Spermatophyta", Türkiye Tabiatını Koruma Derneği Yayınları**,** Ankara**, 2000**.
24. http://www.iucn.org (The website of International Union for Conservation of Nature), last access: September **2009**.
25. Ö. Seçmen and E. Leblebici, "Yurdumuzun Zehirli Bitkileri (The poisonous plants of our country)", Ege Universitesi Fen Fakültesi Kitaplar Serisi, No:103, Bornova, Izmir, **1987**.
26. T. Baytop, "Türkiye'de Zehirli Bitkiler, Bitki Zehirlenmeleri ve Tedavi Yöntemleri (Poisonous plants, plant poisonings and treatment methods in Turkey)", Istanbul Universitesi Yayınları, No: 3560, Istanbul, **1989**.
27. T. Baytop, "Türkiye'de Bitkiler ile Tedavi (Treatment with plants in Turkey)", Istanbul Universitesi Eczacılık Fakültesi Yayınları, No: 40, Istanbul, **1984**.
28. T. Baytop and D. Kadıoğlu, "Istanbul Bölgesi'nin Tıbbi Bitkileri (Medicinal plants of Istanbul Province)", 14. Bitkisel İlaç Hammaddeleri Toplantısı, Bildiriler, 29-31 May **2002**, Eskişehir, Turkey.
29. O.Adedeji and O.A. Jewoola, "Importance of leaf epidermal characters in the Asteraceae family", *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, **2008**, *36*, 7-16.
30. C. Yarci, M. Serin and V. Altay, "The segetal vegetation of Kocaeli Province (Turkey)", *Ekoloji*, **2007**, *63*, 23-33.
31. J. F. Maxwell, "Vascular flora of the Emerald Pool area, Krabi province, southern Thailand", *Maejo Int. J. Sci. Technol.*, **2009**, *3*, 1-25.
32. J. F. Maxwell, "Vegetation and vascular flora of the Mekong River, Kratie and Steung Treng Provinces, Cambodia", *Maejo Int. J. Sci. Technol.*, **2009**, *3*, 143-211.
33. D. Amanatidou, "Analysis and evaluation of a traditional cultural landscape as a basis for its conservation management. A case study in Vikos-Aoos National Park-Greece", *PhD. Thesis*, **2005**, Albert-Ludwigs University, Germany.
34. V. Altay, İ. İ. Özyiğit and C. Yarci, "Urban flora and ecological characteristics of the Kartal District (Istanbul): A contribution to urban ecology in Turkey", *Sci. Res. Essay*, **2010**, *5*, 183-200.
35. H. Schepker and I. Kowarik, "Bekämpfung von Neophyten in Niedersachsen.: Ursachen. Umfang, Erfolg", *Neobiota*, **2002**, *1*, 343-354.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

36. I. Kowarik, "Human agency in biological invasions: Secondary releases foster naturalisation and population expansion of alien plant", *Biol. Invasions*, **2003**, *5*, 293-312.
37. Z. Chocholousková and P. Pysek, "Changes in composition and structure of urban flora over 120 years: A case study of the city of Plzen", *Flora*, **2003**, *198*, 366-376.
38. A. Baytop, "Aydos ve Kayışdağ havalisinin çiçekli bitkileri (The flowering plants of Aydos and Kayışdağ areas)", *Türk Biyolog Dergisi*, **1962**, *12*, 75-111.
39. R Wittig, "The origin and development of the urban flora of Central Europe", *Urban Ecosystems*, **2004**, *7*, 323-339.
40. S. Zerbe, U. Maurer, S. Schmitz and H. Sukopp, "Biodiversity in Berlin and its potential for nature conservation", *Landscape and Urban Planning*, **2003**, *62*, 139-148.
41. I. Kowarik, "Einführung und Ausbreitung nichteinheimischer Gehölzarten in Berlin und Brandenburg und ihre Folgen für Flora und Vegetation. Verhandlungen des Botanischen Vereins von Berlin und Brandenburg", *Beiheft*, **1992**, *3*, 1-188.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Appendix 1: Native plants of Kadıköy district

Abbreviations and symbols: * poisonous plant, ** medicinal plant, LR: lower risk, CR: critically endangered, VU: vulnerable, DD: data deficient. (The LR, CR, VU and DD values are according to IUCN standards) [23- 28].

PTERIDOPHYTA

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

SPERMATOPHYTA

GYMNOSPERMAE

PINACEAE
Cedrus libani A Rich. Ph
Pinus brutia Ten. Ph, E. Medit. El.
P. pinea L. (**), Ph
P. sylvestris L. Ph, Euro-Sib. El.

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

ANGIOSPERMAE

DICOTYLEDONEAE

RANUNCULACEAE
Anemone coronaria L. (*), G, Medit. El.
Consolida ambiqua (L.) P. Bass. & Heyw. Th
Ranunculus constantinopolitanus (DC.) d'Urv. (*), H, widespread
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

PAPAVERACEAE
Fumaria officinalis L. (*), (**), Th
Glaucium flavum Crantz H, widespread
Papaver dubium L. Th
P. rhoeas L. (**), Th, widespread

BRASSICACEAE
Calepina irregularis (Asso) Thellung Th
Capsella bursa-pastoris (L.) Medik. Th, cosmopolitan
Cardaria draba (L.) Desv. subsp. *draba* H, widespread
Diplotaxis tenuifolia (L.) DC. (*), H.
Erophila verna (L.) Chevall. Th
Lepidium graminifolium L. H
Neslia apiculata Fisch. Th, widespread
Raphanus raphanistrum L. (**), Th

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Rapistrum rugosum (L.) All. Th
Sinapis arvensis L. Th, widespread
S. alba L. Th
Sisymbrium altissimum L. Th, widespread
S. officinale (L.) Shop. (*), 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 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
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 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
Salsola ruthenica L. Th

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

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

HYPERICACEAE
Hypericum calycinum L. (*), Ch
H. cerastoides (Spach) Robson (*), 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

OXALIDACEAE
Oxalis corniculata L. Th, cosmopolitan

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

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

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

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

FABACEAE
Cercis siliquastrum L. var. *siliquastrum* Ph
Gleditsia triacanthos L. Ph
Dorycnium pentaphyllum Scop. subsp. *herbaceum* (Vill.) Rouy H
Hippocrepis unisiliquosa L. Th
Lathyrus digitatus (Bieb.) Fiori H, E. Medit. El.
Lotus corniculatus L. var. *corniculatus* (*), H, widespread
Medicago lupulina L. 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. subsp. *leiosperma* (Boiss.) Sirj. H, widespread
Robinia pseudacacia L. (*), (**), Ph

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

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. nigrescens Viv. subsp. *petrisavii* (Clem.) Holmboe Th, widespread
T. pratense L. H
T. repens L. var. *repens* H
T. resupinatum L. var. *resupinatum* Th
T. scabrum L. Th, widespread
T. stellatum L. var. *stellatum* Th
T. subterraneum L. Th
T. tomentosum L. Th
Vicia cracca L. subsp. *cracca* H, Euro-Sib. El.
V. hybrida L. Th, Widespread
V. sativa L. subsp. *nigra* (L.) Ehrh. var. *segetalis* (Thuill) Ser Th

ROSACEAE
Crataegus monogyna Jacq. subsp. *monogyna* (**), Ph
Mespilus germanica L. (**), Ph
Potentilla 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.

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

CRASSULACEAE
Sedum hispanicum L. 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
Sambucus ebulus L. (**), H, Euro-Sib. El.

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

DIPSACACEAE
Knautia orientalis L. Th, E. Medit. El.
Scabiosa columbaria L. subsp. *columbaria* var. *columbaria* H

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

ASTERACEAE
Anthemis cf. c*hia* L. Th
A. cretica L. subsp. *tenuiloba* H
A. tinctoria L. var. *tinctoria* H, widespread
Arctium minus (Hill.) Bernh. subsp. *minus* H
Artemisia absinthium L. (*), (**), H
Bellis perennis L. H, Euro-Sib. El.
Calendula arvensis L. Th
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
Chondrilla juncea L. var. *juncea* (**), H, widespread
Chrysenthemum segetum L. Th
Cichorium intybus L. (**), H, widespread
Cirsium creticum (Lam.) d'Urv. subsp. *creticum* H, E. Medit. El.
C. polycephalum DC. Endemic (CR), H
Conyza canadensis (L.) Cronguist Th
Crepis foetida L. Th
C. sancta (L.) Babcock Th, widespread
C. zacintha (L.) Babcock Th, Medit. El.
Echinops microcephalus Sm. H, Medit. El.
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
Matricaria chamomilla L. (**), Th
Pallenis spinosa (L.) Cass. Th
Picnomon acarna (L.) Cass. Th, widespread, Medit. El.
Picris hieracioides L. Th, Euro-Sib. 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.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

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
Trachystemon orientalis (L.) G. Don (**), G, Euxine El.

SOLANACEAE
Datura stramonium L. (*), (**), Th, cosmopolitan
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
Bellardia trixago (L.) All. Th
Cymbalaria muralis Gaertner Rare (VU), Th
Kickxia spuria (L.) Dumort subsp. *integrifolia* Th
Linaria genistifolia (L.) Miller H
Parentucellia latifolia (L.) Caruel subsp. *latifolia* Th
Verbascum sp. H
Veronica chamaedrys L. H, Euro-Sib. El.
V. cymbalaria Bodard Th, Medit. El.
V. hederifolia L. Th, widespread
V. persica Poiret Th

OROBANCHACEAE
Orobanche minor L. (*), G

LAMIACEAE
Ballota nigra L. subsp. *anatolica* P. H. Davis Endemic (LR), H, Ir.-Tur. El.
Calamintha nepeta (L.) Savi subsp. *glandulosa* (Req.) P.W. H
Lamium amplexicaule L. Th, widespread, Euro-Sib. El.
L. purpureum L. Th, Euro-Sib. El.
Lavandula stoechas L. subsp. *stoechas* (**), Ph, Medit. El.
Melissa officinalis L. (**), H

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Mentha longifolia (L.) Hudson subsp. *typhoides* (Brig.) Harley var. *typhoides* H, widespread
M. pulegium L. (**), H
Origanum vulgare L. (**), H
Prunella vulgaris L. H, widespread, Euro-Sib. El.
Rosmarinus officinalis L. Ph, Medit. El.
Salvia verbenaca L. Ch
Scutellaria albida L. subsp. *albida* H, Medit. El.
Sideritis montana L. subsp. *montana* Th, widespread, Medit. El.
Stachys byzantina C. Koch H, Euro-Sib. El.
Teucrium chamaedrys L. (**), G
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

THYMELAEACEAE
Daphne pontica L. (*), (**), Ph, Euxine El.

ELAEAGNACEAE
Elaeagnus angustifolia L. (**), Ph, widespread

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

SANTALACEAE
Osyris alba L. H, Medit. El.

EUPHORBIACEAE
Euphorbia 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 dioica L. (**), H
U. pilulifera L. (*), Th, Medit. El.

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

PLATANACEAE
Platanus orientalis L. (**), Ph, widespread

FAGACEAE
Quercus coccifera L. (*), (**), Ph, Medit. El.
Q. frainetto Ten. Ph, Euro-Sib. El.
Q. infectoria Olivier Ph
Q. ilex L. Ph, Medit. El.
Q. pubescens Willd. (*), Ph

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

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

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

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.
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 sigmoideum Freyn & Sint. (*), G, Euro-Sib. El.
O. umbellatum L. (**), G
Scilla autumnalis L. G, Medit. El.
Smilax excelsa L. (**), H

IRIDACEAE
Iris germanica L. G
I. sintenisii Janka G, Euro-Sib. El.
I. suaveolens Boiss. & Reuter G, E. Medit. El.

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

TYPHACEAE
Typha 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
Aegilops geniculata Roth. Th, Medit. El.
Agrostis capillaris L. var. ca*pillaris* 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
Brachypodium sylvaticum (Hudson) P. Beauv. H, widespread, Euro-Sib. El.
Briza maxima L. Th
Bromus hordeaceus L. Th
B. japonicus Thunb. subsp. *japonicus*
B. sterilis L. Th, widespread

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Catabrosa aquatica (L.) P. Beauv. G, widespread
Catapodium rigidum (L.) C. E. Hubbard *ex* Dony Th
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. marinum Hudson. Th
H. murinum L. subsp. *leporinum* (Link) Arc. var. *leporinum* Th
Lolium multiflorum Lam. Th
Lolium perenne L. H, Euro-Sib. El.
Melica ciliata L. subsp. *ciliata* G, widespread
Paspalum paspalodes (Michx.) Scribner G
Phalaris aquatica L. H
Phragmites australis (Cav.) Trin. ex Steudel (**), He, widespread, Euro-Sib. El.
Poa annua L. Th, cosmopolitan
P. bulbosa L. G
Rostraria cristata (L.) Tzvelev Th
Setaria verticillata (L.) P. Beauv. Th
S. viridis (L.) P. Beauv. Th, widespread
Sorghum halepense (L.) Pers. var. *halepense* H

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

Appendix 2: Exotic and cultivated plants of Kadıköy district

Abbreviations and symbols: * poisonous plant, ** medicinal plant, LR: lower risk, CR: critically endangered, VU: vulnerable, DD: data deficient. (The LR, CR, VU and DD values are according to IUCN standards) [23- 28].

GINKGOACEAE
Ginkgo biloba L.

TAXACEAE
Taxus baccata L. (*)

PINACEAE
Cedrus libani A. Richard
C. deodora (Roxb.) Loud.
C. atlantica (Endl) Manetti *ex* Carrière "Glauca"
Picea orientalis (L.) Link
P. punges Endelm
Pinus pinaster Ait.
P. pinea L. **(**)**
P. sylvestris L.
P. mugo Turra
P. strobus L.

CUPRESSACEAE
Chamaecyparis lawsoniana (Murr.) Parl.
Cupressus arizonica Grene
C.macrocarpa Hartw. *ex* Gord.
Juniperus horizontalis Moench
Thuja occidentalis L. "Globosa"
T. orientalis L.

ARECACEAE
Chamaerops excelsa Thunb.
Phoenix canariensis Chabaud.

LILIACEAE
Allium orientale Boiss.
Fritillaria persica L.
Hemerocallis fulva L.
Hyacinthus orientalis L. (*)
Lilium candidum L.
Ornithogalum nutans L. (*)
Tulipa species L.

IRIDACEAE
Crocus sativus L. (*)
Iris germanica L.

AGAVACEAE
Agave americana L.
A. americana L. "Marginata"
Yucca flamentosa L.
Y. gloriosa L.

AMARYLLIDACEAE
Narcissus pseudonarcissus L. "Dutch Master" (*)

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

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

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

MAGNOLIACEAE
Liriodendron tulipifera L.
Magnolia grandiflora L.

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

ROSACEAE
Chaenomeles japonica (Thunb.) Lindl. ex Spach
Cotoneaster franchetii Boiss.
Cydonia oblonga Miller **(**)**
C. japonica Pers.
Eriobotrya japonica (Thunb.) Lindl. (**)
Fragaria vesca L. (**)
Kerria japonica (L.) DC. "Pleniflora"
Laurocerasus officinalis Roemer (*),(**)
Malus floribunda Sieb. ex Van Houtte
M. sylvestris Miller (**)
Persica vulgaris Miller (*),(**)
Prunus avium L**.** (*)
P. cerasus L. (*),(**)
P. domestica L. (*),(**)
P. mahalep L. (**)
P. serrulata Lindl.
Pyracantha coccinea Roemer (**)
Pyrus communis L. (**)
Rosa damascena Miller (**)
R. gallica L.
R. multiflora Thunb.
Spiraea x vanhouttei (Briot) Zab.

FABACEAE
Acacia cyanophylla Lindl.
A. dealbata Link
Albizzia julibrissin (Willd.) Durazz. Rare (VU)
Caesalpinia gilliesii (Wall. ex Hook.) Wall. ex D. (*)
Cassia acutifolia Del.
Robinia pseudoacacia L. "Umbraculifera"
Sophora japonica L. var. *pendula* Loud. (*)
Wisteria sinensis (Sim.) DC. (*)

GERANIACEAE
Pelargonium zonale (L.) L'Herit. ex Ait.

OXALIDACEAE
Oxalis floribunda Linn.

BUXACEAE
Buxus sempervirens L. (*)

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

CELASTRACEAE
Euonymus japonicus L. *"*Aureo-variegatus*"*

ACERACEAE
Acer campestre L.
A. negundo L.
A. palmatum Thunb.
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 ex Bieb.

VIOLACEAE
Viola x wittrockiana Gams.

LYTHRACEAE
Lagerstroemia indica L.

PUNICACEAE
Punica granatum L. (**)

MYRTACEAE
Eucalyptus camaldulensis Dehnh.
Callistemon citrinus (Curtis) Skeels

ARALIACEAE
Fatsia japonica (Thunb.) Decne. & Planch.

PRIMULACEAE
Primula vulgaris Huds.

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

APOCYNACEAE
Vinca major L. (*)

VERBENACEAE
Clerodendron trichotomum Thunb.
Lantana camara L. "Aulanche" (*)
Vitex agnus-castus L. (**)

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

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

CAPRIFOLIACEAE
Lonicera japonica Thunb.
Viburnum opulus L. "Sterile"
V. tinus L.

ASTERACEAE
Bellis perennis L. "Pompenette Red"
Calendula officinalis L.
Chrysanthemum maximum Ramond
Cosmos bipinnatus Cav.
Santolina chamaecyparissus L.
Senecio cineraria DC.
Tagetes erecta L.

MELIACEAE
Melia azaderach L. (*)

NYCTAGINACEAE
Bougainvillea spectabilis Willd
Mirabilis jalaba L. (*)

AIZOACEAE
Carpobrotus acinaciformis Folia

CACTACEAE
Opuntia ficus-indica (L.) Mill.

PASSIFLORACEAE
Passiflora coerulea L.

SAPINDACEAE
Koelreuteria paniculata Laxm.

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

EBENACEAE
Diospyros kaki L.
D. 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. (**)

RANUNCULACEAE
Eranthis hyemalis (L.) Salisb.

Maejo Int. J. Sci. Technol. **2010**, *4*(01), 64-87

PLATANACEAE
Platanus acerifolia (Ait.) Willd.

THEACEAE
Camelia japonica L.

POLYGONACEAE
Polygonum bistorta L.

ARALIACEAE
Hedera colchica (C. Koch) C. Koch "Sulphur Heart" (*)
H. helix L. "Aureovariegata*"* (**)

RUTACEAE
Citrus sinensis (L.) Osbeck

ARACEAE
Anthurium andreanum Lenny

CANNACEAE
Canna x generalis Hortus

AMARANTHACEAE
Amaranthus caudatus L.

ONAGRACEAE
Oenothera biennis L.

AQUIFOLIACEAE
Ilex aquifolium L. (*)

CORYLACEAE
Corylus avellana L. var. *avellana* (**)
