

THE FLORISTIC CHARACTERISTICS OF PLANTS IN GARDENS AND STREETS IN URBAN AREAS OF ADANA, TURKEY

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Abstract

This study was carried out to determine the flora of the gardens and road sides in Adana from March 2008 to April 2012. During the floristic studies, 337 vascular plant taxa belonging to 259 genera and 93 families were determined. Families with the greatest number of taxa are Asteraceae 35 species (10%), Fabaceae 30 species (9%), Poaceae 20 species (6%), Rosaceae 11 species (3%) and Lamiaceae 10 species (3%). According to the life-forms phanerophytes 134 species (40%) and therophytes 118 species (35%) are more than the others (chamaephytes, hemicryptophytes, and geophytes). Forty-eight percent (162 taxa) of total flora in the area is exotic species and the rest (52%) are indigenous. Total flora consists of 62% (209 taxa) ornamental species and 38% (128 taxa) ruderal species.

Key words: Adana, Urban flora, Exotic species, Native species, Ornamental species

Introduction

Cities play a major role not only as providers of employment, shelter and services but also as centers of culture, learning and technological development and industrial centers for the processing of agricultural produce and manufacturing and portals to the rest of the world (Mulligan & Crampton, 2005; Eskin *et al.*, 2012).

The alteration of ecosystems by humans is most apparent in and around urbanizing landscapes (Lundholm & Marlin, 2006). There is no doubt that human civilization has had a negative impact on biodiversity, especially since the industrial revolution (Shinwari & Qaisar, 2011). Exposure to pollution, disconnection from nature and wildlife, and surroundings of building and other structures can be elements of an urban lifestyle. The world is urbanizing rapidly and more than half of the world's population lives in towns and cities (Knapp *et al.*, 2008).

Cities generally host a higher number of vascular plant species than rural areas of the same size (Wittig & Becker, 2010). Urban habitats are often compared with rural or wilderness areas and are typically characterized by lower species diversity, replacement of native wildlife with non-native species, simplified species composition, increased patchiness of habitat, low stability, and increased landscape conversion towards the urban centre (Turner *et al.*, 2004; Dearborn & Kark, 2010; Malik *et al.*, 2012; Ugulu *et al.*, 2012; Larondelea & Haaseb, 2013).

The destruction of habitats through agriculture and urban sprawl, excessive use of pesticides and artificial fertilizers, overfishing and hunting, and the release of other toxic compounds into the environment are always harmful to the native biodiversity (Smith *et al.*, 2006).

The main objective of this study was to determine the floristic characteristics of plants in the gardens and streets in Adana, Turkey's fourth largest city.

Material and Methods

Study area Adana (36°29' N, 35°32' E) is a city in the East Mediterranean region of Turkey and a major agricultural and commercial center. The city is located on

both sides of the Seyhan River, extends over an area of c. 105 km², 30 km inland from the Mediterranean Sea, in south-central Anatolia (Fig. 1). It is the administrative seat of the Adana Province and has a population of 2.1 million, making it the fifth most crowded city in Turkey. Adana-Mersin Metropolitan Area, with a population of 3 million, stretches over 100 km from east to west and 25 km from north to south; encompassing the cities of Mersin, Tarsus, Adana, and Ceyhan. NATO's Incirlik Air Base is located in town of Incirlik 12 km away from Adana.

The history of Adana goes back more than 3000 years; findings in the region reveal human occupation of the area during the Paleolithic Age. Tepebag Tumulus, where archaeologists found a stone wall and a city centre, was built in the Neolithic Age; it is considered to be the oldest city of the Cilicia region. 6th BC century onwards, Adana was ruled by the Romans. In the mid 7th century, the city was captured by the Arab Abbasids. The Byzantines recaptured Adana in 964. After the Battle of Manzikert (1071), the Seljuk Turks overran much of the Byzantine Empire. From the end of the Renaissance to the modern era (1517-1918), the Ottoman Empire ruled the area.

The territory of the research area; Pliocene limestone, Pleistocene conglomerates, and Holocene alluvial has formed. The residential and agricultural areas of Adana (Cukurova delta / Cilician plain) is mostly a large stretch of flat, fertile land regarded as one of the most agriculturally productive areas of the world.

The Mediterranean climate in the study area is characterized by long summer droughts and mild and rainy winters. The mean annual precipitation is about 465.2 mm, while the monthly precipitation approximates 5.2 mm in August and 117.8 mm in January. The mean maximum temperatures range from 13.3°C in January to 33.9°C in August and the mean minimum temperatures from 5.5°C in January to 24°C in August. The highest recorded temperature was in July with 44.0°C. The lowest recorded temperature was in January -6.4°C. According to the average climatic data for 10 years (2002-2011) obtained from the Meteorological Station of Cukurova University, the dry period for the study area is from May to October (Fig. 2).

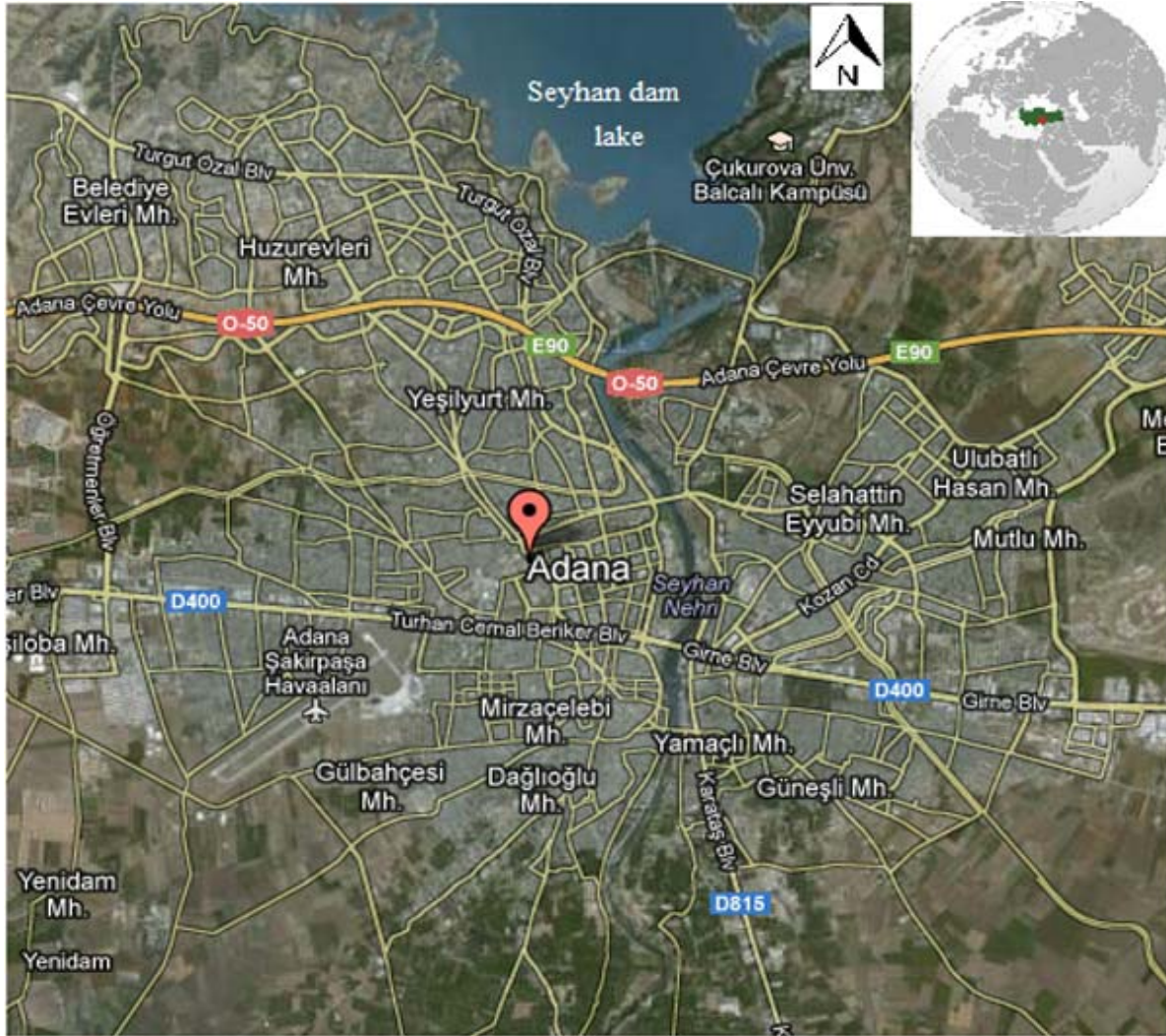


Fig. 1. Geographical position of Adana city center (investigated area).

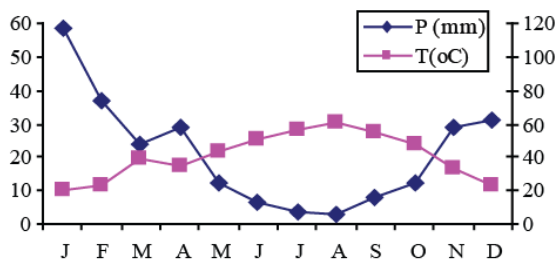


Fig. 2. Ombrothermic diagram of the study area. The dry period in May – November, the rainy period (>100 mm / in January, and transitional period in March and April.

Materials of this study were comprised 337 vascular plant samples collected from gardens and road sides of the city of Adana from March 2008 to April 2012. The all specimens collected were dried according to known herbarium techniques and processes. These samples were mainly determined with the help of Flora of Turkey (Davis, 1965-1988; Guner *et al.*, 2000) and other related publications (Barwick, 2004; Forrest, 2006). All collected plant specimens during the study are kept at the

Herbarium of Çukurova University, Faculty of Science and Letters, Biology Department (ADA).

Floristic list, given in Table 1 appended to the end of the text. Families and species of each family are listed in alphabetical order. The naturalness, ornamental status, voucher number and life-form of each species were specified.

Results

During the floristic researches of ruderal and ornamental flora so far conducted on the territory of the city of Adana, it was established the presence of 337 species of vascular plants, divided into 2 divisions, 7 classes, 93 families and 259 genera. The total flora consists of 285 species, 17 subspecies, 20 varieties, 8 hybrids and 7 cultivars. Division Pteridophyta is represented with one species, Division Spermatophyta with 336 species. Pteridopsida, Araucariopsida and Cycadopsida classes are represented by single species, class Pinopsida with 4 species, class Cupressopsida with 6 species, and class Magnoliopsida with 286, while 38 species belong to the class Liliopsida (Table 2).

Table 1. The floristic list, and the use of plants in urban areas of Adana, Turkey.

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Acanthus mollis</i> L.	Acanthaceae	Havva 14	H	eo
<i>Beloperone guttata</i> Brandege	Acanthaceae	Havva 16	H	eo
<i>Justicia adhatoda</i> L.	Acanthaceae	Havva 15	Ph	eo
<i>Acer negundo</i> L.	Aceraceae	Havva 18	Ph	no
<i>Acer negundo</i> L. 'Flamingo'	Aceraceae	Havva 17	Ph	eo
<i>Agave americana</i> L.	Agavaceae	Havva 20	Ph	eo
<i>Agave americana</i> L. 'Variegata'	Agavaceae	Havva 19	Ph	eo
<i>Cordyline australis</i> (Forst.) Endl.	Agavaceae	Havva 21	Ph	eo
<i>Phormium tenax</i> J.R.Forst. & G.Forst.	Agavaceae	Havva 22	H	eo
<i>Yucca filamentosa</i> L.	Agavaceae	Havva 23	Ph	eo
<i>Carpobrotus edulis</i> (L.) N.E.Br.	Aizoaceae	Havva 24	H	eo
<i>Lampranthus coccineus</i> N.E.Br.	Aizoaceae	Havva 25	H	eo
<i>Mesembryanthemum cordifolium</i> L.f.	Aizoaceae	Havva 26	H	eo
<i>Amaranthus deflexus</i> L.	Amaranthaceae	Havva 29	Th	nr
<i>Amaranthus retroflexus</i> L.	Amaranthaceae	Havva 28	Th	nr
<i>Amaranthus tricolor</i> L.	Amaranthaceae	Havva 27	Th	nr
<i>Celosia argentea</i> L.	Amaranthaceae	Havva 30	Th	eo
<i>Gomphrena globosa</i> L.	Amaranthaceae	Havva 31	Th	eo
<i>Hippeastrum x hortorum</i> Maatsch	Amaryllidaceae	Havva 300	G	eo
<i>Schinus molle</i> L.	Anacardiaceae	Havva 32	Ph	eo
<i>Schinus terebinthifolius</i> Raddi	Anacardiaceae	Havva 33	Ph	eo
<i>Ainsworthia trachycarpa</i> Boiss.	Apiaceae	Havva 34	Th	nr
<i>Daucus carota</i> L.	Apiaceae	Havva 35	Th	nr
<i>Daucus guttatus</i> Sm.	Apiaceae	Havva 36	Th	nr
<i>Scandix pecten-veneris</i> L.	Apiaceae	Havva 37	Th	nr
<i>Torilis nodosa</i> (L.) Gaertn.	Apiaceae	Havva 38	Th	nr
<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Havva 39	Ch	eo
<i>Nerium oleander</i> L.	Apocynaceae	Havva 40	Ph	no
<i>Thevetia peruviana</i> K. Schum.	Apocynaceae	Havva 41	Ph	eo
<i>Vinca major</i> L. 'Variegata'	Apocynaceae	Havva 42	H	eo
<i>Vinca major</i> L. subsp. <i>major</i>	Apocynaceae	Havva 43	H	no
<i>Ilex cornuta</i> Lindl. & Paxton.	Aquifoliaceae	Havva 44	Ph	eo
<i>Monstera deliciosa</i> Liebm.	Araceae	Havva 301	G	eo
<i>Hedera helix</i> L.	Araliaceae	Havva 45	Ph	no
<i>Schefflera arboricola</i> Hayata	Araliaceae	Havva 46	Ph	eo
<i>Araucaria heterophylla</i> (Salisb.) Franco	Araucariaceae	Havva 2	Ph	eo
<i>Livistona mariae</i> F.Muell.	Arecaceae	Havva 302	Ph	eo
<i>Phoenix canariensis</i> Chabaud	Arecaceae	Havva 303	Ph	eo
<i>Syagrus romanzoffiana</i> (Cham.) Glassman	Arecaceae	Havva 304	Ph	eo
<i>Washingtonia filifera</i> (Linden ex André) H.Wendl.	Arecaceae	Havva 305	Ph	eo
<i>Achillea millefolium</i> L.	Asteraceae	Havva 47	H	nr
<i>Ageratum houstonianum</i> Mill.	Asteraceae	Havva 48	Th	eo
<i>Anthemis cotula</i> L.	Asteraceae	Havva 50	Th	nr
<i>Artemisia arborescens</i> L.	Asteraceae	Havva 49	Ph	nr
<i>Bellis perennis</i> L.	Asteraceae	Havva 51	Th	nr
<i>Calendula arvensis</i> L.	Asteraceae	Havva 52	Th	nr
<i>Calendula officinalis</i> L.	Asteraceae	Havva 53	Th	no
<i>Carduus pycnocephalus</i> L. subsp. <i>albidus</i> (Bieb.) Kazmi	Asteraceae	Havva 54	Th	nr
<i>Carthamus tenuis</i> (Boiss. et C.I. Blanche) Bornm. subsp. <i>tenuis</i>	Asteraceae	Havva 55	Th	nr
<i>Centaurea calcitrapa</i> L.; subsp. <i>cilicia</i> (Boiss. & Bal.) Wagenitz	Asteraceae	Havva 57	Th	nr
<i>Centaurea solstitialis</i> L. subsp. <i>carneola</i> (Boiss.) Wagenitz	Asteraceae	Havva 56	H	nr
<i>Chrysanthemum frutescens</i> L.	Asteraceae	Havva 59	H	eo
<i>Chrysanthemum segetum</i> L.	Asteraceae	Havva 58	Th	nr
<i>Cichorium pumilum</i> Jacq.	Asteraceae	Havva 60	Th	nr
<i>Conyza canadensis</i> (L.) Cronquist	Asteraceae	Havva 61	Th	nr
<i>Coreopsis lanceolata</i> L.	Asteraceae	Havva 62	H	eo

Table 1. (Cont'd.).

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Crepis sancta</i> (L.) Babç.	Asteraceae	Havva 63	Th	nr
<i>Dahlia variabilis</i> Desf.	Asteraceae	Havva 64	Th	eo
<i>Euryops pectinatus</i> (L.) Cass.	Asteraceae	Havva 65	Ch	eo
<i>Gaillardia pulchella</i> Foug.	Asteraceae	Havva 66	H	eo
<i>Gazania rigens</i> (L.) Gaertn.	Asteraceae	Havva 67	H	eo
<i>Lactuca serriola</i> L.	Asteraceae	Havva 68	Th	eo
<i>Osteospermum ecklonis</i> (DC.) Norl.	Asteraceae	Havva 69	Ch	eo
<i>Rudbeckia hirta</i> L.	Asteraceae	Havva 70	H	eo
<i>Santolina chamaecyparissus</i> L.	Asteraceae	Havva 71	Ch	no
<i>Senecio cineraria</i> DC.	Asteraceae	Havva 73	H	no
<i>Senecio vernalis</i> Waldst. & Kit.	Asteraceae	Havva 72	Th	nr
<i>Silybum marianum</i> (L.) Gaertn.	Asteraceae	Havva 74	Th	nr
<i>Sonchus oleraceus</i> L.	Asteraceae	Havva 75	Th	nr
<i>Tagetes erecta</i> L.	Asteraceae	Havva 76	Th	no
<i>Tagetes patula</i> L.	Asteraceae	Havva 77	Th	no
<i>Tragopogon longirostris</i> Bisch. ex Schultz var. <i>longirostris</i>	Asteraceae	Havva 78	Th	nr
<i>Urospermum picroides</i> (L.) F.W. Schmidt	Asteraceae	Havva 79	Th	nr
<i>Xanthium strumarium</i> L. subsp. <i>cavenillesii</i>	Asteraceae	Havva 80	Th	nr
<i>Zinnia elegans</i> Jacq.	Asteraceae	Havva 81	Th	eo
<i>Berberis thunbergii</i> D.C.	Berberidaceae	Havva 82	Ph	eo
<i>Nandina domestica</i> Thunb.	Berberidaceae	Havva 83	Ph	eo
<i>Campsis radicans</i> (L.) Seem.	Bignoniaceae	Havva 84	Ph	eo
<i>Catalpa bignonioides</i> Walter	Bignoniaceae	Havva 85	Ph	eo
<i>Jacaranda minosifolia</i> D.Don.	Bignoniaceae	Havva 86	Ph	eo
<i>Ceiba speciosa</i> St. Hilaire	Bombacaceae	Havva 87	Ph	eo
<i>Echium italicum</i> L.	Boraginaceae	Havva 88	H	nr
<i>Echium plantagineum</i> L.	Boraginaceae	Havva 89	H	nr
<i>Heliotropium europaeum</i> L.	Boraginaceae	Havva 90	Th	nr
<i>Nonea ventricosa</i> (Sm.) Griseb.	Boraginaceae	Havva 91	Th	nr
<i>Alyssum maritimum</i> (L.) Lam.	Brassicaceae	Havva 92	Th	nr
<i>Brassica oleracea</i> L.	Brassicaceae	Havva 93	Th	nr
<i>Capsella bursa-pastoris</i> (L.) Medik.	Brassicaceae	Havva 94	Th	nr
<i>Coronopus squamatus</i> (Forssk.) Asch.	Brassicaceae	Havva 95	Th	nr
<i>Ochthodium aegyptiacum</i> (L.) DC.	Brassicaceae	Havva 96	Th	nr
<i>Raphanus raphanistrum</i> L.	Brassicaceae	Havva 97	Th	nr
<i>Sinapis arvensis</i> L.	Brassicaceae	Havva 98	Th	nr
<i>Sisymbrium officinale</i> (L.) Scop.	Brassicaceae	Havva 99	Th	nr
<i>Thlaspi perfoliatum</i> L.	Brassicaceae	Havva 100	Th	nr
<i>Aechmea fasciata</i> Baker	Bromeliaceae	Havva 306	G	eo
<i>Buxus microphylla</i> Siebold & Zucc.	Buxaceae	Havva 101	Ch	eo
<i>Opuntia ficus-indica</i> (L.) Mill.	Cactaceae	Havva 102	Ph	eo
<i>Legousia speculum-veneris</i> (L.) Chaix.	Campanulaceae	Havva 103	Th	eo
<i>Capparis spinosa</i> L. var. <i>spinosa</i>	Capparaceae	Havva 104	Ch	nr
<i>Abelia x grandiflora</i> (Rovelli ex André) Rehder	Caprifoliaceae	Havva 105	Ch	eo
<i>Lonicera etrusca</i> Santi var. <i>hispidula</i>	Caprifoliaceae	Havva 106	Ph	eo
<i>Lonicera periclymenum</i> L.	Caprifoliaceae	Havva 107	Ph	eo
<i>Viburnum lantana</i> L.	Caprifoliaceae	Havva 108	Ph	no
<i>Cerastium tomentosum</i> L.	Caryophyllaceae	Havva 109	Th	eo
<i>Dianthus barbatus</i> L.	Caryophyllaceae	Havva 110	Th	no
<i>Dianthus chinensis</i> L.	Caryophyllaceae	Havva 111	Th	eo
<i>Polycarpon tetraphyllum</i> (L.) L.	Caryophyllaceae	Havva 112	Th	nr
<i>Silene aegyptiaca</i> (L.) L. subsp. <i>aegyptiaca</i>	Caryophyllaceae	Havva 113	Th	nr
<i>Silene colorata</i> Poiret.	Caryophyllaceae	Havva 114	Th	nr
<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	Havva 115	Th	nr
<i>Casuarina equisetifolia</i> L.	Casuarinaceae	Havva 116	Ph	eo
<i>Euonymus japonica</i> Thunb.	Celastraceae	Havva 117	Ph	eo

Table 1. (Cont'd.).

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Chenopodium album</i> L. subsp. <i>album</i> var. <i>album</i>	Chenopodiaceae	Havva 118	Th	nr
<i>Setcreasea purpurea</i> Boom	Commelinaceae	Havva 307	Ch	eo
<i>Tradescantia navicularis</i> Ortgies	Commelinaceae	Havva 308	Ch	eo
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Havva 119	G	nr
<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Havva 120	Ph	eo
<i>Kalanchoe blossfeldiana</i> Poelln.	Crassulaceae	Havva 121	H	eo
<i>Kalanchoe delagoensis</i> Eckl. & Zeyh.	Crassulaceae	Havva 122	H	eo
<i>Sedum spurium</i> Bieb.	Crassulaceae	Havva 123	H	no
<i>Ecballium elaterium</i> (L.) A.Rich.	Cucurbitaceae	Havva 124	H	nr
x <i>Cupressocypris leylandii</i> (A.B. Jacks. & Dallim.) Dallim.	Cupressaceae	Havva 4	Ph	eo
<i>Cupressus arizonica</i> Greene	Cupressaceae	Havva 5	Ph	no
<i>Cupressus sempervirens</i> L.	Cupressaceae	Havva 6	Ph	no
<i>Juniperus horizontalis</i> Moench	Cupressaceae	Havva 7	Ph	eo
<i>Cuscuta australis</i> R. Br. subsp. <i>tinei</i>	Cuscutaceae	Havva 125	Th	nr
<i>Cycas revoluta</i> Thunb.	Cycadaceae	Havva 9	Ph	eo
<i>Cyperus alternifolius</i> L.	Cyperaceae	Havva 309	G	eo
<i>Cyperus rotundus</i> L.	Cyperaceae	Havva 310	G	nr
<i>Nephrolepis exaltata</i> (L.) Schott	Davalliaceae	Havva 1	H	eo
<i>Elaeagnus angustifolia</i> L.	Elaeagnaceae	Havva 126	Ph	no
<i>Erica carnea</i> L.	Ericaceae	Havva 127	Ph	eo
<i>Euphorbia chamaesyce</i> L.	Euphorbiaceae	Havva 128	Th	nr
<i>Euphorbia pulcherrima</i> Willd.	Euphorbiaceae	Havva 129	Ch	eo
<i>Euphorbia peplus</i> L. var. <i>peplus</i>	Euphorbiaceae	Havva 130	Th	nr
<i>Euphorbia supina</i> Raf.	Euphorbiaceae	Havva 131	Th	nr
<i>Mercurialis annua</i> L.	Euphorbiaceae	Havva 132	Th	nr
<i>Ricinus communis</i> L.	Euphorbiaceae	Havva 133	Ph	eo
<i>Acacia cyanophylla</i> Lindl.	Fabaceae	Havva 134	Ph	eo
<i>Acacia dealbata</i> Link	Fabaceae	Havva 135	Ph	eo
<i>Acacia horrida</i> Wild.	Fabaceae	Havva 136	Ph	eo
<i>Albizia julibrissin</i> Durazz.	Fabaceae	Havva 137	Ph	eo
<i>Alhagi mannifera</i> Desv.	Fabaceae	Havva 138	H	nr
<i>Bauhinia variegata</i> L.	Fabaceae	Havva 139	Ph	eo
<i>Caesalpinia gilliesii</i> Wall. ex Hook	Fabaceae	Havva 140	Ph	eo
<i>Ceratonia siliqua</i> L.	Fabaceae	Havva 141	Ph	no
<i>Cercis siliquastrum</i> L.	Fabaceae	Havva 142	Ph	no
<i>Coronilla parviflora</i> Willd.	Fabaceae	Havva 143	Th	nr
<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Havva 144	Ph	eo
<i>Erythrina crista-galli</i> L.	Fabaceae	Havva 145	Ph	eo
<i>Erythrina flabelliformis</i> Kearney	Fabaceae	Havva 146	Ph	eo
<i>Lathyrus cicera</i> L.	Fabaceae	Havva 147	Th	nr
<i>Medicago arborea</i> L.	Fabaceae	Havva 148	Ph	eo
<i>Medicago minima</i> (L.) Bart. var. <i>minima</i>	Fabaceae	Havva 149	Th	nr
<i>Melilotus indica</i> (L.) All.	Fabaceae	Havva 150	Th	nr
<i>Ononis viscosa</i> L. subsp. <i>brevifolia</i>	Fabaceae	Havva 151	Th	nr
<i>Parkinsonia aculeata</i> L.	Fabaceae	Havva 152	Ph	eo
<i>Prosopis farcta</i> (Banks et Sol.) Macbr.	Fabaceae	Havva 153	Ch	nr
<i>Robinia hispida</i> L.	Fabaceae	Havva 154	Ph	eo
<i>Trifolium boissieri</i> Guss.	Fabaceae	Havva 155	Th	nr
<i>Trifolium campestre</i> Schreb.	Fabaceae	Havva 156	Th	nr
<i>Trifolium cherleri</i> L.	Fabaceae	Havva 157	Th	nr
<i>Trifolium lappaceum</i> L.	Fabaceae	Havva 158	Th	nr
<i>Trifolium patens</i> Schreb.	Fabaceae	Havva 159	Th	nr
<i>Trigonella monspeliaca</i> L.	Fabaceae	Havva 160	Th	nr
<i>Vicia hybrida</i> L.	Fabaceae	Havva 161	Th	nr
<i>Vicia peregrina</i> L.	Fabaceae	Havva 162	Th	nr
<i>Wisteria sinensis</i> (Sims) Sweet	Fabaceae	Havva 163	Ph	eo

Table 1. (Cont'd.).

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Quercus cerris</i> L. var. <i>cerris</i>	Fagaceae	Havva 164	Ph	no
<i>Quercus ilex</i> L.	Fagaceae	Havva 165	Ph	no
<i>Erodium cicutarium</i> (L.) L. subsp. <i>cutarium</i>	Geraniaceae	Havva 166	Th	nr
<i>Erodium laciniatum</i> (Cav.) Wild. subsp. <i>laciniatum</i>	Geraniaceae	Havva 167	Th	nr
<i>Erodium malacoides</i> (L.) L'Her.	Geraniaceae	Havva 168	Th	nr
<i>Geranium dissectum</i> L.	Geraniaceae	Havva 169	Th	nr
<i>Pelargonium graveolens</i> L.	Geraniaceae	Havva 170	Ch	eo
<i>Pelargonium zonale</i> (L.) L.	Geraniaceae	Havva 171	Ch	eo
<i>Liquidambar orientalis</i> L.	Hamamelidaceae	Havva 172	Ph	no
<i>Aesculus hippocastanum</i> L.	Hippocastanaceae	Havva 173	H	nr
<i>Paronychia argentea</i> Lam. var. <i>argentea</i>	Illecebraceae	Havva 174	H	nr
<i>Juglans regia</i> L.	Juglandaceae	Havva 175	Ph	no
<i>Ajuga chamaepitys</i> (L.) Scrib. subsp. <i>chia</i> var. <i>chia</i>	Lamiaceae	Havva 176	Th	nr
<i>Ajuga reptans</i> L.	Lamiaceae	Havva 177	H	nr
<i>Coleus blumei</i> Benth.	Lamiaceae	Havva 178	H	eo
<i>Lamium amplexicaule</i> L.	Lamiaceae	Havva 179	Th	nr
<i>Lavandula angustifolia</i> Mill. subsp. <i>angustifolia</i>	Lamiaceae	Havva 180	Ch	no
<i>Mentha longifolia</i> (L.) Huds. subsp. <i>typhoides</i> var. <i>typhoides</i>	Lamiaceae	Havva 181	Ch	nr
<i>Rosmarinus officinalis</i> L.	Lamiaceae	Havva 182	Ch	no
<i>Salvia splendens</i> Ker Gawl.	Lamiaceae	Havva 183	Th	eo
<i>Salvia viridis</i> L.	Lamiaceae	Havva 184	Th	nr
<i>Teucrium fruticans</i> L.	Lamiaceae	Havva 185	Ch	eo
<i>Laurus nobilis</i> L.	Lauraceae	Havva 186	Ph	no
<i>Asparagus officinalis</i> L.	Liliaceae	Havva 311	G	no
<i>Asphodelus aestivus</i> Brot.	Liliaceae	Havva 315	G	nr
<i>Hyacinthus orientalis</i> L. 'Delf Blue'	Liliaceae	Havva 316	G	eo
<i>Lilium formosanum</i> Wallace	Liliaceae	Havva 312	G	eo
<i>Ophiopogon japonicus</i> (L.f.) Ker Gawl.	Liliaceae	Havva 313	G	eo
<i>Ornithogalum narbonense</i> L.	Liliaceae	Havva 314	G	nr
<i>Cuphea hyssopifolia</i> Kunth	Lythraceae	Havva 189	Ch	eo
<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Havva 187	Ph	eo
<i>Lagerstroemia indica</i> L.	Lythraceae	Havva 188	Ph	eo
<i>Liriodendron tulipifera</i> L.	Magnoliaceae	Havva 192	Ph	eo
<i>Magnolia grandiflora</i> L.	Magnoliaceae	Havva 190	Ph	eo
<i>Magnolia x soulangeana</i> Soul.-Bod.	Magnoliaceae	Havva 191	Ph	eo
<i>Hibiscus mutabilis</i> L.	Malvaceae	Havva 193	Ph	eo
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Havva 194	Ph	eo
<i>Hibiscus syriacus</i> L.	Malvaceae	Havva 195	Ph	eo
<i>Malva neglecta</i> Wallr.	Malvaceae	Havva 196	Th	nr
<i>Malva sylvestris</i> L.	Malvaceae	Havva 197	H	nr
<i>Malvaviscus arboreus</i> Dill.	Malvaceae	Havva 198	Ph	eo
<i>Malvella sherardiana</i> (L.) Jaub.	Malvaceae	Havva 199	H	nr
<i>Melia azedarach</i> L.	Meliaceae	Havva 200	Ph	eo
<i>Broussonetia papyrifera</i> (L.) Vent.	Moraceae	Havva 201	Ph	eo
<i>Ficus carica</i> L.	Moraceae	Havva 202	Ph	no
<i>Ficus elastica</i> Roxb. ex Hornem.	Moraceae	Havva 203	Ph	eo
<i>Ficus macrophylla</i> Desf.	Moraceae	Havva 204	Ph	eo
<i>Ficus microcarpa</i> L. f. var. <i>nitida</i> (King) R.R. Fernandez	Moraceae	Havva 205	Ph	eo
<i>Morus alba</i> L. 'Pendula'	Moraceae	Havva 206	Ph	eo
<i>Morus alba</i> L.	Moraceae	Havva 207	Ph	no
<i>Callistemon citrinus</i> (Curtis) Stapf	Myrtaceae	Havva 208	Ph	eo
<i>Callistemon viminalis</i> (Gaertn.) G.Don	Myrtaceae	Havva 209	Ph	eo
<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	Havva 210	Ph	eo
<i>Melaleuca armillaris</i> (Gaertn.) Sm.	Myrtaceae	Havva 211	Ph	eo
<i>Myrtus communis</i> L. subsp. <i>communis</i>	Myrtaceae	Havva 212	Ph	no
<i>Bougainvillea glabra</i> Choisy	Nyctaginaceae	Havva 213	Ph	eo

Table 1. (Cont'd.).

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Bougainvillea x buttiana</i> Holttum & Standl.	Nyctaginaceae	Havva 214	Ph	eo
<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Havva 215	H	eo
<i>Fraxinus excelsior</i> L.	Oleaceae	Havva 216	Ph	no
<i>Jasminum fruticans</i> L.	Oleaceae	Havva 217	Ph	no
<i>Jasminum nudiflorum</i> Lindl.	Oleaceae	Havva 218	Ph	eo
<i>Jasminum officinale</i> L.	Oleaceae	Havva 219	Ph	eo
<i>Ligustrum japonicum</i> Thunb.	Oleaceae	Havva 220	Ph	eo
<i>Ligustrum ovalifolium</i> Hassk.	Oleaceae	Havva 221	Ph	eo
<i>Ligustrum vulgare</i> L.	Oleaceae	Havva 222	Ph	no
<i>Olea europaea</i> L. var. <i>europaea</i>	Oleaceae	Havva 223	Ph	no
<i>Orobanche minor</i> Sm.	Orobanchaceae	Havva 224	Th	nr
<i>Oxalis articulata</i> Savigny	Oxalidaceae	Havva 225	G	eo
<i>Oxalis corniculata</i> L.	Oxalidaceae	Havva 226	H	nr
<i>Oxalis pes-caprae</i> L.	Oxalidaceae	Havva 227	G	nr
<i>Fumaria officinalis</i> L.	Papaveraceae	Havva 228	Th	nr
<i>Fumaria parviflora</i> Lam.	Papaveraceae	Havva 229	Th	nr
<i>Paliurus spina-christi</i> Mill.	Papaveraceae	Havva 230	Ph	no
<i>Papaver rhoeas</i> L.	Papaveraceae	Havva 231	Th	nr
<i>Passiflora caerulea</i> L.	Passifloraceae	Havva 232	Ph	eo
<i>Cedrus libani</i> A. Rich.	Pinaceae	Havva 13	Ph	no
<i>Pinus brutia</i> Ten.	Pinaceae	Havva 10	Ph	no
<i>Pinus halepensis</i> Mill.	Pinaceae	Havva 11	Ph	no
<i>Pinus pinea</i> L.	Pinaceae	Havva 12	Ph	no
<i>Pittosporum tobira</i> (Thunb.) Aiton	Pittosporaceae	Havva 233	Ph	eo
<i>Plantago afra</i> L.	Plantaginaceae	Havva 234	Th	nr
<i>Plantago lanceolata</i> L.	Plantaginaceae	Havva 235	H	nr
<i>Platanus orientalis</i> L.	Platanaceae	Havva 236	Ph	no
<i>Plumbago auriculata</i> Lam.	Plumbaginaceae	Havva 237	Ph	eo
<i>Alopecurus myosuroides</i> Huds. var. <i>myosuroides</i>	Poaceae	Havva 317	Th	nr
<i>Alopecurus myosuroides</i> Huds. var. <i>tonsus</i> Blanche ex Boiss.	Poaceae	Havva 318	Th	nr
<i>Arundo donax</i> L.	Poaceae	Havva 319	G	no
<i>Avena sterilis</i> L. subsp. <i>ludoviciana</i>	Poaceae	Havva 320	Th	nr
<i>Bromus madritensis</i> L.	Poaceae	Havva 321	Th	nr
<i>Bromus tectorum</i> L.	Poaceae	Havva 322	Th	nr
<i>Cortaderia selloana</i> (Schult. & Schult.f.) Asch. & Graebn.	Poaceae	Havva 323	G	eo
<i>Cynodon dactylon</i> (L.) Pers. var. <i>dactylon</i>	Poaceae	Havva 324	G	nr
<i>Echinochloa colonum</i> L.	Poaceae	Havva 325	Th	nr
<i>Hakonechloa macra</i> Makino	Poaceae	Havva 326	G	eo
<i>Hordeum bulbosum</i> L.	Poaceae	Havva 327	G	nr
<i>Hordeum murinum</i> L. subsp. <i>leporinum</i> (Link) Arc. var. <i>simulans</i> Bowden	Poaceae	Havva 328	Th	nr
<i>Lolium multiflorum</i> Lam.	Poaceae	Havva 329	Th	nr
<i>Paspalum paspalodes</i> (Michx.) Scribn.	Poaceae	Havva 330	G	nr
<i>Pennisetum setaceum</i> (Forsk.) Chiov.	Poaceae	Havva 331	G	eo
<i>Phalaris arundinacea</i> L. 'Variegatum'	Poaceae	Havva 332	G	eo
<i>Piptatherum miliaceum</i> (L.) Coss. subsp. <i>miliaceum</i>	Poaceae	Havva 333	G	nr
<i>Polypogon monspeliensis</i> (L.) Desf.	Poaceae	Havva 334	Th	nr
<i>Setaria viridis</i> (L.) P.Beauv.	Poaceae	Havva 335	Th	nr
<i>Sorghum halepense</i> (L.) Pers. var. <i>muticum</i>	Poaceae	Havva 336	G	nr
<i>Polygala myrtifolia</i> L.	Polygalaceae	Havva 238	Ph	eo
<i>Homalocladium platycladum</i> (F.J.Muell.) Bailey	Polygonaceae	Havva 240	Ch	eo
<i>Polygonum aviculare</i> L.	Polygonaceae	Havva 241	Th	nr
<i>Polygonum lapathifolium</i> L.	Polygonaceae	Havva 242	Th	nr
<i>Rumex conglomeratus</i> Murr.	Polygonaceae	Havva 239	H	nr
<i>Portulaca grandiflora</i> Hook.	Portulacaceae	Havva 243	Th	eo
<i>Portulaca oleracea</i> L.	Portulacaceae	Havva 244	Th	nr
<i>Anagallis arvensis</i> L. var. <i>arvensis</i>	Primulaceae	Havva 245	Th	nr

Table 1. (Cont'd.).

Name of species	Name of family	Voucher number	Life form	Naturalness and usage
<i>Anagallis arvensis</i> L. var. <i>caerulea</i>	Primulaceae	Havva 246	Th	nr
<i>Cyclamen persicum</i> Mill 'Bonfire'	Primulaceae	Havva 247	G	eo
<i>Primula x polyantha</i> Mill.	Primulaceae	Havva 248	Th	eo
<i>Grevillea robusta</i> A. Cunn. ex R.Br.	Proteaceae	Havva 249	Ph	eo
<i>Grevillea rosmarinifolia</i> A.Cunn.	Proteaceae	Havva 250	Ph	eo
<i>Punica granatum</i> L.	Punicaceae	Havva 251	Ph	no
<i>Punica granatum</i> L. 'Nana'	Punicaceae	Havva 252	Ph	eo
<i>Ranunculus asiaticus</i> L.	Ranunculaceae	Havva 253	Th	eo
<i>Ranunculus muricatus</i> L.	Ranunculaceae	Havva 254	Th	nr
<i>Amygdalus communis</i> L.	Rosaceae	Havva 257	Ph	no
<i>Chaenomeles speciosa</i> (Sweet) Nakai	Rosaceae	Havva 255	Ph	eo
<i>Cotoneaster adpressus</i> Boiss.	Rosaceae	Havva 258	Ph	eo
<i>Cotoneaster franchetii</i> Boiss.	Rosaceae	Havva 256	Ph	eo
<i>Cotoneaster microphyllus</i> Wall.	Rosaceae	Havva 259	Ph	eo
<i>Malus floribunda</i> Siebold	Rosaceae	Havva 260	Ph	eo
<i>Pyracantha coccinea</i> Roemer.	Rosaceae	Havva 261	Ph	eo
<i>Rosa x hybrida</i> L.	Rosaceae	Havva262	Ph	eo
<i>Rubus sanctus</i> Screb.	Rosaceae	Havva 263	Ph	nr
<i>Spiraea japonica</i> Cambess.	Rosaceae	Havva 264	Ph	eo
<i>Spiraea vanhouttei</i> (Briot) Zabel	Rosaceae	Havva 265	Ph	eo
<i>Galium aparine</i> L.	Rubiaceae	Havva 266	Th	nr
<i>Sheardia arvensis</i> L.	Rubiaceae	Havva 267	Th	nr
<i>Citrus aurantium</i> L.	Rutaceae	Havva 268	Ph	eo
<i>Populus alba</i> L.	Salicaceae	Havva 269	Ph	eo
<i>Salix alba</i> L.	Salicaceae	Havva 270	Ph	no
<i>Antirrhinum majus</i> L.	Scrophulariaceae	Havva 272	Th	eo
<i>Paulownia tomentosa</i> (Thunb.) Steud.	Scrophulariaceae	Havva 271	Ph	eo
<i>Russelia equisetiformis</i> Schlecth. & Chamb.	Scrophulariaceae	Havva 273	Ph	eo
<i>Verbascum sinuatum</i> L. var. <i>adenosepalum</i>	Scrophulariaceae	Havva 274	H	nr
<i>Veronica anagalloides</i> Guss.	Scrophulariaceae	Havva 275	Th	nr
<i>Veronica cymbalaria</i> Boiard.	Scrophulariaceae	Havva 276	Th	nr
<i>Veronica hispidula</i> Boiss. subsp. <i>hispidula</i>	Scrophulariaceae	Havva 277	Th	nr
<i>Veronica persica</i> Poirat.	Scrophulariaceae	Havva 278	Th	nr
<i>Veronica polita</i> Fries	Scrophulariaceae	Havva 279	Th	nr
<i>Ailanthus altissima</i> (Mill.) Swingle	Simaroubaceae	Havva 280	Ph	eo
<i>Lycianthes rantonnei</i> (Lesc.) Bitter	Solanaceae	Havva 282	Ph	eo
<i>Petunia x hybrida</i> Vilm.	Solanaceae	Havva 281	Th	eo
<i>Solanum nigrum</i> L.	Solanaceae	Havva 283	Th	nr
<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Havva 284	Ch	nr
<i>Brachychiton populneum</i> R.Br.	Sterculiaceae	Havva 285	Ph	eo
<i>Strelitzia reginae</i> Banks	Strelitziaceae	Havva 337	G	eo
<i>Tilia rubra</i> DC. subsp. <i>caucasica</i> (Rupr.) V. Engler	Tiliaceae	Havva 286	Ph	no
<i>Tropaeolum majus</i> L.	Tropaeolaceae	Havva 287	H	eo
<i>Celtis australis</i> L.	Ulmaceae	Havva 288	Ph	no
<i>Duranta erecta</i> L.	Verbenaceae	Havva 289	Ph	eo
<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	Havva 290	H	nr
<i>Lantana camara</i> L.	Verbenaceae	Havva 291	Ch	eo
<i>Verbena x hybrida</i> Voss ex Rümpler	Verbenaceae	Havva 292	Th	eo
<i>Verbena officinalis</i> L.	Verbenaceae	Havva 293	H	nr
<i>Verbena tenuisecta</i> Briq.	Verbenaceae	Havva 294	Ch	eo
<i>Viola tricolor</i> L.	Violaceae	Havva 295	Th	eo
<i>Viola x wittrockiana</i> Gams	Violaceae	Havva 296	Th	eo
<i>Parthenocissus quinquefolia</i> (L.) Planch.	Violaceae	Havva 297	Ph	eo
<i>Vitis vinifera</i> L.	Vitaceae	Havva 298	Ph	no
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Havva299	Th	nr

(Abbreviations: eo, exotic ornamental species for Turkey; nr, native ruderal species (weed species) for Turkey; no, native ornamental species; Th, Therophyte; Ph, Phanerophyte; Ch, Chamaephyte; H, Hemicryptophyte; G, Geophyte)

Table 2. Representation of species, genera and families in the urban flora of the city of Adana.

Class	No. of families	%	No. of genera	%	No. of species	%
Pteridopsida	1	1.07	1	0.40	1	0.30
Araucariopsida	1	1.07	1	0.40	1	0.30
Cycadopsida	1	1.07	1	0.40	1	0.30
Pinopsida	1	1.07	2	0.80	4	1.19
Cupressopsida	1	1.07	3	1.20	6	1.78
Magnoliopsida	79	84.95	207	83.13	286	84.87
Liliopsida	9	9.68	34	13.66	38	11.19
Total	93	100.00	249	100.00	337	100.00

Table 3. The families represented with 10 and more genera in the urban flora of the city of Adana.

Families	No. of species	%
Asteraceae	35	10.3
Fabaceae	30	8.9
Poaceae	20	5.9
Rosaceae	11	3.3
Lamiaceae	10	3.0
Total	106	31.4

The composition of the urban flora of the city of Adana includes 5 families with 10 or more species, where the most numerous are the family Asteraceae with 35 species, family Fabaceae with 30 species, family Poaceae with 20 species, family Rosaceae with 11 species, and the family Lamiaceae with 10 species (Table 3).

The genera including the most species are *Trifolium* (5 species), *Veronica* (5 species), *Ficus* (4 species) and *Euphorbia* (4 species).

The life-form spectrum in the present study showed predominance of phanerophytes (134 spp., 40% of the total flora), followed by therophytes (118 spp., 35%), hemicryptophytes (37 spp., 11%), geophytes (26 spp., 8%) and chamaephytes (22 spp., 6%) (Table 4).

Discussions

The phanerophytes included trees, large woody shrubs, perennial herbs and woody climbers. Therophytes (annuals) are drought evaders in the sense that the whole plant sheds during unfavorable conditions. Phanerophytes are very common in tropical areas and their number decreases towards temperate and polar areas. Therophytes are most abundant in arid climates such as regions with Mediterranean climate. In this study, high rates of phanerophytes and therophytes can be attributed human activities (Reddy & Pattanaik, 2009). Indeed, phanerophytes dominance stemmed from plantation of exotic woody ornamental plants in the research area. Phanerophytes rate of native flora in the region where the research area was 5% (Turkmen & Duzenli, 1990).

The 48% (162 taxa) of total flora in the research area is exotic species and the rest (52%) are indigenous. Total

Table 4. Life form spectrum of urban flora of Adana city.

Life form	No. of species	%
Phanerophyte	134	40
Therophyte	118	35
Hemicryptophyte	37	11
Geophyte	26	8
Chamaephyte	22	6
Total	337	100.00

flora consists of 62% (209 taxa) ornamental species and 38% (128 taxa) weed species. The native ornamental species were represented with 37 species (11%).

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