



COMPOSITION, DISTRIBUTION PATTERNS AND HABITAT DIVERGENCE OF STREET TREES IN THE GREATER CAIRO CITY, EGYPT

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ABSTRACT:

Species diversity of the tree flora of 38 districts in the Greater Cairo city was studied with reference to landscape differentiation of species make-up. Three main habitats including 14 sites with 263 sample plots were considered (35 urban parks, 76 road islands and 152 street verges). In total, 378 of vascular plant species belonging to 264 genera and 79 families were recorded in urban areas of the Greater Cairo city. The most species-rich (44.7%) families were Fabaceae (36 spp.), Asparagaceae, Poaceae (21 spp.), Moraceae (19 spp.), Asteraceae (17 spp.), Euphorbiaceae and Malvaceae (15 spp.), Arecaceae (14 spp.), Lamiaceae (11 spp.), whereas the remaining families (70) constituted together 193 species. *Ficus* (18 spp.) was the highest among the species-rich genera, followed by *Euphorbia* (11 spp.), *Asparagus*, *Brachychiton*, *Callistemon*, *Citrus* and *Pinus* (4 spp. each). 257 genera contained only 1-3 species e.g. *Cereus*, *Koelreuteria*, *Strelitzia*, *Terminalia*, *Carica* and *Toona*. Growth form spectra revealed that, the recorded trees (139 spp.) belonged to 32 families; shrubs (79 spp.) to 30 families, herbs and others (160 spp.) to 48 families.

Keywords: *Urban biodiversity, street trees, urban trees, metropolitan flora, Egypt, growth forms, green spaces.*

Introduction

The proportion of the world's population living in urban areas is increasing rapidly such that by 2030 almost two-thirds of the world's population will reside in cities (United Nations, 2007). Urban landscapes are generally dominated by human infrastructure: building (residential and industrial); transport links (roads, pavements, railways, canals); and open land required for parking vehicles and disposal

of waste. There also, sometimes substantial, areas of green space: gardens, parks, playing fields, golf courses, road verges and grounds of public institutions comprise nearly half of the land area (Baines, 1995). Urban- industrial ecosystems differ from non-urban ones in a number of ways. Most of the factors which affect ecosystems in cities (climate, soil, water conditions, human impact, etc.) are comparable

to the site conditions in non-urban areas; the combination of these factors creates unique urban-industrial ecosystems. Consequently, the city has to be regarded as a new type of environment with species compositions and habitats peculiar to urban-industrial areas (Maurer, 2002).

Biodiversity conservation in greater cities faces an uphill battle due to rapid development and urbanization (Tsai, 1999). The considerable magnitude, extent and pace of urban expansion have brought drastic habitat degradation and biodiversity losses at different scales (Czech & Krausman, 1997; Cilliers, et al., 2004; Prasad & Badarinth, 2004; McKinney, 2006). Consequently, the sustainability of towns and cities is becoming an environmental issue of increasing concern. In this regard, urban greening is of primary interest because it provides numerous ecosystem goods and services which benefit humankind (Colding et al., 2006), a key one of which is biodiversity (Jim & Chen, 2009). Biodiversity in cities provides social and biological functions to residents, including ecological balance, ecosystem services, environmental protection, outdoor recreation, aesthetic enjoyment, nature education, and refuges and dispersal centres for wildlife species (Box & Harrison, 1994; Reduron, 1996; Tsai, 2001; Cilliers et al., 2004). The sustainable development of human society could be achieved with the help of ecological sustainability, in which urban biodiversity conservation could play a useful role.

Egypt's population still grows each year by approximately 1.5 million people. United Nations projections indicate that the population will grow from 62.3 million in 1995 to 95.6 million by 2020. Increased habitat fragmentation is of particular concern in Greater Cairo city because it is located on the Nile River. Habitat loss and fragmentation are important factors

contributing to a reduction in the planet's biodiversity. Besides resource extraction in mining, fishing, and forestry, most habitat loss and fragmentation is due to urban and agricultural development (Wasylikowa et al., 1991). Urban green spaces provide sustenance for many floral and faunal species. They contribute notably to urban diversity conservation (Box & Harrison, 1994; Sukopp, 2002; Thompson et al., 2003; Smith et al., 2006). Many studies focused on plant diversity (e.g. Pyšek, 1989; Zerbe et al., 2003; Turner et al., 2005; Smith et al., 2006), others on animals (e.g. Melles et al., 2003; Shochat et al., 2004), or in both plants and animals (Angold et al., 2006).

Despite the growing acknowledgement of the importance of green spaces and trees in the urban environment, most of the research into, and understanding of, urban greening is centered on examples from the developed world, predominantly from European and North American countries, and has been investigated by many authors e.g. Wittig (2004), Loram et al. (2007), Ken (2009), and Stewart et al. (2009). In Egypt, there is a limited literature on urban greening, and even less on urban forestry, including street trees (El Hadidi and Boulos, 1988; Soliman & Amer, 2002). However, most of the vegetation studies were stressed on the Egyptian wild flora (Täckholm, 1974; Boulos & El Hadidi, 1994; El Hadidi & Fayed, 1995; Boulos, 1995; 1999; 2000; 2002; 2005 and 2009), which indirectly increased the knowledge about identification, description, and recording the wild plants. Hence there is a paucity of documentary studies on the cultivated plants in parks, avenues and urban areas generally in Egypt and specifically in the Greater Cairo.

The present study aimed at: (1) evaluating the current status of species diversity of the tree flora of selected areas in the Greater Cairo city with reference to the landscape differentiation of

species make-up; (2) application the methods of quantitative analysis of vegetation to study the arborescent components; (3) evaluating the similarity and divergence of floristic composition in three major urban green landscape types (urban parks, road islands and street verges) by using quantitative methods of community ecology; and (4) exploring the underlying interactions between human disturbance, habitat conditions and tree composition.

The study area

Egypt is divided into four major geomorphologic areas: Nile River (Valley and Delta), Western Desert, Eastern Desert, and Sinai Peninsula. The Nile Valley known as Upper Egypt extends along the Nile River from Aswan to the outskirts of Cairo, while the Nile Delta is known as Lower Egypt. The Nile Delta is a classic delta with a triangular shape situated in North Egypt where the Nile River spreads out and drains into the Mediterranean Sea. The area chosen for the present study i.e. Greater Cairo region is located at southern of the Nile Delta, 165 km south of the Mediterranean Sea and 120 km west of the Gulf of Suez and Suez Canal; between 29° 45', 30° 10' of the northern latitudes and between 31° 05' and 31° 30' of the eastern longitudes (Fig. 1). Its center (Cairo city) is found along the Nile River, immediately south of the point where the river leaves its desert-bound valley and branches into the low-lying Nile Delta region. It extends on a total area of about 717 Km² as an administrative semi-official entity including Giza city and some of its suburbs; Shubra-Al-Khaymah of the Qalyubia province. It comprises 38 districts (Fig. 1) along both banks of the Nile from Shubra-Al-Khaymah in the north to Helwan in the south (Robaa, 1999; Bondok, 2004). Shubra-Al-Khaymah and El-Qanater regions of Qalyubia province have previously been covered (Hussein, 2011 and El-

Sheikh et al., 2004, respectively) so that they are excluded from the present study.

Study area is considered as one of the world's 15 largest cities in urban and population growth, where almost 20% of all Egyptians lived in the urban agglomeration known as Greater Cairo (Robaa, 1999).

Climatically the study area is in the subtropical climatic region; the climate is a mixture between the Mediterranean and the desert, but often with high humidity due to the river valley's effect. Among the outstanding weather events are the dust and sandstorms that frequently blow in transitional seasons of spring (March to May) and autumn (September to November). In spring, hot desert depressions are known as the Khamsin depression. They are always associated with strong hot dry wind often laden with dust and sand increasing the atmospheric Pollution. In winter (December to February), the general climate of the Greater Cairo region is cold, moist and rainy while during summer (Jun to August), Cairo's climate is hot, dry and rainless (Robaa, 1999). High temperatures in winter range from 19°C to 29°C, while night-time lows drop to below 11°C, often to 5°C. In summer, the highs rarely surpass 40°C, and lows drop to about 20°C. Rainfall is sparse, but sudden showers do cause harsh flooding. The average long-term of climatic data over 10 years (from 2003-2013) for this region is obtained from Egyptian Meteorological Department, Cairo. The urbanization and industrialization have increased very rapidly in Greater Cairo, particularly in the second half of the last century causing an increase in the pollution of its atmosphere. This in turn has an effective role in intensifying the problem of contaminating Cairo's environment with various impurities and environmental hazards (Robaa & Hafez, 2002).

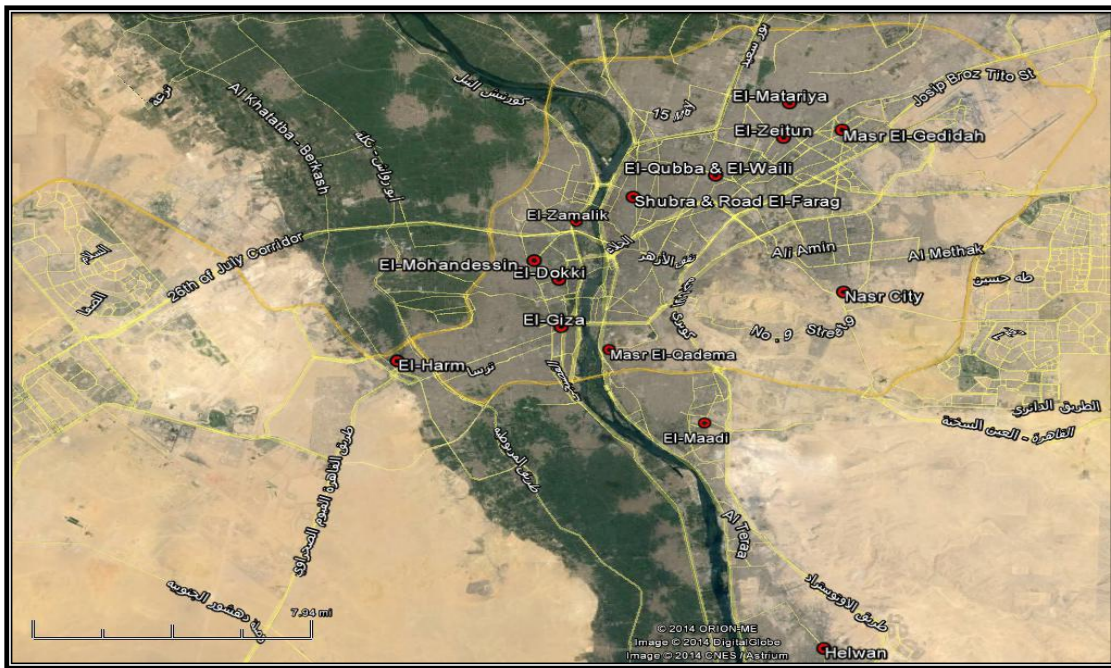


Fig. 1: Satellite image of the Greater Cairo city showing sites of the study area.

Methods

Field work and data collection

This study focused on landscape tree flora in urban area of the Greater Cairo City. Field trips were conducted to sites of the study area; each site was divided into a number of randomly selected sample plots which were surveyed periodically during the period of study from winter 2012 to summer 2014 to enumerate the growing species and record their distribution patterns. Distributed randomly, the sites were selected in different areas of both old and new suburbs to record; as much as possible; the similarity and divergence of tree communities in urban green landscape types. Three main habitats were considered: (1) street verges (SV), represented by the area of land that lies between the road edge and the property boundary; (2) road islands (RI), viz. medians and central

islands are the portion of the roadway separating opposing directions of the roadway

and represented by a planter space that located in the middle of the street; and (3) urban parks (UP), delineated open green areas are at least 2500 m², with a minimum width of 10 m, mostly dominated by vegetation and water, and generally reserved for public use, such as gardens, zoos, parks. For this purpose, 14 sites included 263 sample plots (35 urban parks, 76 road islands and 152 street verges) in the three recognized habitats were evaluated as representative samples that accommodate most landscape trees and main site variations.

The present floristic status has been described in terms of species presence/absence. Taxonomic diversity and growth forms in each

urban habitat have been also estimated and graphically compared. Specimens of the recorded taxa have been identified and checked at both the herbaria of Cairo University (CAI) and the Orman garden. Photographs were taken and vouchers are kept (excluding palms and succulents) at the Herbarium of the Biological and geological Sciences Department, Faculty of Education, Ain Shams University. Wild species nomenclature follows Täckholm (1974), Boulos & El Hadidi (1994), El Hadidi & Fayed (1995) and Boulos (1995; 1999; 2000; 2002; 2005 and 2009). Systematic and nomenclatural revisions of the recorded taxa have been aided by each of Hooker & Jackson (1893), Bailey & Bailey (1976), Huxley et al. (1992), GRIN (2012), W3Tropicos (2014).

Data analysis

A data matrix was constructed based on a binary code (presence /absence) for the scored species in the study area. Data was processed by multivariate analysis using Multivariate Statistical Package MVSP for Windows, version 3.1 (Kovack, 1999). All other statistical analyses are carried out using SPSS for windows version 10.0 (SPSS, 1999). For the classification of vegetation, cluster analysis using minimum variance as agglomeration criterion (Orloci, 1978) was applied to squared Euclidean distance dissimilarity matrix and the obtained groups are represented in a dendrogram. In order to reveal possible intrinsic patterns, vegetation ordination with Principal Coordinates Analysis (PCoA) is performed using the product-moment correlation as a coefficient. It is preferred over PCA (Principal Components Analysis) because the former performs better on data sets with missing data (Rohlf, 1972). Sites that are more similar in vegetation structure (species composition and abundance) were depicted as being closer together in the diagram.

Results

General floristic features

The study revealed a total of 378 taxa in 79 families and 264 genera of the seed plants were recorded in urban areas of the Greater Cairo city. Generally, the most species-rich families were Fabaceae (36 species), Asparagaceae and Poaceae (21 species for each), followed by Moraceae (19), Asteraceae (17), Euphorbiaceae and Malvaceae (15 species each), Arecaceae (14), Lamiaceae (11 species) and comprise about 44.7% of the recorded species. The other remaining families (70) were represented by less than ten species, and constituted together 193 species, as Bignoniaceae and Myrtaceae (9 species each), Apocynaceae and Solanaceae (8 species each), Acanthaceae and Araceae (7 species each), Brassicaceae, Cactaceae, Rutaceae and Verbenaceae (6 species each), Amaranthaceae, Anacardiaceae, Araliaceae and Rosaceae (5 species each), and Convolvulaceae, Cupressaceae, Pinaceae and Sapindaceae (4 species each). Fifty two families are represented by 1-3 species; amongst others, these families include Araucariaceae, Oleaceae, Cycadaceae, Geraniaceae, Sterculiaceae, Cannaceae and Zygophyllaceae. The present results also indicated that, *Ficus* (18 species) is the highest among the species-rich genera, followed by *Euphorbia* (11), *Asparagus*, *Brachychiton*, *Callistemon*, *Citrus* and *Pinus* (4 species each). It is noted that 257 genera contain 1-3 species only, examples of these species are: *Cereus*, *Koelreuteria*, *Strelitzia*, *Terminalia*, *Carica* and *Toona* were recorded.

Growth forms spectra (Fig. 2) revealed that, flora of the study area is classified into: trees (139 species; among them 14 were palms, 11 were conifers and two were cycads), shrubs (79), annuals (54), perennial herbs (53), succulents (22), climbers (18), tree-like (7) and cacti (6). Woody perennials (trees and shrubs)

constituted the main bulk of the flora of urban area in the Greater Cairo City (218 species) represented 57.7% of the total flora. The recorded trees belonged to 32 families; the most common are Fabaceae (24 species), Moraceae (21 species), Palmae (14), Malvaceae and Myrtaceae (9 species each). Shrubs are represented by 30 families; mostly Euphorbiaceae (9 species), Apocynaceae and Fabaceae (6 species each). On the other hand, herbs with the other remaining growth forms were represented by 160 species belonged to 48 families; of which Poaceae contributed the highest number of species (21), Asparagaceae (17) then Asteraceae (15 species).

Floristic composition of habitats

Street verges

The species compositions of street verges are collected from 14 sites to represent the plant life in this habitat. Altogether, 246 species belonging to 181 genera and 69 families are recorded (Table 1). More than 50% of these species belonged to 8 species-rich families arranged in the following sequence: Fabaceae (23 species), Moraceae, Poaceae (17 for each), Malvaceae (12), Arecaceae, Asparagaceae (11 for each), Euphorbiaceae and Lamiaceae (9 species for each). However, 44 families are represented by only 1-2 species (e.g. Nyctaginaceae, Salicaceae, Casuarinaceae, Meliaceae, Musaceae and Rhamnaceae). The genera that contained the highest number of species are *Ficus* (16), *Euphorbia* (6), *Citrus* (4), *Ceiba* and *Pinus* (3 for each). It was noted that 176 genera contained 1-2 species only (e.g., *Bauhinia*, *Bougainvillea*, *Cassia*, *Ipomoea*, *Albizia*, *Enterolobium* and *Jacaranda*).

Growth forms spectra are varied greatly in the street verges habitat where trees (103 species) showed the highest representation of the total number of recorded species (Fig. 3)

followed by shrubs (47), Perennial herbs (32), Annual herbs (31), Succulents (14), Climbers (12), Tree-like (5) and Cacti (two species). Woody perennials (trees and shrubs) constituted the main bulk (150 species) of the flora of street verges representing 61% of the total flora. The most important recorded woody perennials are *Ficus microcarpa* (P=94.1%), *Delonix regia* (P=83.6%), *Ficus benjamina* (P=75%), *Ficus elastica* var. *Decora* (P=67.8%), *Phoenix dactylifera* (P=52%) and *Morus* sp. (P=49.3%). *Canna indica* (P= 12.5%), *Phragmites australis* (P=5.3%), *Lolium perenne* and *Ruscus aculeatus* (P=3.3% each) are the most important perennial herbs. Annual herbs such as *Chenopodium murale* (P= 28.9%), *Amaranthus hybridus* (P=25%), *Sonchus oleraceus* (P=17.8%), *Euphorbia peplus* (P=16.4%), *Solanum nigrum* (P=13.2%), *Portulaca oleracea* (P=11.2%) and *Trianthema portulacastrum* (P=7.2%) were noted. Succulents, climbers and cactus plants are modestly represented such as *Yucca guatemalensis* (P=55.3%), *Euphorbia umbellata* (P=28.3%), *Sansevieria trifasciata* (P=14.5%), *Ipomoea cairica* (P=9.2%) and *Opuntia ficus-indica* (P= 0.7%).

Road islands

To recognize the species composition in road islands habitat, species are collected from 76 selected sample plots representing most of the plant life. Such plots are regularly distributed in the 14 studied sites in Greater Cairo city. Altogether 224 species of vascular plants belonging to 161 genera in 58 families are recorded; from which nine constituting most of the studied species with a percentage of 50.9%. Species-rich families are Fabaceae (22 species), Poaceae (18 species), Moraceae (15 species), Asparagaceae (13 species), Asteraceae, Euphorbiaceae (11 species each), Malvaceae (10 species), Arecaceae (8 species) and Lamiaceae (6

species). Thirty-four families are represented by 1-2 species; amongst others, Araucariaceae, Cannaceae, Geraniaceae, Lytharaceae, Meliaceae, Strelitziaceae and Tropaeolaceae were recorded. The most species-rich genera are *Ficus* (14 species), *Euphorbia* (8), *Citrus* (4), *Brachychiton*, *Cyperus* and *Yucca* (3 species each), whereas the other remaining genera are either represented by 2 or one species.

The growth forms analysis (Fig. 3) indicated that the Trees (79 spp.) are highly represented followed by Annual herbs (45 spp.), Shrubs (42 spp.), Perennial herbs (38 spp.), Succulents (13 spp.), Climbers (5 spp.), Cacti and Tree-like (1 spp. each). Woody perennials constituted the main bulk of the flora, where 121 species (54% of the total flora of the city) were recorded. The most important recorded woody perennials are *Ficus microcarpa* (P=77.6%), *Ishingtonia robusta* (P=72.4%), *Acalypha wilkesiana* (P=67.1%), *Nerium oleander* (P=64.5%), *Dodonaea viscosa* (P=56.6%), *Phoenix dactylifera* (P=52.6%), and *Delonix regia* (P=50%). Among the important perennial herbs are *Cynodon dactylon* (P=84.2%) and *Alternanthera brasiliana* (P=35.5%). The annuals included; *Amaranthus hybridus* (P=50%), *Poa annua* (P=47.4%) and *Euphorbia peplus* (P=46.1%).

Clearly, this habitat characterized by a mixture of wild and cultivated species, for example of wild species; *Amaranthus hybridus*, *Poa annua*, *Euphorbia peplus*, *Sonchus oleraceus*, *Paspalidium geminatum*, *Plantago major* and *Urtica urens*, while the cultivated species included *Ficus microcarpa*, *Washingtonia robusta*, *Nerium oleander*, *Dodonaea viscosa*, *Delonix regia*, *Hibiscus rosa-sinensis* and *Lantana camara*.

Urban parks

Thirty-five sample plots are selected to represent most of the plant life in urban park habitat. They are conducted to sites of the present study area except those of El-Matariya, El-Maadi, El-Mohandessin and El-Dokki districts. The vascular flora contained a total of 346 species from 246 genera and 77 families. The largest families in terms of the number of species are each of Fabaceae (34 species), Asparagaceae (18), Asteraceae, Poaceae (17 spp. each), Moraceae (15), Arecaceae (14), Euphorbiaceae, Malvaceae (12 spp. each) and Lamiaceae (10 species). Furthermore, 41 families comprised 1-2 species; amongst others, they include Crassulaceae, Strelitziaceae, Zamiaceae, Cucurbitaceae, Rubiaceae and Sapotaceae.

The results indicated also that the highest species-rich genera are *Ficus* (14 species), *Euphorbia* (10 species), *Callistemon*, *Pinus* and *Citrus* (4 species for each), whereas 241 genera contain 1-3 species only, examples of these species are: *Asparagus*, *Opuntia*, *Araucaria*, *Cordia*, *Terminalia*, *Vitex*, *Anisacanthus*, *Ruellia* and *Mimusops*. Analysis of the growth form spectra revealed that, the majority of the recorded species are woody perennials (57.8% of the total flora), whereas Trees comprised 127 species of the total number of recorded species followed by shrubs (73 species), Perennial herbs (51 species), Annual herbs (48 species), Succulents (20 species), Climbers (15 species), Tree-like (7 species) and Cacti (five species).

The most important recorded woody perennials are *Ficus microcarpa* (P= 94.3%), *Acalypha wilkesiana* 'Mooeri', *Delonix regia*, *Hibiscus rosa-sinensis* (P= 85.7% for each), *Platyclusus orientalis*, *Lantana camara* (P= 82.9% for each) and *Dodonaea viscosa* (P= 80%). *Cynodon dactylon* (P= 94.3%), *Plantago major* (P= 71.4%), *Alternanthera brasiliana* (P= 68.6%), *Centaurea cineraria* (P= 57.1%), *Gazania rigens* (P= 48.6%) and *Asparagus*

densiflorus (P= 42.9%) are the most important perennial herbs. Annual herbs such as *Amaranthus hybridus* (P= 85.7%), *Euphorbia peplus* (P= 82.9%), *Chenopodium murale* (P= 71.4%), *Sonchus oleraceus*, *Poa annua* (P= 68.6% each), *Oxalis corniculata* (P= 60%) and *Melilotus indicus* (P= 57.1%) were noted. Several growth forms of succulent, climber and cactus plants were modestly represented such as *Yucca aloifolia* (P= 45.7%), *Agave americana* (P= 40%), *Sansevieria trifasciata* (P= 34.3%), *Ipomoea cairica* (P= 20%) and *Opuntia ficus-indica* (P= 5.7%).

Actually, urban park habitat is marked by the presence of greatest biological diversity between all the studied habitats, it included some ornamental plants; such as *Cassia javanica* subsp. *nodosa*, *Plumeria rubra*, *Thevetia peruviana*, *Gazania rigens*, *Kalanchoe marmorata* and *Platycladus orientalis*. Also, it contained shade plants; e.g. *Ficus benghalensis*, *Ficus benjamina*, *Ficus elastica*, *Ficus religiosa*,

Melaleuca ericifolia and *Brachychiton discolor*, hedge plants; e.g. *Dodonaea viscosa*, *Duranta erecta*, *Hibiscus rosa-sinensis* and *Malvaviscus arboreus*, fruit plants; such as *Casimiroa edulis*, *Mangifera indica*, *Psidium guajava*, *Hyphaena thebaica*, *Phoenix dactylifera*, *Citrus aurantium*, *C. limon*, *C. reticulata*, *C. sinensis*, *Carica papaya*, *Musa sp.* and *Cordia sebestena*. It comprised some medicinal plants; amongst others, *Aloe vera*, *Mentha sativa*, *Rosmarinus officinalis* and *Ocimum basilicum*, poisonous plants; e.g. *Melia azedarach* and *Cynanchum acutum*, vegetables plants; for example *Solanum lycopersicum* var. *lycopersicum*, *Malva parviflora* and *Eruca sativa*. Also, it included some timber plants (e.g. *Eucalyptus camaldulensis*, *Dalbergia sissoo* and *Cassia fistula*), oil plants (e.g. *Olea europaea* var. *europaea*), and fiber plants (e.g. *Bombax ceiba* and *Ceiba pentandra*).

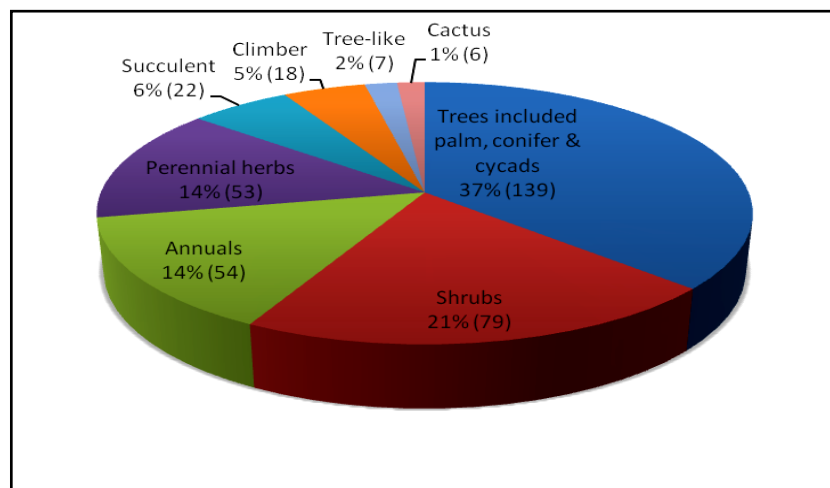


Fig. 2: General distribution pattern of the growth forms for the recorded species in the study area.

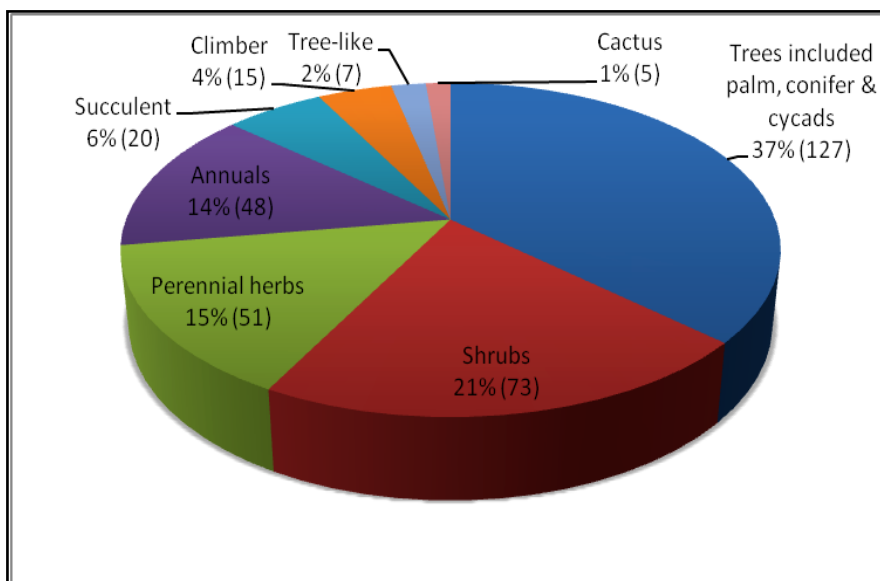
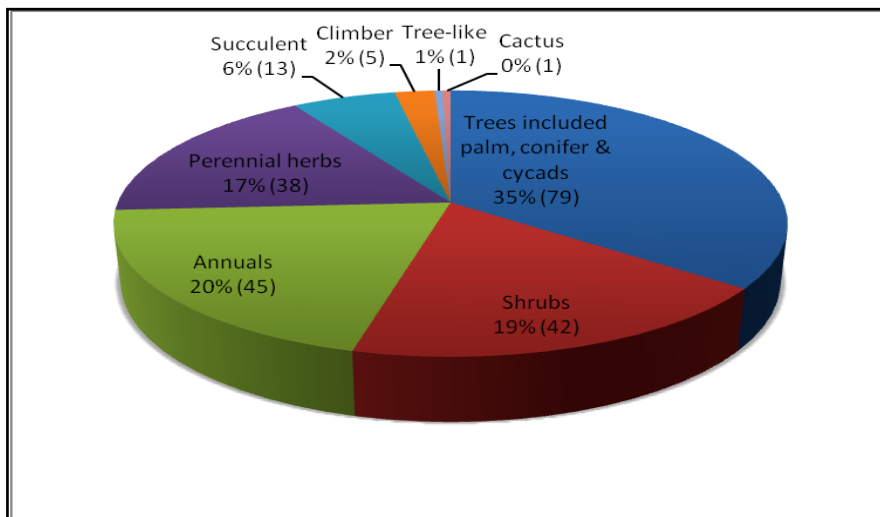
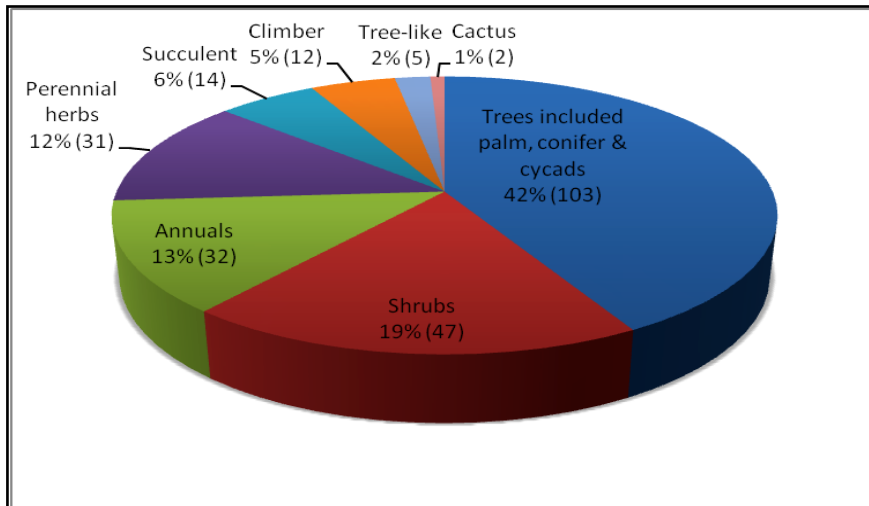


Fig. 3: Distribution patterns of the growth forms for the recorded species in the three studied urban habitats. Abbreviations: SV = Street Verges, RI = Road Island and UP = Urban Parks

General distribution patterns of species in the habitats

The total number of recorded species and species richness of the recognized habitats showed remarkable differences (Table 1). While the public gardens had the highest species number and richness (346 species), followed by street verges (246 species), the road islands had the lowest ones (224 species). Species of fifty-three families were widely distributed and represented in all the studied urban habitats. In the same time, eight families were confined to either the urban parks habitat (6) or the road islands habitat (2).

The results revealed also that some of the recorded species had wide ecological range of distribution, besides *F. microcarpa*, *Cynodon dactylon*, *Delonix regia* and *Washingtonia robusta* which are widely planted in all three habitats, 164 species were shared between them. Fifty-seven species were shared between street verges and urban parks, 38 between road islands and urban parks, and 7 species only between street verges and road islands. On the other hand, 108 species (28.6% of the total) demonstrated a certain degree of consistency, where they are exclusively recorded or confined to a certain habitat and do not penetrate elsewhere. These species are distributed as follows: 83 in the urban parks, 14 in the street verges and 11 in the road islands.

Eight different growth forms were observed in all the studied urban habitats. In general, trees are the dominant growth forms followed by shrubs and herbs.

Arborescent species constituted 37% of the total number of recorded species, mostly native to tropical, sub tropical and temperate species. The urban parks and road islands shared in high percentage of herbs (99 and 83 species respectively) comparable to street verges.

Classification of species composition in the three studied habitats by using cluster analysis based on the species percentage yielded two major vegetation groups A & B (Fig. 4). Group A can be divided into two sub groups; Group A1 comprised thirteen sites from street verges habitats and Group A2 included 14 sites of road islands and one site of street verges habitats. Group B included 14 sites from urban parks habitats. This classification of the examined habitats is confirmed by the Principal Coordinate Analysis (PCoA; Fig. 5), which demonstrated the segregation of the three groups along the first two axes. The first (eigenvalue = 2.115) and second (eigenvalue= 0.923) axes accounted of the overall floristic variance. Along PCoA axis 2, the urban parks (Group B) occupied the extreme negative end; while all of street verges except one site (group A1) are located in the extreme positive end of the same axis. The road islands and the rest site of street verges (group A2) occupied an intermediate position between groups A1 and B.

Table 1: Distribution of the recorded species in relation to the three habitats recognized in the study area, with their presence values (P%). For abbreviations, see Fig. 3.

<i>Species/Habitats</i>	UP	SV	RI
<i>Total number of sample plots</i>	35	152	76
<i>Total number of species</i>	346	246	224
<i>Ubiquitous (Species in all habitats)</i>			
<i>Ficus microcarpa L. f.</i>	94.3	94.1	77.6
<i>Cynodon dactylon (L.) Pers.</i>	94.3	4.6	84.2
<i>Delonix regia (Bojer) Raf.</i>	85.7	83.6	50
<i>Amaranthus hybridus L.</i>	85.7	25	50
<i>Hibiscus rosa-sinensis L.</i>	85.7	23	44.7
<i>Acalypha wilkesiana Müll. Arg.</i>	85.7	9.9	67.1
<i>Ishingtonia robusta H. Wendl.</i>	82.9	42.1	72.4
<i>Lantana camara L.</i>	82.9	19.7	32.9
<i>Euphorbia peplus L.</i>	82.9	16.4	46.1
<i>Platycladus orientalis (L.) Franco</i>	82.9	7.2	34.2
<i>Dodonaea viscosa (L.) Jacq.</i>	80	32.2	56.6
<i>Yucca guatemalensis Baker</i>	77.1	55.3	38.2
<i>Duranta erecta L.</i>	74.3	17.1	19.7
<i>Ficus microcarpa L. f. 'Hawaii'</i>	71.4	30.3	31.6
<i>Chenopodium murale L.</i>	71.4	28.9	43.4
<i>Nerium oleander L.</i>	71.4	26.3	64.5
<i>Justicia adhatoda L.</i>	71.4	10.5	39.5
<i>Plantago major L.</i>	71.4	0.7	25
<i>Ficus elastica Roxb. ex Hornem. Var. Decora</i>	68.6	67.8	28.9
<i>Phoenix dactylifera L.</i>	68.6	52	52.6
<i>Sonchus oleraceus L.</i>	68.6	17.8	39.5
<i>Alternanthera brasiliana (L.) Kuntze</i>	68.6	3.3	35.5
<i>Poa annua L.</i>	68.6	0.7	47.4
<i>Bougainvillea spectabilis Willd.</i>	65.7	33.6	10.5
<i>Duranta erecta L. 'variegata'</i>	62.9	4.6	14.5
<i>Psidium guajava L.</i>	60	18.4	15.8
<i>Schinus terebinthifolius Raddi</i>	60	16.4	25
<i>Oxalis corniculata L.</i>	60	5.9	31.6
<i>Acalypha wilkesiana Müll. Arg. 'Hoffmaniana'</i>	60	2.6	14.5
<i>Acalypha wilkesiana Müll. Arg.</i>	60	2	21.1
<i>Cassia javanica subsp. nodosa (Buch.-Ham ex Roxb.) K. Larsen & S. S. Larsen</i>	57.1	27.6	14.5
<i>Sisymbrium irio L.</i>	57.1	8.6	22.4
<i>Roystonea regia (Kunth) O. F. Cook</i>	57.1	7.9	10.5
<i>Melilotus indicus (L.) All.</i>	57.1	5.3	25
<i>Setaria pumila (Poir.) Roem. & Schult.</i>	57.1	4.6	21.1
<i>Centaurea cineraria L.</i>	57.1	4.6	15.8
<i>Paspalidium geminatum (Forssk.) Stapf</i>	57.1	2.6	28.9
<i>Ficus benamina L.</i>	54.3	75	42.1
<i>Ishingtonia filifera (Linden ex André) H. Wendl.</i>	54.3	25.7	31.6
<i>Trifolium resupinatum L.</i>	54.3	2	11.8
<i>Cupressus sempervirens L.</i>	54.3	1.3	2.6
<i>Jacaranda acutifolia Humb. & Bonpl.</i>	51.4	13.8	5.3
<i>Breynia disticha J. R. Forst. & G. Forst.</i>	51.4	7.9	19.7
<i>Urtica urens L.</i>	51.4	3.9	23.7
<i>Enterolobium contortisiliquum (Vell.) Morong</i>	48.6	27	19.7
<i>Senna surattensis (Burm f.) H. S. Irwin & Barneby</i>	48.6	13.8	18.4
<i>Schefflera arboricola (Hayata) Merr.</i>	48.6	11.8	3.9
<i>Portulaca oleracea L.</i>	48.6	11.2	17.1
<i>Yucca aloifolia L.</i>	45.7	3.9	7.9
<i>Morus sp.</i>	42.9	49.3	9.2
<i>Leucaena leucocephala (Lam.) de Wit</i>	42.9	46.7	19.7

<i>Cupressus macrocarpa</i> Hartw.	42.9	5.9	11.8
<i>Pelargonium graveolens</i> L'Hér.	42.9	4.6	7.9
<i>Asparagus densiflorus</i> (Kunth) Jessop	42.9	2.6	7.9
<i>Euryops pectinatus</i> (L.) Cass.	42.9	0.7	9.2
<i>Plumeria rubra</i> f. <i>tricolor</i> (Ruiz & Pav.) Woodson	40	25.7	7.9
<i>Cycas revoluta</i> Thunb.	40	11.2	3.9
<i>Agave americana</i> L.	40	9.9	21.1
<i>Ocimum basilicum</i> L.	37.1	32.9	14.5
<i>Ficus virens</i> Ait.	37.1	23	10.5
<i>Bombax ceiba</i> L.	37.1	13.8	13.2
<i>Paspalum distichum</i> L.	37.1	3.3	15.8
<i>Lolium perenne</i> L.	37.1	3.3	6.6
<i>Sansevieria trifasciata</i> Prain	34.3	14.5	5.3
<i>Solanum nigrum</i> L.	34.3	13.2	15.8
<i>Syagrus romanzoffiana</i> (Cham.) Glassman	34.3	9.2	26.3
<i>Malvaviscus arboreus</i> Cav.	34.3	3.9	10.5
<i>Convolvulus arvensis</i> L.	34.3	1.3	5.3
<i>Thevetia peruviana</i> (Pers.) K. Schum.	31.4	12.5	26.3
<i>Canna indica</i> L.	31.4	12.5	25
<i>Ficus altissima</i> Blume	31.4	12.5	3.9
<i>Trianthema portulacastrum</i> L.	31.4	7.2	7.9
<i>Malva parviflora</i> L.	31.4	3.9	19.7
<i>Lantana montevidensis</i> (Spreng.) Briq.	31.4	2.6	5.3
<i>Nerium oleander</i> L. 'variegata'	31.4	2	15.8
<i>Alcea rosea</i> L.	31.4	0.7	10.5
<i>Brachychiton populneus</i> (Schott & Endl.) R. Br.	28.6	8.6	3.9
<i>Schefflera arboricola</i> (Hayata) Merr. 'variegata'	28.6	7.2	2.6
<i>Ceiba insignis</i> (Kunth) P. E. Gibbs & Semir	28.6	6.6	5.3
<i>Araucaria heterophylla</i> (Salisb.) Franco	28.6	2	3.9
<i>Mangifera indica</i> L.	25.7	25	3.9
<i>Ficus religiosa</i> L.	25.7	15.1	1.3
<i>Tipuana tipu</i> (Benth.) Kuntze	25.7	14.5	7.9
<i>Ficus lyrata</i> Warb.	25.7	11.8	3.9
<i>Duranta erecta</i> L. var. <i>aurea</i>	25.7	7.2	15.8
<i>Agave americana</i> L. var. <i>Marginata</i>	25.7	5.9	9.2
<i>Schefflera actinophylla</i> (Endl.) Harms	25.7	2	1.3
<i>Tropaeolum majus</i> L.	25.7	1.3	7.9
<i>Strelitzia reginae</i> Aiton	25.7	1.3	2.6
<i>Eucalyptus camaldulensis</i> Dehnh.	22.9	33.6	15.8
<i>Euphorbia umbellata</i> (Pax) Bruyns	22.9	28.3	3.9
<i>Ziziphus spina-christi</i> (L.) Desf.	22.9	17.8	6.6
<i>Dracaena draco</i> (L.) L.	22.9	16.4	14.5
<i>Bauhinia variegata</i> L.	22.9	7.9	6.6
<i>Cassia fistula</i> L.	22.9	7.9	3.9
<i>Brachychiton discolor</i> F. J. Muell.	22.9	7.9	3.9
<i>Amaranthus lividus</i> L.	22.9	5.3	11.8
<i>Rosa multiflora</i> Thunb.	22.9	3.3	9.2
<i>Cordyline fruticosa</i> (L.) A. Chev.	22.9	2.6	1.3
<i>Capsella bursa-pastoris</i> (L.) Medik.	22.9	1.3	13.2
<i>Cyperus rotundus</i> L.	22.9	0.7	14.5
<i>Bauhinia purpurea</i> L.	20	10.5	7.9
<i>Ipomoea cairica</i> (L.) Sweet	20	9.2	2.6
<i>Pleiogynium cerasiferum</i> (F. Muell.) R. Parker	20	6.6	1.3
<i>Tecoma stans</i> (L.) Juss. ex Kunth	20	5.9	14.5
<i>Ruscus aculeatus</i> L.	20	3.3	1.3
<i>Citrus sinensis</i> (L.) Osbeck	20	2.6	3.9
<i>Callistemon viminalis</i> (Sol. ex Gaertn.) G. Don ex Loud.	20	2	1.3
<i>Digitaria sanguinalis</i> (L.) Scop.	20	0.7	6.6

<i>Bromus catharticus</i> Vahl	20	0.7	5.3
<i>Koeleria paniculata</i> Laxm.	17.1	15.8	5.3
<i>Pluchea dioscorides</i> (L.) DC.	17.1	7.2	13.2
<i>Ficus platyphylla</i> Delile	17.1	7.2	9.2
<i>Tradescantia pallida</i> (Rose) D. R. Hunt 'Purple heart'	17.1	5.3	1.3
<i>Citrus limon</i> (L.) Burm. f.	17.1	4.6	7.9
<i>Philodendron bipinnatifidum</i> Schott ex Endl.	17.1	3.9	1.3
<i>Catharanthus roseus</i> (L.) G. Don.	17.1	3.3	5.3
<i>Allocasuarina verticillata</i> (Lam.) L. A. S. Johnson	14.3	15.8	5.3
<i>Casimiroa edulis</i> La Llave & Lex.	14.3	11.8	2.6
<i>Ficus laurifolia</i> Hort. ex Lam.	14.3	11.2	3.9
<i>Millettia pinnata</i> (L.) Panigrahi	14.3	6.6	3.9
<i>Crinum asiaticum</i> L.	14.3	5.9	21.1
<i>Ceiba speciosa</i> (A. St.-Hil.) Ravenna	14.3	5.9	5.3
<i>Alocasia macrorrhizos</i> (L.) G. Don	14.3	5.9	1.3
<i>Citrus aurantium</i> L.	14.3	3.9	6.6
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	14.3	3.9	5.3
<i>Chenopodium album</i> L.	14.3	1.3	5.3
<i>Sphagneticola trilobata</i> (L.) Pruski	14.3	0.7	2.6
<i>Dracaena fragrans</i> (L.) Ker Gawl.	14.3	0.7	1.3
<i>Melia azedarach</i> L.	11.4	6.6	6.6
<i>Euphorbia tirucalli</i> L.	11.4	6.6	5.3
<i>Sabal palmetto</i> (Walter) Lodd. ex Schult. & Schult. f.	11.4	3.3	6.6
<i>Monstera deliciosa</i> Liebm.	11.4	3.3	1.3
<i>Ficus cyathistipula</i> Warb.	11.4	2.6	1.3
<i>Ficus lutea</i> Vahl	11.4	2.6	1.3
<i>Salvia splendens</i> F. Sellow ex Roem. & Schult.	11.4	1.3	1.3
<i>Panicum coloratum</i> L.	11.4	0.7	11.8
<i>Leptochloa fusca</i> (L.) Kunth	11.4	0.7	3.9
<i>Phalaris minor</i> Retz.	11.4	0.7	2.6
<i>Solanum lycopersicum</i> L. var. <i>lycopersicum</i>	11.4	0.7	2.6
<i>Coleus blumei</i> Benth.	11.4	0.7	1.3
<i>Euphorbia lactea</i> Haw.	8.6	9.2	5.3
<i>Hyphaena thebaica</i> (L.) Mart.	8.6	5.9	6.6
<i>Peltophorum africanum</i> Sond.	8.6	5.3	3.9
<i>Clerodendrum splendens</i> G. Don ex James	8.6	3.3	2.6
<i>Citrus reticulata</i> Blanco	8.6	1.3	1.3
<i>Pittosporum tobira</i> (Thunb.) W. T. Aiton	8.6	0.7	2.6
<i>Eragrostis pilosa</i> (L.) P. Beauv.	8.6	0.7	2.6
<i>Sansevieria cylindrica</i> Bojer ex Hook.	8.6	0.7	1.3
<i>Dalbergia sissoo</i> Roxb. ex DC.	5.7	13.8	3.9
<i>Plumeria rubra</i> f. <i>acutifolia</i> (Poir.) Woodson	5.7	4.6	2.6
<i>Albizia lebbek</i> (L.) Benth.	5.7	4.6	1.3
<i>Tribulus bimucronatus</i> Viv. var. <i>bispinulosus</i> (Kralik) Hosni	5.7	3.9	6.6
<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	5.7	3.3	1.3
<i>Callistemon citrinus</i> (Curtis) Skeels. Var. <i>splendens</i> Stapf.	5.7	2	2.6
<i>Erythrina variegata</i> L.	5.7	1.3	6.6
<i>Eruca sativa</i> Mill.	5.7	1.3	3.9
<i>Vitex trifolia</i> L. 'purpurea'	5.7	0.7	1.3
<i>Conocarpus erectus</i> L.	2.9	12.5	3.9
<i>Datura innoxia</i> Mill.	2.9	3.3	2.6
<i>Sesbania sesban</i> (L.) Merr.	2.9	2.6	2.6
<i>Kalanchoe marmorata</i> Baker	2.9	2	1.3
<i>Withania somnifera</i> (L.) Dunal	2.9	2	1.3
<i>Dichanthium annulatum</i> (Forssk.) Stapf	2.9	1.3	5.3
<i>Salix mucronata</i> Thunb.	2.9	1.3	1.3
<i>Haematoxylum campechianum</i> L.	2.9	0.7	2.6
<i>Polypogon monspeliensis</i> (L.) Desf.	2.9	0.7	2.6

<i>Luffa aegyptiaca</i> Mill.	2.9	0.7	1.3
<i>Species in two habitats</i>			
<i>Pinus roxburghii</i> Sarg.	31.4	2	0
<i>Bougainvillea glabra</i> Choisy	25.7	11.2	0
<i>Aloe vera</i> (L.) Burm. f.	22.9	8.6	0
<i>Nephtytis afzelii</i> Schott	22.9	2	0
<i>Codiaeum variegatum</i> (L.) A. Juss.	22.9	0.7	0
<i>Volkameria inermis</i> L.	20	5.3	0
<i>Strelitzia alba</i> (L. f.) Skeels	20	2	0
<i>Pinus halepensis</i> Mill.	20	0.7	0
<i>Ficus benghalensis</i> L.	17.1	4.6	0
<i>Aptenia cordifolia</i> (L.f.) Schwantes	17.1	2.6	0
<i>Xanthosoma violaceum</i> Schott	17.1	1.3	0
<i>Pelargonium zonale</i> (L.) L'Hér.	17.1	0.7	0
<i>Ceiba pentandra</i> (L.) Gaertn.	14.3	3.9	0
<i>Livistona chinensis</i> (Jacq.) R. Br. ex Mart.	14.3	2	0
<i>Pinus canariensis</i> C. Sm.	14.3	1.3	0
<i>Grevillea robusta</i> A. Cunn. ex R. Br.	14.3	0.7	0
<i>Citharexylum spinosum</i> L.	14.3	0.7	0
<i>Kigelia africana</i> (Lam.) Benth.	11.4	2	0
<i>Euonymus japonicus</i> Thunb.	11.4	2	0
<i>Nephrolepis exaltata</i> (L.) Schott	11.4	1.3	0
<i>Crinum bulbispermum</i> (Burm. f.) Milne-Redh. & Schweick.	11.4	0.7	0
<i>Vitex agnus-castus</i> L.	11.4	0.7	0
<i>Murraya paniculata</i> (L.) Jack OR <i>Murraya exotica</i> L.	11.4	0.7	0
<i>Vitis vinifera</i> L.	11.4	0.7	0
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	8.6	5.3	0
<i>Koelreuteria elegans</i> subsp. <i>formosana</i> (Hayata) F. G. Mey.	8.6	3.3	0
<i>Carica papaya</i> L.	8.6	2.6	0
<i>Bignonia binata</i> Thunb.	8.6	1.3	0
<i>Dendrocalamus giganteus</i> Munro	8.6	1.3	0
<i>Musa</i> sp.	5.7	9.9	0
<i>Jasminum grandiflorum</i> L.	5.7	9.9	0
<i>Argyrea nervosa</i> (Burm. f.) Bojer	5.7	5.9	0
<i>Conyza bonariensis</i> (L.) Cronquist	5.7	3.9	0
<i>Jasminum sambac</i> (L.) Aiton	5.7	3.9	0
<i>Olea europaea</i> L. var. <i>europaea</i>	5.7	3.9	0
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	5.7	3.9	0
<i>Cestrum diurnum</i> L.	5.7	3.9	0
<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch.	5.7	1.3	0
<i>Caryota mitis</i> Lour.	5.7	0.7	0
<i>Phoenix canariensis</i> Hort. ex Chabaud.	5.7	0.7	0
<i>Opuntia ficus-indica</i> (L.) Mill.	5.7	0.7	0
<i>Calliandra haematocephala</i> Hassk.	5.7	0.7	0
<i>Cynanchum acutum</i> L. subsp. <i>acutum</i>	2.9	2.6	0
<i>Cordia myxa</i> L.	2.9	1.3	0
<i>Tamarindus indica</i> L.	2.9	1.3	0
<i>Punica granatum</i> L. var. <i>nana</i> AGM	2.9	1.3	0
<i>Ficus cordata</i> subsp. <i>salicifolia</i> (Vahl) C. C. Berg	2.9	1.3	0
<i>Physalis angulata</i> L.	2.9	1.3	0
<i>Tamarix nilotica</i> (Ehrenb.) Bunge	2.9	1.3	0
<i>Opuntia tomentosa</i> Salm-Dyck	2.9	0.7	0
<i>Ceratonia siliqua</i> L.	2.9	0.7	0
<i>Clerodendrum speciosum</i> Dombrain	2.9	0.7	0
<i>Plumbago auriculata</i> Lam.	2.9	0.7	0
<i>Antigonon leptopus</i> Hook. & Arn.	2.9	0.7	0
<i>Prunus persica</i> (L.) Batsch (subg. <i>Amygdalus</i>)	2.9	0.7	0
<i>Ailanthus altissima</i> (Mill.) Swingle	2.9	0.7	0

<i>Cestrum parqui</i> L' Hér.	2.9	0.7	0
<i>Euphorbia forsskaolii</i> J. Gay	57.1	0	25
<i>Gazania rigens</i> (L.) Gaertn.	48.6	0	6.6
<i>Calendula officinalis</i> L.	37.1	0	7.9
<i>Tagetes erecta</i> L.	34.3	0	11.8
<i>Jacobaea maritima</i> (L.) Pelsler & Meijden	34.3	0	6.6
<i>Acalypha wilkesiana</i> Müll. Arg. 'Macrophylla'	34.3	0	6.6
<i>Acalypha wilkesiana</i> Müll. Arg. 'Marginata'	31.4	0	3.9
<i>Coronopus didymus</i> (L.) Sm.	28.6	0	14.5
<i>Lotus glaber</i> Mill.	22.9	0	14.5
<i>Coronopus squamatus</i> (Forssk.) Asch.	22.9	0	13.2
<i>Anagallis arvensis</i> L. var. <i>caerulea</i> Gouan	22.9	0	7.9
<i>Dimorphotheca ecklonis</i> DC.	20	0	3.9
<i>Anagallis arvensis</i> L. var. <i>arvensis</i>	17.1	0	10.5
<i>Myoporum laetum</i> G. Forst.	17.1	0	1.3
<i>Petunia ×atkinsiana</i> (Sweet) D. Don ex W. H. Baxter	14.3	0	6.6
<i>Justicia betonica</i> L.	14.3	0	1.3
<i>Phyla nodiflora</i> (L.) Greene	11.4	0	6.6
<i>Ruellia tuberosa</i> L.	11.4	0	3.9
<i>Eranthemum pulchellum</i> Andrews	11.4	0	1.3
<i>Schinus molle</i> L.	11.4	0	1.3
<i>Spathodea campanulata</i> P. Beauv.	11.4	0	1.3
<i>Alternanthera pungens</i> Kunth	8.6	0	13.2
<i>Lagerstroemia indica</i> L.	8.6	0	2.6
<i>Furcraea foetida</i> (L.) Haw.	8.6	0	1.3
<i>Bidens pilosa</i> L.	8.6	0	1.3
<i>Medicago intertexta</i> (L.) Mill. Var. <i>ciliaris</i> (L.) Heyn	8.6	0	1.3
<i>Cyperus alopecuroides</i> Rottb.	5.7	0	2.6
<i>Rosmarinus officinalis</i> L.	5.7	0	2.6
<i>Verbena bipinnatifida</i> Nutt.	5.7	0	2.6
<i>Cyperus laevigatus</i> L.	5.7	0	1.3
<i>Euphorbia helioscopia</i> L.	5.7	0	1.3
<i>Euphorbia heterophylla</i> L.	5.7	0	1.3
<i>Vicia sativa</i> L.	5.7	0	1.3
<i>Polyscias guilfoylei</i> (W. Bull) L. H. Bail.	2.9	0	3.9
<i>Euphorbia cotinifolia</i> L.	2.9	0	3.9
<i>Senna didymobotrya</i> (Fresen.) H. S. Irwin & Barneby	2.9	0	2.6
<i>Yucca desmetiana</i> Baker	2.9	0	1.3
<i>Zea mays</i> L.	2.9	0	1.3
<i>Ricinus communis</i> L.	0	9.2	1.3
<i>Ipomoea carnea</i> subsp. <i>fistulosa</i> (Mart. ex Choisy) D. F. Austin	0	4.6	2.6
<i>Harpephyllum caffrum</i> Bernh. ex C. Krauss	0	2.6	1.3
<i>Ficus sycomorus</i> L.	0	2	1.3
<i>Sambucus nigra</i> L.	0	1.3	1.3
<i>Calotropis procera</i> (Aiton) W. T. Aiton	0	1.3	1.3
<i>Ficus carica</i> L.	0	0.7	1.3
Species in one habitat			
<i>Ficus elastica</i> Roxb. ex Hornem.	28.6	0	0
<i>Dracaena reflexa</i> Lam.	22.9	0	0
<i>Sanchezia speciosa</i> Leonard	17.1	0	0
<i>Aspidistra elatior</i> Blume	14.3	0	0
<i>Markhamia lutea</i> (Benth.) K. Schum.	14.3	0	0
<i>Tecoma capensis</i> (Thunb.) Lindl.	14.3	0	0
<i>Zinnia elegans</i> Jacq.	11.4	0	0
<i>Terminalia muelleri</i> Benth.	11.4	0	0
<i>Asparagus falcatus</i> L.	8.6	0	0
<i>Santolina chamaecyparissus</i> L. aggr.	8.6	0	0
<i>Cycas circinalis</i> L.	8.6	0	0

<i>Acacia saligna</i> (Labill.) H. L. Wendl.	8.6	0	0
<i>Pithecellobium dulce</i> (Roxb.) Benth.	8.6	0	0
<i>Vicia faba</i> L.	8.6	0	0
<i>Pittosporum tobira</i> Ait. 'variegatum'	8.6	0	0
<i>Anisacanthus virgularis</i> Nees	5.7	0	0
<i>Carpobrotus edulis</i> (L.) N. E. Br.	5.7	0	0
<i>Acokanthera oblongifolia</i> (Hochst.) Codd	5.7	0	0
<i>Chamaerops humilis</i> L.	5.7	0	0
<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder	5.7	0	0
<i>Agave angustifolia</i> Haw.	5.7	0	0
<i>Asparagus pyramidalis</i> Kar.	5.7	0	0
<i>Dahlia pinnata</i> Cav.	5.7	0	0
<i>Gerbera jamesonii</i> Adlam	5.7	0	0
<i>Pericallis cruenta</i> (Masson ex L'Hér.) Bolle	5.7	0	0
<i>Atriplex halimus</i> L.	5.7	0	0
<i>Enterolobium cyclocarpum</i> (Jacq.) Griseb.	5.7	0	0
<i>Lathyrus odoratus</i> L.	5.7	0	0
<i>Mentha sativa</i> L.	5.7	0	0
<i>Laurus nobilis</i> L.	5.7	0	0
<i>Hibiscus rosa-sinensis</i> L. 'Butterfly Wings'	5.7	0	0
<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry	5.7	0	0
<i>Syzygium cumini</i> (L.) skeels	5.7	0	0
<i>Oxalis anthelmintica</i> A. Rich.	5.7	0	0
<i>Phlox drummondii</i> Hook.	5.7	0	0
<i>Ixora coccinea</i> L.	5.7	0	0
<i>Gomphrena globosa</i> L.	2.9	0	0
<i>Clivia miniata</i> (Lindl.) Regel	2.9	0	0
<i>Tabernaemontana divaricata</i> (L.) R. Br. ex Roem. & Schult.	2.9	0	0
<i>Epipremnum aureum</i> (Linden & André) G. S. Bunting	2.9	0	0
<i>Hedera helix</i> L.	2.9	0	0
<i>Oreopanax reticulatus</i> (Linden ex B. S. Williams) L. H. Bailey	2.9	0	0
<i>Agathis robusta</i> (C. Moore ex F. Muell.) F.M. Bailey	2.9	0	0
<i>Araucaria bidwillii</i> Hook.	2.9	0	0
<i>Ptychosperma elegans</i> (R. Br.) Blume	2.9	0	0
<i>Chlorophytum comosum</i> (Thunb.) Jacques	2.9	0	0
<i>Dolichandra unguis-cati</i> (L.) L. G. Lohmann	2.9	0	0
<i>Tabebuia rosea</i> (Bertol.) DC.	2.9	0	0
<i>Cordia sebestena</i> L.	2.9	0	0
<i>Matthiola incana</i> (L.) W.T. Aiton.	2.9	0	0
<i>Cereus hildmannianus</i> subsp. <i>uruguayanus</i> (R. Kiesling) N. P. Taylor	2.9	0	0
<i>Hylocereus undatus</i> (Haw.) Britton & Rose	2.9	0	0
<i>Opuntia stricta</i> var. <i>dillenii</i> (Ker Gawl.) L. D. Benson	2.9	0	0
<i>Kalanchoe daigremontiana</i> Raym.-Hamet & H. Perrier	2.9	0	0
<i>Portulacaria afra</i> (L.) Jacq.	2.9	0	0
<i>Ephedra aphylla</i> Forssk.	2.9	0	0
<i>Euphorbia milii</i> Des Moul.	2.9	0	0
<i>Amorpha fruticosa</i> L.	2.9	0	0
<i>Caesalpinia pulcherrima</i> (L.) Swartz.	2.9	0	0
<i>Erythrina corallodendron</i> L. var. <i>bicolor</i> Kruk.	2.9	0	0
<i>Parkinsonia aculeata</i> L.	2.9	0	0
<i>Senna surattensis</i> subsp. <i>sulfurea</i> (DC. ex Collad.) Randell	2.9	0	0
<i>Vitex trifolia</i> L.	2.9	0	0
<i>Cinnamomum verum</i> J. Presl	2.9	0	0
<i>Persea americana</i> Mill.	2.9	0	0
<i>Lawsonia inermis</i> L.	2.9	0	0
<i>Brachychiton acerifolius</i> (A. Cunn. ex G. Don) Macarthur	2.9	0	0
<i>Pterospermum acerifolium</i> (L.) Willd.	2.9	0	0
<i>Toona ciliata</i> M. Roem.	2.9	0	0

<i>Ficus drupacea</i> Thunb.	2.9	0	0
<i>Callistemon lanceolatus</i> (Sm.) Sweet	2.9	0	0
<i>Callistemon rigidus</i> R. Br.	2.9	0	0
<i>Melaleuca ericifolia</i> Sm.	2.9	0	0
<i>Phyllanthus reticulatus</i> Poir.	2.9	0	0
<i>Pinus pinea</i> L.	2.9	0	0
<i>Russelia equisetiformis</i> Schlttdl. & Cham.	2.9	0	0
<i>Malus domestica</i> Borkh. = <i>Pyrus malus</i> L.	2.9	0	0
<i>Rosa banksiae</i> W. T. Aiton	2.9	0	0
<i>Populus nigra</i> L.	2.9	0	0
<i>Sapindus saponaria</i> L.	2.9	0	0
<i>Mimusops caffra</i> E. Mey. ex A. DC.	2.9	0	0
<i>Dioon edule</i> Lindl.	2.9	0	0
<i>Zamia furfuracea</i> L.f.	2.9	0	0
<i>Salix tetrasperma</i> Roxb.	0	3.9	0
<i>Monstera obliqua</i> (Miq.) Walp.	0	3.3	0
<i>Euphorbia royleana</i> Boiss.	0	1.3	0
<i>Vachellia nilotica</i> subsp. <i>nilotica</i>	0	1.3	0
<i>Corchorus olitorius</i> L.	0	1.3	0
<i>Sorghum virgatum</i> (Hack.) Stapf	0	1.3	0
<i>Thunbergia grandiflora</i> Roxb.	0	0.7	0
<i>Carissa macrocarpa</i> (Eckl.) A. DC.	0	0.7	0
<i>Asparagus setaceus</i> (Kunth) Jessop	0	0.7	0
<i>Taxodium distichum</i> (L.) Rich.	0	0.7	0
<i>Gleditsia triacanthos</i> L.	0	0.7	0
<i>Tectona grandis</i> L. f.	0	0.7	0
<i>Abutilon hirtum</i> (Lam.) Sweet	0	0.7	0
<i>Ficus bennedykii</i> (Miq.) Miq.	0	0.7	0
<i>Agave sisalana</i> Perrine	0	0	1.3
<i>Cereus jamacaru</i> DC.	0	0	1.3
<i>Jatropha multifida</i> L.	0	0	1.3
<i>Fumaria densiflora</i> DC.	0	0	1.3
<i>Brachychiton australis</i> (Schott & Endl.) A. Terracc.	0	0	1.3
<i>Ficus macrophylla</i> Pers. (sect. <i>Malvanthera</i>)	0	0	1.3
<i>Plantago lagopus</i> L.	0	0	1.3
<i>Cenchrus biflorus</i> Roxb.	0	0	1.3
<i>Sacciolepis curvata</i> (L.) Chase	0	0	1.3
<i>Setaria verticillata</i> (L.) P. Beauv.	0	0	1.3
<i>Pentas lanceolata</i> (Forssk.) Defflers	0	0	1.3

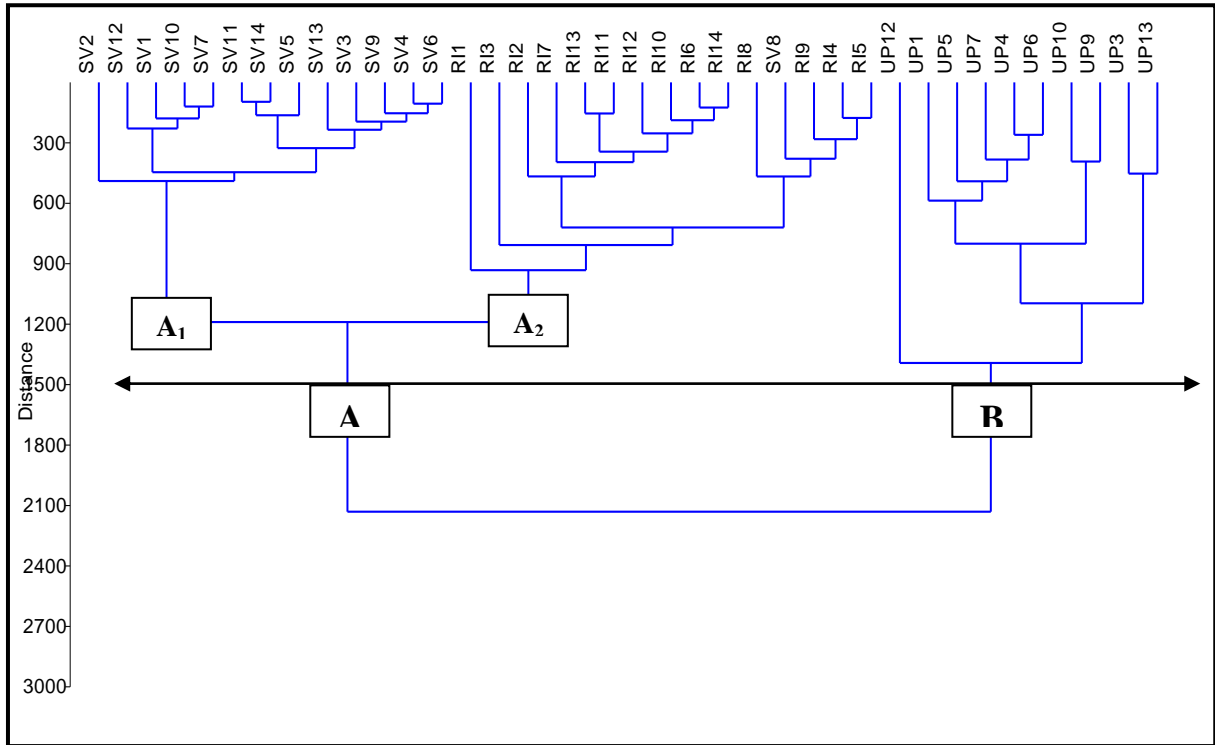


Fig. 4. Cluster analysis dendrogram of the studied habitats.

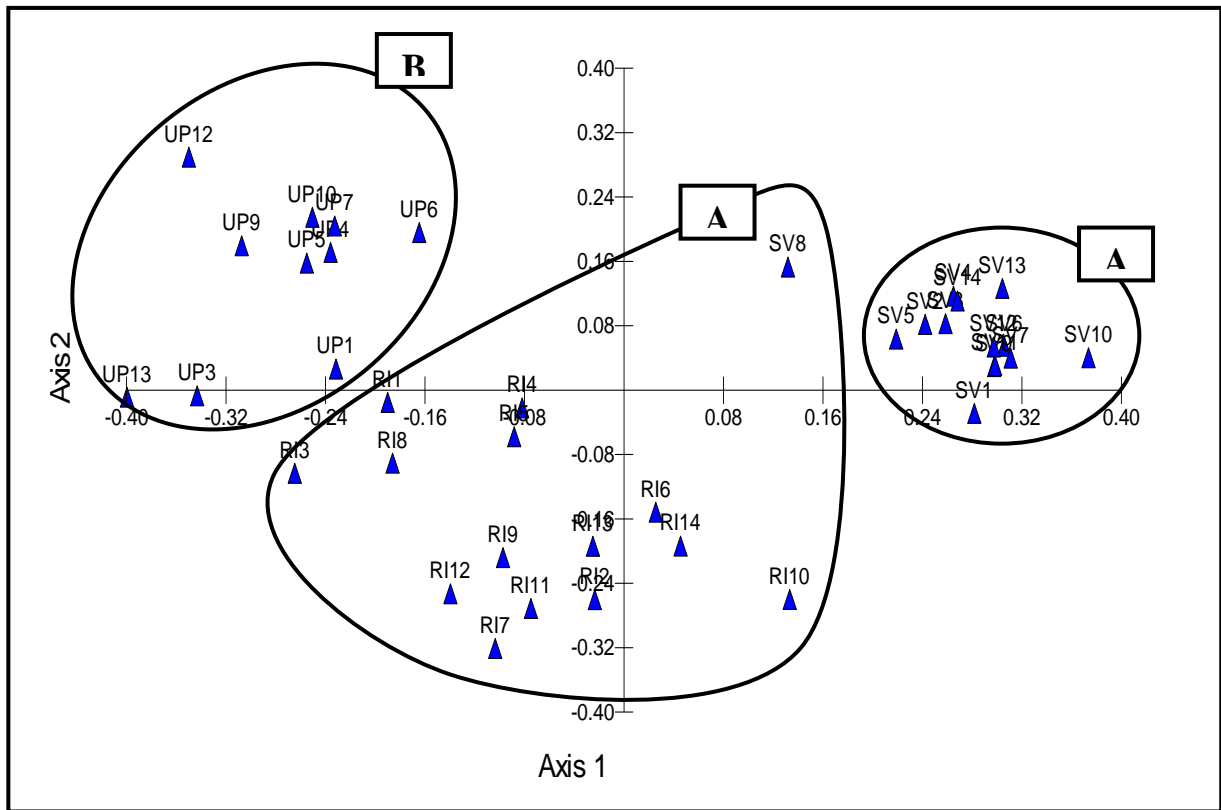


Fig. 5. Principal Coordinates Analysis (PCoA) of the three habitats, with three groups clearly separated along axes 1 and 2.

Discussion

Studies on urban ecology and biogeography have provided ample evidence of high biodiversity in urban areas. In a study on the species enrichment in urbanized areas in comparison with the surrounding countryside; Kühn, Brandl & Klotz (2004) reported that, plant diversity in urban area is higher in cities than surrounding areas. The present data are compatible with such findings as the total recorded number of vascular plants in urban area was 378 species belonging to 264 genera and 79 families. The majority of species were belonging to families: Fabaceae, Asparagaceae, Poaceae, Moraceae, Asteraceae Euphorbiaceae, Malvaceae, Arecaceae, and Lamiaceae. The most species rich genera was *Ficus* (18 species) followed by *Euphorbia* (11 species). The surrounding areas especially the agro-ecosystem of the Greater Cairo has less diversity of such genera (Hussein, 2011). Furthermore, comparison of the genera in terms of the largest number of species recorded in the present investigation and in similar studies e.g. El-Hady (2007) on the public gardens in Greater Cairo in Egypt, and El-Hady (2011) on East Cairo city; revealed the same conclusion.

Gatrell & Jensen (2002) attributed the increasing spread of trees in the urban ecosystem to their sizeable stature, wide crown, dense foliage and excellent shading effect.

A large number of species with large final dimensions, indicating their potential ability to offer a high leaf area index to bestow environmental and ecological benefits. On the other hand, El-Hady (2007; 2011) and Hamdy (2010); in their studies on the species diversity in different localities of Egypt; pointed out that, woody perennials constituted the main bulk of the flora of urban area. In the present study,

trees are the dominant growth form for the plants in the examined habitats, followed by shrubs and annuals. These data could support the conclusion of Gatrell & Jensen (2002). Furthermore, the recorded woody perennials herein represented 57.7% of total flora of the studied urban area in the Greater Cairo city (218 species). Thus, the present data is congruent with those of El-Hady (2007; 2011) and Hamdy (2010).

Previous studies on the urban ecosystem in each of the East Africa (Agnew, 1994); Taipei city, China (Jim & Chen, 2009); Sheffield, UK (Ken, 2009); Road sides between Al-Kobba and Al-Obour area, Egypt (Amin, 2011); East Cairo city (El-Hady, 2011) and Nordic cities (Sjöman et al., 2012) revealed that, the urban ecosystem is dominated by three main habitats namely street verges, road islands and urban parks, each of which has its own species diversity. In the present study, the three vegetation groups identified within the urban ecosystem of Greater Cairo City are separated along the PCoA first two axes with their indicator species: (1) group A1 inhabits the street verges. (2) Group A2 is situated in road island habitats, which represent, in most cases; either small forms (phases) or transitional areas between street verges and public gardens habitats. (3) Group B included species of common occurrence in urban park habitats. Also, the results of this study showed that the most species rich habitats are the public gardens, while street verges and road islands are the least diversified habitats. This variation in plant diversity between the studied habitats could be attributed to three main reasons, namely natural/ human factors, air pollution by heavy metals and trampling.

The natural and human factors have always been reported to have differential effects on tree diversity in different habitats (Serra et al., 2008). Generally, urban parks with site heterogeneity and multiple functions accommodate the highest richness, and streets (road island and street verges) with acute site limitations the poorest represented by plant species. Street trees serve similar environmental benefits such as air pollutant removal (McPherson et al., 1997), wildlife habitats (Clark et al., 1997) and ornamental functions (McPherson et al., 1999). Street trees are beset by a stressful growth regime; they share similar management concerns and challenges. The common physical and physiological constraints also restrict species selection. Usually, the relatively narrow roadside corridor and underground utilities severely confined tree growth in compact city environment (Jim, 1992). The heavy shading, air pollution, poor soil quality, restricted soil volume and soil compaction would exclude many species from roadside use (Bassuk & Whitlow, 1987; Jim, 1999).

Street trees habitats are subjected to continuous trampling, which may directly affect its species composition and the species richness (the number of species present). This finding agrees with the previous studies on the effects of trampling loss of vegetation cover (Agnew, 1994).

The divergence in species composition between parks and streets is conspicuous. Differences in site conditions and landscape intentions have generated marked species differentiation. Urban parks are mainly semi-natural sites with less human modifications than street habitats. The findings imply that human-oriented functions could accumulate species

diversity in urban parks to a high level. These results corroborate results obtained by Nair (1993), Eichemberg et al. (2009), and Jacob (2002). Comparing with streets, urban parks in general are blessed with a genial (a better) environment condition with subdued negative growth factors. Both site limitations and deleterious human impacts are less arresting, and more management inputs and cares are regularly introduced to foster tree performance. This tree growth regime is conducive to longevity, stability in the tree population and a general resistance to changes. Unlike the more changeable street trees, in urban parks the initial tree flora will tend to linger for decades.

Davis & Glick (1978) pointed out that, the goals of garden ecology are to create or retain a wide range of habitat, include all plant layers, preserve ecologically rich edges, and protect links between habitats such as hedges and road verges. In the present study, road islands take an intermediate position between street verges and urban parks, the species diversity of which is mainly determined by their special environmental condition. This may be due to high similarity between these two habitats, where road islands represent, in most cases; transitional areas of public gardens. They shared in high percentage of herbs (99 and 83 species respectively) comparable to street verges. The weed assemblages in the shaded, cool and humid habitats are rich in the weed species especially shade-tolerant plants such as *Euphorbia peplus* and *Oxalis corniculata* that thrive in the dense shade of these habitats. The results revealed also that some of the recorded species had wide ecological range of distribution, besides *F. microcarpa*, *Cynodon dactylon*, *Delonix regia* and *Washingtonia robusta* which

are widely planted in all three habitats, 164 species were shared between them.

The presence of ecological races suited to specific habitat conditions and the very effective vegetative spread by runners, in addition to seed production of these species may explain their wide ecological amplitude. Ramakrishnan & Singh (1966) had reached a similar conclusion. Shaltout & Sharaf El-Din (1988) reported that the flourishing of *Cynodon dactylon* in many of habitats may be related to their great plasticity under different situations; which is further supporting the present conclusion.

Conclusions and implications

One of the main constraints to conserving plant diversity is a lack of the necessary skills and knowledge in many organization and local communities. The increasing cultural disturbance could reduce natural potential and the conservation and ecological values of flora. Therefore, understanding the status and dynamics of species diversity marks the first step in nature and biodiversity conservation in urban areas. Based on our findings, we have deduced some implications to promote and preserve urban biodiversity in urban areas. On the one hand, introducing more indigenous species could create biologically rich urban forests to benefit not only humans but also the sustainability of urban ecosystems, especially for street habitats with a small species cohort. It can be concluded that, biodiversity in urban ecosystems could be enhanced by creating or enhancing a wide range of habitats, and varied habitats could be inserted in tandem with the city's development and redevelopment. Additionally, our data clarified the importance of preserving large patches of native vegetation when possible, because they are adapted to the local soil, climate, and

wildlife. New ideas and practices in urban green space design should be adopted. On a city-wide scale, plan for a maximum of no more than 52% urban land cover and more than 64% total forest cover.

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Table 2: List of vascular plant species recorded in the study area. Habitats abbreviations: SV=Street Verges, RI=Road Island and UP=Urban Parks. Figures represent the presence percentages (P%) for each species.

Families	Species	Growth form	Habitats		
			SV	RI	UP
Acanthaceae	<i>Anisacanthus virgularis</i> Nees	Shrub	0	0	5.7
	<i>Eranthemum pulchellum</i> Andrews	Shrub	0	1.3	11.4
	<i>Justicia adhatoda</i> L.	Shrub	11	39.5	71.4
	<i>Justicia betonica</i> L.	Shrub	0	1.3	14.3
	<i>Ruellia tuberosa</i> L.	Perennial herb	0	3.9	11.4
	<i>Sanchezia speciosa</i> Leonard	Shrub	0	0	17.1
	<i>Thunbergia grandiflora</i> Roxb.	Climber	0.7	0	0
Adoxaceae	<i>Sambucus nigra</i> L.	Shrub	1.3	1.3	0
Aizoaceae	<i>Aptenia cordifolia</i> (L.f.) Schwantes	Succulent	2.6	0	17.1
	<i>Carpobrotus edulis</i> (L.) N. E. Br.	Succulent	0	0	5.7
	<i>Trianthema portulacastrum</i> L.	Annual herb	7.2	7.9	31.4

Amaranthaceae	<i>Alternanthera brasiliana</i> (L.) Kuntze	Perennial herb	3.3	35.5	68.6
	<i>Alternanthera pungens</i> Kunth	Perennial herb	0	13.2	8.6
	<i>Amaranthus hybridus</i> L.	Annual herb	25	50	85.7
	<i>Amaranthus lividus</i> L.	Annual herb	5.3	11.8	22.9
	<i>Gomphrena globosa</i> L.	Annual herb	0	0	2.9
Amaryllidaceae	<i>Clivia miniata</i> (Lindl.) Regel	Perennial herb	0	0	2.9
	<i>Crinum asiaticum</i> L.	Perennial herb	5.9	21.1	14.3
	<i>Crinum bulbispermum</i> (Burm. f.) Milne-Redh. & Schweick.	Perennial herb	0.7	0	11.4
Anacardiaceae	<i>Harpephyllum caffrum</i> Bernh. ex C. Krauss	Tree	2.6	1.3	0
	<i>Mangifera indica</i> L.	Tree	25	3.9	25.7
	<i>Pleiogynium cerasiferum</i> (F. Muell.) R. Parker	Tree	6.6	1.3	20
	<i>Schinus molle</i> L.	Tree	0	1.3	11.4
	<i>Schinus terebinthifolius</i> Raddi	Tree	16	25	60
Apocynaceae	<i>Acokanthera oblongifolia</i> (Hochst.) Codd	Shrub	0	0	5.7
	<i>Calotropis procera</i> (Aiton) W. T. Aiton	Tree	1.3	1.3	0
	<i>Carissa macrocarpa</i> (Eckl.) A. DC.	Shrub	0.7	0	0
	<i>Catharanthus roseus</i> (L.) G. Don.	Perennial herb	3.3	5.3	17.1
	<i>Nerium oleander</i> L.	Shrub	26	64.5	71.4
	<i>Nerium oleander</i> L. 'variegata'	Shrub	2	15.8	31.4
	<i>Plumeria rubra</i> f. <i>acutifolia</i> (Poir.) Woodson	Tree	4.6	2.6	5.7
	<i>Plumeria rubra</i> f. <i>tricolor</i> (Ruiz & Pav.) Woodson	Tree	26	7.9	40
	<i>Tabernaemontana divaricata</i> (L.) R. Br. ex Roem. & Schult.	Shrub	0	0	2.9
	<i>Thevetia peruviana</i> (Pers.) K. Schum.	Shrub	13	26.3	31.4
Araceae	<i>Alocasia macrorrhizos</i> (L.) G. Don	Perennial herb	5.9	1.3	14.3
	<i>Epipremnum aureum</i> (Linden & André) G. S. Bunting	Climber	0	0	2.9
	<i>Monstera deliciosa</i> Liebm.	Shrub	3.3	1.3	11.4
	<i>Monstera obliqua</i> (Miq.) Walp.	Shrub	3.3	0	0
	<i>Nephtytis afzelii</i> Schott	Perennial herb	2	0	22.9
	<i>Philodendron bipinnatifidum</i> Schott ex Endl.	Shrub	3.9	1.3	17.1
	<i>Xanthosoma violaceum</i> Schott	Perennial herb	1.3	0	17.1
Araliaceae	<i>Hedera helix</i> L.	Climber	0	0	2.9
	<i>Oreopanax reticulatus</i> (Linden ex B. S. Williams) L. H. Bailey	Shrub	0	0	2.9
	<i>Polyscias guilfoylei</i> (W. Bull) L. H. Bail.	Shrub	0	3.9	2.9
	<i>Schefflera actinophylla</i> (Endl.) Harms	Tree	2	1.3	25.7
	<i>Schefflera arboricola</i> (Hayata) Merr.	Shrub	12	3.9	48.6
	<i>Schefflera arboricola</i> (Hayata) Merr. 'variegata'	Shrub	7.2	2.6	28.6
Araucariaceae	<i>Agathis robusta</i> (C. Moore ex F. Muell.) F.M. Bailey	Tree (Conifer)	0	0	2.9
	<i>Araucaria bidwillii</i> Hook.	Tree (Conifer)	0	0	2.9
	<i>Araucaria heterophylla</i> (Salisb.) Franco	Tree (Conifer)	2	3.9	28.6
Areaceae	<i>Caryota mitis</i> Lour.	Tree (Palm)	0.7	0	5.7
	<i>Chamaerops humilis</i> L.	Tree (Palm)	0	0	5.7
	<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	Tree (Palm)	3.3	1.3	5.7
	<i>Hyphaena thebaica</i> (L.) Mart.	Tree (Palm)	5.9	6.6	8.6
	<i>Livistona chinensis</i> (Jacq.) R. Br. ex Mart.	Tree (Palm)	2	0	14.3
	<i>Phoenix canariensis</i> Hort. ex Chabaud.	Tree (Palm)	0.7	0	5.7
	<i>Phoenix dactylifera</i> L.	Tree (Palm)	52	52.6	68.6
	<i>Ptychosperma elegans</i> (R. Br.) Blume	Tree (Palm)	0	0	2.9
	<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder	Tree (Palm)	0	0	5.7
	<i>Roystonea regia</i> (Kunth) O. F. Cook	Tree (Palm)	7.9	10.5	57.1
	<i>Sabal palmetto</i> (Walter) Lodd. ex Schult.&Schult. f.	Tree (Palm)	3.3	6.6	11.4
	<i>Syagrus romanzoffiana</i> (Cham.) Glassman	Tree (Palm)	9.2	26.3	34.3
	<i>Washingtonia filifera</i> (Linden ex André) H. Wendl.	Tree (Palm)	26	31.6	54.3
	<i>Washingtonia robusta</i> H. Wendl.	Tree (Palm)	42	72.4	82.9
Asclepiadaceae	<i>Cynanchum acutum</i> L. subsp. <i>acutum</i>	Perennial herb	2.6	0	2.9
Asparagaceae	<i>Agave americana</i> L.	Succulent	9.9	21.1	40

	<i>Agave americana</i> L. var. <i>marginata</i>	Succulent	5.9	9.2	25.7
	<i>Agave angustifolia</i> Haw.	Succulent	0	0	5.7
	<i>Agave sisalana</i> Perrine	Succulent	0	1.3	0
	<i>Asparagus densiflorus</i> (Kunth) Jessop	Perennial herb	2.6	7.9	42.9
	<i>Asparagus falcatus</i> L.	Climber	0	0	8.6
	<i>Asparagus pyramidalis</i> Kar.	Climber	0	0	5.7
	<i>Asparagus setaceus</i> (Kunth) Jessop	Climber	0.7	0	0
	<i>Aspidistra elatior</i> Blume	Perennial herb	0	0	14.3
	<i>Chlorophytum comosum</i> (Thunb.) Jacques	Perennial herb	0	0	2.9
	<i>Cordyline fruticosa</i> (L.) A. Chev.	Shrub	2.6	1.3	22.9
	<i>Dracaena draco</i> (L.) L.	Tree	16	14.5	22.9
	<i>Dracaena fragrans</i> (L.) Ker Gawl.	Shrub	0.7	1.3	14.3
	<i>Dracaena reflexa</i> Lam.	Shrub	0	0	22.9
	<i>Furcraea foetida</i> (L.) Haw.	Succulent	0	1.3	8.6
	<i>Ruscus aculeatus</i> L.	Perennial herb	3.3	1.3	20
	<i>Sansevieria cylindrica</i> Bojer ex Hook.	Succulent	0.7	1.3	8.6
	<i>Sansevieria trifasciata</i> Prain	Succulent	15	5.3	34.3
	<i>Yucca aloifolia</i> L.	Succulent	3.9	7.9	45.7
	<i>Yucca desmetiana</i> Baker	Succulent	0	1.3	2.9
	<i>Yucca guatemalensis</i> Baker	Succulent	55	38.2	77.1
Asteraceae (Compositae)	<i>Bidens pilosa</i> L.	Annual herb	0	1.3	8.6
	<i>Calendula officinalis</i> L.	Perennial herb	0	7.9	37.1
	<i>Centaurea cineraria</i> L.	Perennial herb	4.6	15.8	57.1
	<i>Conyza bonariensis</i> (L.) Cronquist	Annual herb	3.9	0	5.7
	<i>Dahlia pinnata</i> Cav.	Perennial herb	0	0	5.7
	<i>Dimorphotheca ecklonis</i> DC.	Annual herb	0	3.9	20
	<i>Euryops pectinatus</i> (L.) Cass.	Perennial herb	0.7	9.2	42.9
	<i>Gazania rigens</i> (L.) Gaertn.	Perennial herb	0	6.6	48.6
	<i>Gerbera jamesonii</i> Adlam	Perennial herb	0	0	5.7
	<i>Jacobaea maritima</i> (L.) Pelsers & Meijden	Perennial herb	0	6.6	34.3
	<i>Pericallis cruenta</i> (Masson ex L'Hér.) Bolle	Perennial herb	0	0	5.7
	<i>Pluchea dioscorides</i> (L.) DC.	Shrub	7.2	13.2	17.1
	<i>Santolina chamaecyparissus</i> L. aggr.	Shrub	0	0	8.6
	<i>Sonchus oleraceus</i> L.	Annual herb	18	39.5	68.6
	<i>Sphagneticola trilobata</i> (L.) Pruski	Perennial herb	0.7	2.6	14.3
	<i>Tagetes erecta</i> L.	Annual herb	0	11.8	34.3
	<i>Zinnia elegans</i> Jacq.	Perennial herb	0	0	11.4
Bignoniaceae	<i>Bignonia binata</i> Thunb.	Climber	1.3	0	8.6
	<i>Dolichandra unguis-cati</i> (L.) L. G. Lohmann	Climber	0	0	2.9
	<i>Jacaranda acutifolia</i> Humb. & Bonpl.	Tree	14	5.3	51.4
	<i>Kigelia africana</i> (Lam.) Benth.	Tree	2	0	11.4
	<i>Markhamia lutea</i> (Benth.) K. Schum.	Tree	0	0	14.3
	<i>Spathodea campanulata</i> P. Beauv.	Tree	0	1.3	11.4
	<i>Tabebuia rosea</i> (Bertol.) DC.	Tree	0	0	2.9
	<i>Tecoma capensis</i> (Thunb.) Lindl.	Shrub	0	0	14.3
	<i>Tecoma stans</i> (L.) Juss. ex Kunth	Tree	5.9	14.5	20
Boraginaceae	<i>Cordia myxa</i> L.	Tree	1.3	0	2.9
	<i>Cordia sebestena</i> L.	Shrub	0	0	2.9
Brassicaceae (Cruciferae)	<i>Capsella bursa-pastoris</i> (L.) Medik.	Annual herb	1.3	13.2	22.9
	<i>Coronopus didymus</i> (L.) Sm.	Annual herb	0	14.5	28.6
	<i>Coronopus squamatus</i> (Forssk.) Asch.	Annual herb	0	13.2	22.9
	<i>Eruca sativa</i> Mill.	Annual herb	1.3	3.9	5.7
	<i>Matthiola incana</i> (L.) W.T. Aiton.	Annual herb	0	0	2.9
	<i>Sisymbrium irio</i> L.	Annual herb	8.6	22.4	57.1
Cactaceae	<i>Cereus hildmannianus</i> subsp. <i>uruguayanus</i> (R. Kiesling) N. P. Taylor	Cactus	0	0	2.9
	<i>Cereus jamacaru</i> DC.	Cactus	0	1.3	0
	<i>Hylocereus undatus</i> (Haw.) Britton & Rose	Cactus	0	0	2.9

	<i>Opuntia ficus-indica</i> (L.) Mill.	Cactus	0.7	0	5.7
	<i>Opuntia stricta</i> var. <i>dillenii</i> (Ker Gawl.) L. D. Benson	Cactus	0	0	2.9
	<i>Opuntia tomentosa</i> Salm-Dyck	Cactus	0.7	0	2.9
Cannaceae	<i>Canna indica</i> L.	Perennial herb	13	25	31.4
Caricaceae	<i>Carica papaya</i> L.	Tree-like	2.6	0	8.6
Casuarinaceae	<i>Allocasuarina verticillata</i> (Lam.) L. A. S. Johnson	Tree	16	5.3	14.3
Celastraceae	<i>Euonymus japonicus</i> Thunb.	Tree	2	0	11.4
Chenopodiaceae	<i>Atriplex halimus</i> L.	Shrub	0	0	5.7
	<i>Chenopodium album</i> L.	Annual herb	1.3	5.3	14.3
	<i>Chenopodium murale</i> L.	Annual herb	29	43.4	71.4
Combretaceae	<i>Conocarpus erectus</i> L.	Tree	13	3.9	2.9
	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Tree	3.9	5.3	14.3
	<i>Terminalia muelleri</i> Benth.	Tree	0	0	11.4
Commelinaceae	<i>Tradescantia pallida</i> (Rose) D. R. Hunt	Perennial herb	5.3	1.3	17.1
Convolvulaceae	<i>Argyreia nervosa</i> (Burm. f.) Bojer	Climber	5.9	0	5.7
	<i>Convolvulus arvensis</i> L.	Climber	1.3	5.3	34.3
	<i>Ipomoea cairica</i> (L.) Sweet	Climber	9.2	2.6	20
	<i>Ipomoea carnea</i> subsp. <i>fistulosa</i> (Mart. ex Choisy) D. F. Austin	Climber	4.6	2.6	0
Crassulaceae	<i>Kalanchoe daigremontiana</i> Raym.-Hamet & H. Perrier	Succulent	0	0	2.9
	<i>Kalanchoe marmorata</i> Baker	Succulent	2	1.3	2.9
Cucurbitaceae	<i>Luffa aegyptiaca</i> Mill.	Climber	0.7	1.3	2.9
Cupressaceae	<i>Cupressus macrocarpa</i> Hartw.	Tree (Conifer)	5.9	11.8	42.9
	<i>Cupressus sempervirens</i> L.	Tree (Conifer)	1.3	2.6	54.3
	<i>Platycladus orientalis</i> (L.) Franco	Tree (Conifer)	7.2	34.2	82.9
	<i>Taxodium distichum</i> (L.) Rich.	Tree (Conifer)	0.7	0	0
Cycadaceae	<i>Cycas circinalis</i> L.	Tree (Cycads)	0	0	8.6
	<i>Cycas revoluta</i> Thunb.	Tree (Cycads)	11	3.9	40
Cyperaceae	<i>Cyperus alopecuroides</i> Rottb.	Perennial herb	0	2.6	5.7
	<i>Cyperus laevigatus</i> L.	Perennial herb	0	1.3	5.7
	<i>Cyperus rotundus</i> L.	Perennial herb	0.7	14.5	22.9
Didiereaceae	<i>Portulacaria afra</i> (L.) Jacq.	Succulent	0	0	2.9
Ephedraceae	<i>Ephedra aphylla</i> Forssk.	Shrub	0	0	2.9
Euphorbiaceae	<i>Acalypha wilkesiana</i> Müll. Arg.	Shrub	2	21.1	60
	<i>Acalypha wilkesiana</i> Müll. Arg. 'Hoffmaniana'	Shrub	2.6	14.5	60
	<i>Acalypha wilkesiana</i> Müll. Arg. 'Macrophylla'	Shrub	0	6.6	34.3
	<i>Acalypha wilkesiana</i> Müll. Arg. 'Marginata'	Shrub	0	3.9	31.4
	<i>Acalypha wilkesiana</i> Müll. Arg. 'Mooeri'	Shrub	9.9	67.1	85.7
	<i>Codiaeum variegatum</i> (L.) A. Juss.	Shrub	0.7	0	22.9
	<i>Euphorbia cotinifolia</i> L.	Shrub	0	3.9	2.9
	<i>Euphorbia forsskaolii</i> J. Gay	Annual herb	0	25	57.1
	<i>Euphorbia helioscopia</i> L.	Annual herb	0	1.3	5.7
	<i>Euphorbia heterophylla</i> L.	Annual herb	0	1.3	5.7
	<i>Euphorbia lactea</i> Haw.	Succulent	9.2	5.3	8.6
	<i>Euphorbia milii</i> Des Moul.	Succulent	0	0	2.9
	<i>Euphorbia peplus</i> L.	Annual herb	16	46.1	82.9
	<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch.	Succulent	1.3	0	5.7
	<i>Euphorbia royleana</i> Boiss.	Succulent	1.3	0	0
	<i>Euphorbia tirucalli</i> L.	Succulent	6.6	5.3	11.4
	<i>Euphorbia umbellata</i> (Pax) Bruyns	Succulent	28	3.9	22.9
	<i>Jatropha multifida</i> L.	Shrub	0	1.3	0
	<i>Ricinus communis</i> L.	Shrub	9.2	1.3	0
Fabaceae	<i>Acacia saligna</i> (Labill.) H. L. Wendl.	Tree	0	0	8.6
	<i>Albizia lebbek</i> (L.) Benth.	Tree	4.6	1.3	5.7
	<i>Amorpha fruticosa</i> L.	Shrub	0	0	2.9
	<i>Bauhinia purpurea</i> L.	Tree	11	7.9	20

	<i>Bauhinia variegata</i> L.	Tree	7.9	6.6	22.9
	<i>Caesalpinia pulcherrima</i> (L.) Swartz.	Shrub	0	0	2.9
	<i>Calliandra haematocephala</i> Hassk.	Shrub	0.7	0	5.7
	<i>Cassia fistula</i> L.	Tree	7.9	3.9	22.9
	<i>Cassia javanica</i> subsp. <i>nodosa</i> (Buch.-Ham ex Roxb.) K. Larsen & S. S. Larsen	Tree	28	14.5	57.1
	<i>Ceratonia siliqua</i> L.	Tree	0.7	0	2.9
	<i>Dalbergia sissoo</i> Roxb. ex DC.	Tree	14	3.9	5.7
	<i>Delonix regia</i> (Bojer) Raf.	Tree	84	50	85.7
	<i>Enterolobium contortisiliquum</i> (Vell.) Morong	Tree	27	19.7	48.6
	<i>Enterolobium cyclocarpum</i> (Jacq.) Griseb.	Tree	0	0	5.7
	<i>Erythrina corallodendron</i> L. var. <i>bicolor</i> Kruk.	Tree	0	0	2.9
	<i>Erythrina variegata</i> L.	Tree	1.3	6.6	5.7
	<i>Gleditsia triacanthos</i> L.	Tree	0.7	0	0
	<i>Haematoxylum campechianum</i> L.	Tree	0.7	2.6	2.9
	<i>Lathyrus odoratus</i> L.	Climber	0	0	5.7
	<i>Leucaena leucocephala</i> (Lam.) de Wit	Tree	47	19.7	42.9
	<i>Lotus glaber</i> Mill.	Annual herb	0	14.5	22.9
	<i>Medicago intertexta</i> (L.) Mill. Var. <i>ciliaris</i> (L.) Heyn	Perennial herb	0	1.3	8.6
	<i>Melilotus indicus</i> (L.) All.	Annual herb	5.3	25	57.1
	<i>Millettia pinnata</i> (L.) Panigrahi	Tree	6.6	3.9	14.3
	<i>Parkinsonia aculeata</i> L.	Tree	0	0	2.9
	<i>Peltophorum africanum</i> Sond.	Tree	5.3	3.9	8.6
	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Tree	0	0	8.6
	<i>Senna didymobotrya</i> (Fresen.) H. S. Irwin & Barneby	Shrub	0	2.6	2.9
	<i>Senna surattensis</i> (Burm f.) H. S. Irwin & Barneby	Shrub	14	18.4	48.6
	<i>Senna surattensis</i> subsp. <i>sulfurea</i> (DC. ex Collad.) Randell	Shrub	0	0	2.9
	<i>Sesbania sesban</i> (L.) Merr.	Tree	2.6	2.6	2.9
	<i>Tamarindus indica</i> L.	Tree	1.3	0	2.9
	<i>Tipuana tipu</i> (Benth.) Kuntze	Tree	15	7.9	25.7
	<i>Trifolium resupinatum</i> L.	Annual herb	2	11.8	54.3
	<i>Vachellia nilotica</i> subsp. <i>nilotica</i>	Tree	1.3	0	0
	<i>Vicia faba</i> L.	Annual herb	0	0	8.6
	<i>Vicia sativa</i> L.	Annual herb	0	1.3	5.7
Fumariaceae	<i>Fumaria densiflora</i> DC.	Annual herb	0	1.3	0
Geraniaceae	<i>Pelargonium graveolens</i> L'Hér.	Shrub	4.6	7.9	42.9
	<i>Pelargonium zonale</i> (L.) L'Hér.	Perennial herb	0.7	0	17.1
Lamiaceae	<i>Clerodendrum ×speciosum</i> Dombrain	Shrub	0.7	0	2.9
	<i>Clerodendrum splendens</i> G. Don ex James	Climber	3.3	2.6	8.6
	<i>Coleus blumei</i> Benth.	Perennial herb	0.7	1.3	11.4
	<i>Mentha sativa</i> L.	Perennial herb	0	0	5.7
	<i>Ocimum basilicum</i> L.	Perennial herb	33	14.5	37.1
	<i>Rosmarinus officinalis</i> L.	Perennial herb	0	2.6	5.7
	<i>Salvia splendens</i> F. Sellow ex Roem. & Schult.	Perennial herb	1.3	1.3	11.4
	<i>Tectona grandis</i> L. f.	Tree	0.7	0	0
	<i>Vitex agnus-castus</i> L.	Shrub	0.7	0	11.4
	<i>Vitex trifolia</i> L.	Shrub	0	0	2.9
	<i>Vitex trifolia</i> L. 'purpurea'	Shrub	0.7	1.3	5.7
	<i>Volkameria inermis</i> L.	Shrub	5.3	0	20
Lauraceae	<i>Cinnamomum verum</i> J. Presl	Tree	0	0	2.9
	<i>Laurus nobilis</i> L.	Tree	0	0	5.7
	<i>Persea americana</i> Mill.	Tree	0	0	2.9
Lythraceae	<i>Lagerstroemia indica</i> L.	Shrub	0	2.6	8.6
	<i>Lawsonia inermis</i> L.	Shrub	0	0	2.9
	<i>Punica granatum</i> L. var. <i>nana</i> AGM	Shrub	1.3	0	2.9
Malvaceae	<i>Abutilon hirtum</i> (Lam.) Sweet	Shrub	0.7	0	0
	<i>Alcea rosea</i> L.	Perennial herb	0.7	10.5	31.4

	<i>Bombax ceiba</i> L.	Tree	14	13.2	37.1
	<i>Brachychiton acerifolius</i> (A. Cunn. ex G. Don)	Tree	0	0	2.9
	Macarthur				
	<i>Brachychiton australis</i> (Schott & Endl.) A. Terracc.	Tree	0	1.3	0
	<i>Brachychiton discolor</i> F. J. Muell.	Tree	7.9	3.9	22.9
	<i>Brachychiton populneus</i> (Schott & Endl.) R. Br.	Tree	8.6	3.9	28.6
	<i>Ceiba insignis</i> (Kunth) P. E. Gibbs & Semir	Tree	6.6	5.3	28.6
	<i>Ceiba pentandra</i> (L.) Gaertn.	Tree	3.9	0	14.3
	<i>Ceiba speciosa</i> (A. St.-Hil.) Ravenna	Tree	5.9	5.3	14.3
	<i>Corchorus olerius</i> L.	Annual herb	1.3	0	0
	<i>Hibiscus rosa-sinensis</i> L.	Shrub	23	44.7	85.7
	<i>Hibiscus rosa-sinensis</i> L. 'Butterfly Wings'	Shrub	0	0	5.7
	<i>Malva parviflora</i> L.	Annual herb	3.9	19.7	31.4
	<i>Malvaviscus arboreus</i> Cav.	Shrub	3.9	10.5	34.3
	<i>Pterospermum acerifolium</i> (L.) Willd.	Tree	0	0	2.9
Meliaceae	<i>Melia azedarach</i> L.	Tree	6.6	6.6	11.4
	<i>Toona ciliata</i> M. Roem.	Tree	0	0	2.9
Moraceae	<i>Ficus altissima</i> Blume	Tree	13	3.9	31.4
	<i>Ficus benghalensis</i> L.	Tree	4.6	0	17.1
	<i>Ficus benjamina</i> L.	Tree	75	42.1	54.3
	<i>Ficus bennedykii</i> (Miq.) Miq.	Tree	0.7	0	0
	<i>Ficus carica</i> L.	Tree	0.7	1.3	0
	<i>Ficus cordata</i> subsp. <i>salicifolia</i> (Vahl) C. C. Berg	Tree	1.3	0	2.9
	<i>Ficus cyathistipula</i> Warb.	Tree	2.6	1.3	11.4
	<i>Ficus drupacea</i> Thunb.	Tree	0	0	2.9
	<i>Ficus elastica</i> Roxb. ex Hornem.	Tree	0	0	28.6
	<i>Ficus elastica</i> Roxb. ex Hornem. Var. <i>Decora</i>	Tree	68	28.9	68.6
	<i>Ficus laurifolia</i> Hort. ex Lam.	Tree	11	3.9	14.3
	<i>Ficus lutea</i> Vahl	Tree	2.6	1.3	11.4
	<i>Ficus lyrata</i> Warb.	Tree	12	3.9	25.7
	<i>Ficus macrophylla</i> Pers.	Tree	0	1.3	0
	<i>Ficus microcarpa</i> L. f.	Tree	94	77.6	94.3
	<i>Ficus microcarpa</i> L. f. 'Hawaii'	Tree	30	31.6	71.4
	<i>Ficus platyphylla</i> Delile	Tree	7.2	9.2	17.1
	<i>Ficus religiosa</i> L.	Tree	15	1.3	25.7
	<i>Ficus sycomorus</i> L.	Tree	2	1.3	0
	<i>Ficus virens</i> Ait.	Tree	23	10.5	37.1
	<i>Morus</i> sp.	Tree	49	9.2	42.9
Musaceae	<i>Musa</i> sp.	Tree-like	9.9	0	5.7
Myrtaceae	<i>Callistemon citrinus</i> (Curtis) Skeels. var. <i>splendens</i>	Tree	2	2.6	5.7
	Stapf.				
	<i>Callistemon lanceolatus</i> (Sm.) Sweet	Tree	0	0	2.9
	<i>Callistemon rigidus</i> R. Br.	Tree	0	0	2.9
	<i>Callistemon viminalis</i> (Sol. ex Gaertn.) G. Don ex Loud.	Tree	2	1.3	20
	<i>Eucalyptus camaldulensis</i> Dehnh.	Tree	34	15.8	22.9
	<i>Melaleuca ericifolia</i> Sm.	Tree	0	0	2.9
	<i>Psidium guajava</i> L.	Tree	18	15.8	60
	<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry	Tree	0	0	5.7
	<i>Syzygium cumini</i> (L.) skeels	Tree	0	0	5.7
Nephrolepidaceae	<i>Nephrolepis exaltata</i> (L.) Schott	Perennial herb	1.3	0	11.4
Nyctaginaceae	<i>Bougainvillea glabra</i> Choisy	Shrub	11	0	25.7
	<i>Bougainvillea spectabilis</i> Willd.	Shrub	34	10.5	65.7
Oleaceae	<i>Jasminum grandiflorum</i> L.	Shrub	9.9	0	5.7
	<i>Jasminum sambac</i> (L.) Aiton	Climber	3.9	0	5.7
	<i>Olea europaea</i> L. var. <i>europaea</i>	Tree	3.9	0	5.7
Oxalidaceae	<i>Oxalis anthelmintica</i> A. Rich.	Annual herb	0	0	5.7
	<i>Oxalis corniculata</i> L.	Annual herb	5.9	31.6	60
Phyllanthaceae	<i>Breynia disticha</i> J. R. Forst. & G. Forst.	Shrub	7.9	19.7	51.4
	<i>Phyllanthus reticulatus</i> Poir.	Shrub	0	0	2.9

Pinaceae	<i>Pinus canariensis</i> C. Sm.	Tree (Conifer)	1.3	0	14.3
	<i>Pinus halepensis</i> Mill.	Tree (Conifer)	0.7	0	20
	<i>Pinus pinea</i> L.	Tree (Conifer)	0	0	2.9
	<i>Pinus roxburghii</i> Sarg.	Tree (Conifer)	2	0	31.4
Pittosporaceae	<i>Pittosporum tobira</i> Ait. 'variegatum'	Shrub	0	0	8.6
	<i>Pittosporum tobira</i> (Thunb.) W. T. Aiton	Shrub	0.7	2.6	8.6
Plantaginaceae	<i>Plantago lagopus</i> L.	Annual herb	0	1.3	0
	<i>Plantago major</i> L.	Perennial herb	0.7	25	71.4
	<i>Russelia equisetiformis</i> Schlttdl. & Cham.	Shrub	0	0	2.9
Plumbaginaceae	<i>Plumbago auriculata</i> Lam.	Shrub	0.7	0	2.9
Poaceae	<i>Bromus catharticus</i> Vahl	Perennial herb	0.7	5.3	20
	<i>Cenchrus biflorus</i> Roxb.	Perennial herb	0	1.3	0
	<i>Cynodon dactylon</i> (L.) Pers.	Perennial herb	4.6	84.2	94.3
	<i>Dendrocalamus giganteus</i> Munro	Tree-like	1.3	0	8.6
	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Perennial herb	1.3	5.3	2.9
	<i>Digitaria sanguinalis</i> (L.) Scop.	Annual herb	0.7	6.6	20
	<i>Eragrostis pilosa</i> (L.) P. Beauv.	Annual herb	0.7	2.6	8.6
	<i>Leptochloa fusca</i> (L.) Kunth	Perennial herb	0.7	3.9	11.4
	<i>Lolium perenne</i> L.	Perennial herb	3.3	6.6	37.1
	<i>Panicum coloratum</i> L.	Perennial herb	0.7	11.8	11.4
	<i>Paspalidium geminatum</i> (Forssk.) Stapf	Perennial herb	2.6	28.9	57.1
	<i>Paspalum distichum</i> L.	Perennial herb	3.3	15.8	37.1
	<i>Phalaris minor</i> Retz.	Annual herb	0.7	2.6	11.4
	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Perennial herb	5.3	0	8.6
	<i>Poa annua</i> L.	Annual herb	0.7	47.4	68.6
	<i>Polypogon monspeliensis</i> (L.) Desf.	Annual herb	0.7	2.6	2.9
	<i>Sacciolepis curvata</i> (L.) Chase	Annual herb	0	1.3	0
	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	Annual herb	4.6	21.1	57.1
	<i>Setaria verticillata</i> (L.) P. Beauv.	Annual herb	0	1.3	0
	<i>Sorghum virgatum</i> (Hack.) Stapf	Annual herb	1.3	0	0
<i>Zea mays</i> L.	Annual herb	0	1.3	2.9	
Polemoniaceae	<i>Phlox drummondii</i> Hook.	Annual herb	0	0	5.7
Polygonaceae	<i>Antigonon leptopus</i> Hook. & Arn.	Climber	0.7	0	2.9
Portulacaceae	<i>Portulaca oleracea</i> L.	Annual herb	11	17.1	48.6
Primulaceae	<i>Anagallis arvensis</i> L. var. <i>arvensis</i>	Annual herb	0	10.5	17.1
	<i>Anagallis arvensis</i> L. var. <i>caerulea</i> Gouan	Annual herb	0	7.9	22.9
Proteaceae	<i>Grevillea robusta</i> A. Cunn. ex R. Br.	Tree	0.7	0	14.3
Rhamnaceae	<i>Ziziphus spina-christi</i> (L.) Desf.	Tree	18	6.6	22.9
Rosaceae	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Tree	3.9	0	5.7
	<i>Malus domestica</i> Borkh.	Tree	0	0	2.9
	<i>Prunus persica</i> (L.) Batsch	Tree	0.7	0	2.9
	<i>Rosa banksiae</i> W. T. Aiton	Shrub	0	0	2.9
	<i>Rosa multiflora</i> Thunb.	Shrub	3.3	9.2	22.9
Rubiaceae	<i>Ixora coccinea</i> L.	Shrub	0	0	5.7
	<i>Pentas lanceolata</i> (Forssk.) Deflers	Perennial herb	0	1.3	0
Rutaceae	<i>Casimiroa edulis</i> La Llave & Lex.	Tree	12	2.6	14.3
	<i>Citrus aurantium</i> L.	Tree	3.9	6.6	14.3
	<i>Citrus limon</i> (L.) Burm. f.	Tree	4.6	7.9	17.1
	<i>Citrus reticulata</i> Blanco	Tree	1.3	1.3	8.6
	<i>Citrus sinensis</i> (L.) Osbeck	Tree	2.6	3.9	20
	<i>Murraya paniculata</i> (L.) Jack	Shrub	0.7	0	11.4
Salicaceae	<i>Populus nigra</i> L.	Tree	0	0	2.9
	<i>Salix mucronata</i> Thunb.	Tree	1.3	1.3	2.9
	<i>Salix tetrasperma</i> Roxb.	Tree	3.9	0	0
Sapindaceae	<i>Dodonaea viscosa</i> (L.) Jacq.	Shrub	32	56.6	80
	<i>Koelreuteria elegans</i> subsp. <i>formosana</i> (Hayata) F. G. Mey.	Tree	3.3	0	8.6
	<i>Koelreuteria paniculata</i> Laxm.	Tree	16	5.3	17.1
	<i>Sapindus saponaria</i> L.	Tree	0	0	2.9
Sapotaceae	<i>Mimusops caffra</i> E. Mey. ex A. DC.	Tree	0	0	2.9

Scrophulariaceae	<i>Myoporum laetum</i> G. Forst.	Shrub	0	1.3	17.1
Simaroubaceae	<i>Ailanthus altissima</i> (Mill.) Swingle	Tree	0.7	0	2.9
Solanaceae	<i>Cestrum diurnum</i> L.	Shrub	3.9	0	5.7
	<i>Cestrum parqui</i> L' Hér.	Shrub	0.7	0	2.9
	<i>Datura innoxia</i> Mill.	Annual herb	3.3	2.6	2.9
	<i>Petunia ×atkinsiana</i> (Sweet) D. Don ex W. H. Baxter	Annual herb	0	6.6	14.3
	<i>Physalis angulata</i> L.	Annual herb	1.3	0	2.9
	<i>Solanum lycopersicum</i> L. var. <i>lycopersicum</i>	Annual herb	0.7	2.6	11.4
	<i>Solanum nigrum</i> L.	Annual herb	13	15.8	34.3
	<i>Withania somnifera</i> (L.) Dunal	Shrub	2	1.3	2.9
Strelitziaceae	<i>Strelitzia alba</i> (L. f.) Skeels	Tree-like	2	0	20
	<i>Strelitzia reginae</i> Aiton	Tree-like	1.3	2.6	25.7
Tamaricaceae	<i>Tamarix nilotica</i> (Ehrenb.) Bunge	Tree	1.3	0	2.9
Tropaeolaceae	<i>Tropaeolum majus</i> L.	Annual herb	1.3	7.9	25.7
Urticaceae	<i>Urtica urens</i> L.	Annual herb	3.9	23.7	51.4
Verbenaceae	<i>Citharexylum spinosum</i> L.	Tree	0.7	0	14.3
	<i>Duranta erecta</i> L.	Shrub	17	19.7	74.3
	<i>Duranta erecta</i> L. 'variegata'	Shrub	4.6	14.5	62.9
	<i>Duranta erecta</i> L. var. <i>aurea</i>	Shrub	7.2	15.8	25.7
	<i>Lantana camara</i> L.	Shrub	20	32.9	82.9
	<i>Lantana montevidensis</i> (Spreng.) Briq.	Shrub	2.6	5.3	31.4
	<i>Phyla nodiflora</i> (L.) Greene	Perennial herb	0	6.6	11.4
<i>Verbena bipinnatifida</i> Nutt.	Perennial herb	0	2.6	5.7	
Vitaceae	<i>Vitis vinifera</i> L.	Climber	0.7	0	11.4
Xanthorrhoeaceae	<i>Aloe vera</i> (L.) Burm. f.	Succulent	8.6	0	22.9
Zamiaceae	<i>Dioon edule</i> Lindl.	Tree-like	0	0	2.9
	<i>Zamia furfuracea</i> L.f.	Tree-like	0	0	2.9
Zygophyllaceae	<i>Tribulus bimucronatus</i> Viv. var. <i>bispinulosus</i> (Kralik) Hosni	Annual herb	3.9	6.6	5.7

الملخص العربي

تركيب وأنماط توزيع وحيود أشجار الشوارع بموائل مدينة القاهرة الكبرى، مصر.

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** قسم العلوم البيولوجية والجيولوجية، كلية التربية، جامعة عين شمس، ش المقريري روكسي (هليوبوليس)، القاهرة،

كود بريدي ١١٣٤١.

تمت دراسة التنوع النباتي للفلورة الشجرية في ٣٨ منطقة ممثلة للقاهرة الكبرى بمصر من حيث الفروق في توزيعها في المسطحات الخضراء وتمثيل الأنواع المرتبطة بها، وذلك في عدد ١٤ حيا تشمل ٢٦٣ موقعا في ثلاث موائل - هي الحدائق العامة، وجزر الطرق، وأرصفت الشوارع - واحتوى كل منها على عدد ٣٥ و٦٧ و١٥٢ موقعا على الترتيب. وقد أجريت جميع التحليلات الإحصائية الأساسية على الحاسب الآلي باستخدام البرنامج SPSS v. 10.0، بينما أجريت نظيرتها متعددة التباين باستخدام حزمة برمجيات MVSP v. 3.1، حيث تم عمل تحليل إحصائي تجميعي للكساء الخضري باستخدام لوغاريتم التباين الأدنى كمييار لمربع المسافة الإقليدية والتعبير عن المجموعات النباتية الناتجة في شكل شجرة العلاقات التصنيفية. كما تم عمل تحليل الإحداثيات الأساسية باستخدام معامل ارتباط ناتج العزم لتحديد الأنماط النباتية الجوهرية المؤثرة في عملية التوزيع. وتم تحديد وفرة الأنواع النباتية من خلال تطبيق معامل ألفا للتنوع ممثلا عن العدد الكلي منها بكل بيئة. وقد بلغ إجمالي النباتات الوعائية في منطقة الدراسة بوجه عام عدد ٣٧٨ نوعا تنتمي إلى ٢٦٤ جنسا موزعة في ٧٩ فصيلة. وكانت معظم النباتات المسجلة منتمة لتسعة فصائل هي القرنية (٣٦ نوعا)، الأسباراجية والنجيلية (٢١ نوعا لكل منهما)، التوتية (١٩ نوعا)، الأسترية (١٧ نوعا)، اليوفورية والخبازية (١٥ نوعا لكل منهما)، الآسرية (١٤ نوعا)، اللامية أو الشفوية (١١ نوعا). وكانت الأجناس الأكثر تنوعا هي الفيكس (١٨ نوعا) واليوفوريا (١١ نوعا)، واتضح نقص هذه الأنواع في المناطق المحيطة بالقاهرة الكبرى وتحديدًا في النظام البيئي الزراعي، في حين سجل عدد ١٩٣ نوعا في جميع الفصائل المتبقية (٧٠ فصيلة). وقد سجل جنس فيكس النسبة الأعلى بين الأجناس الغنية بالأنواع (١٨ نوعا)، يليها أجناس يوفوريا (١١ نوعا)، أسباراجس، بودرة العفريت، فرشاة الزجاج، صنوبر و جنس الموالح (أربعة أنواع لكل منهما)، بينما سجلت الأجناس الـ ٢٥٧ المتبقية عددا يتراوح بين ١-٣ من الأنواع فقط ومن أهمها أجناس: سيرس، كويلريتوريا، عصفور الجنة، الإهليلج، بياض، تونا. أوضح تحليل أطراف صور الحياة في الموائل المدروسة أن نمط النمو السائد هو الأشجار (١٣٩ نوعا) والتي سجل وجودها في عدد ٣٢ فصيلة بنسبة بلغت ٣٧% من جملة الأنواع يليها الشجيرات (٧٩ نوعا) والتي سجل وجودها في عدد ٣٠ فصيلة، بينما الأعشاب وياقي اشكال النمو (١٦٠ نوعا) فتنتهي إلى ٤٨ فصيلة. وبوجه عام فقد بلغت النباتات الخشبية المعمرة المسجلة بفلورة المناطق الحضرية بالقاهرة الكبرى عدد ٢١٨ نوعا بنسبة ٥٧.٧% من جملة الأنواع. وقد تم تقدير التباين التصنيفي وأنماط نمو النباتات ومقارنتها بين الموائل الثلاثة المدروسة، وكذلك إيضاح العلاقة بين تأثير الإنسان، وظروف الموئل وتركيب الأشجار على نمط التوزيع الى جانب اقتراح التوصيات المتعلقة بالحفاظ على البيئة.