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LANDSCAPE USE AND AESTHETICAL VALUE OF SURVEYED WOODY ORNAMENTAL PLANTS IN CAIRO FESTIVAL CITY - CAIRO - EGYPT IN LANDSCAPE GARDENING

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ABSTRACT

Sustainability and successful utilize of plants in gardens and landscape will be achieved by using proper plant in the right place. Hence landscape uses and aesthetical values of plants must be determined. Therefore, the present study were conducted to survey woody ornamental plants located in Cairo Festival City gardens, CairoGovernorate, Egypt through 2018 and 2019 as well as to determine their uses and values in terms of landscaping. Form beauty, ornamental foliage, ornamental fruit, ornamental flowers, and fragrance were took as aesthetical values parameters while landscape uses were recorded by the existing uses and potential uses of each plant. As a result of the study, totally 83 woody plant species belong to 33 families were recorded and they follow trees (40%), palms (12%), shrubs (41%), and vines (7%). Moreover, it has been found that Schinus molle, Plumeria alba, and Duranta erecta are attractive for four parameters of aesthetical value and the most of species are attractive for their ornamental foliage (32%). Also, Tecoma capensis, Cupressus sempervirens, Ficus benjamina, Plumbago auriculataare detected to be in nine different landscape uses and the most of species are recommended to be used as a specimen (68 species).

Keywords: Landscape use, Aesthetical value, Ornamental plants, Gardening.

INTRODUCTION

It is known that humankind always prefers to stay in a region surrounded by plants, these plants have unique advantages in the plant universe, some of which are used in industry, humans and animals feeding, medicine to treat diseases and others have attractive characteristics that relax human eyesight or for recreation. Hence, it was necessary to include such plants in the design of gardens. For the sustainability and success use of these plants in the landscape gardening, it is necessary to use the proper plant in the right place. This comes through knowing the aesthetic value, ecological and functional characteristics of each plant in addition to its habitus to obtain the best growth, which plays a major role in landscape practices. Also Plants and plantations are among the main areas of work in landscape architecture. The plants selected for landscape design should be of high quality and able to adapt to the environmental conditions in the area to be cultivated in order to achieve an efficient process of cost management of the facilities and installations (Irmak, 2013). Woody ornamentals include (trees, palms, shrubs and woody vines),these plants are assess by their ability to satisfy the eye of consumers as pot or garden plants or when sold as cut material. For these reasons, ornamental plants must achieve aesthetic criteria in demand.

Plants contribute to urban environments in various ways such as reducing air pollution, releasing moisture, energy preservation by balancing temperatures, providing habitats for flora and fauna (Akbari *et al.*, 2001), decreasing impacts of the wind, dust and greenhouse gases (Novak and Crane, 2002), noise control (Walker, 1991) and reduction of light reflection (Heisler and Grant, 2000). In addition to positive functions such as prevention of erosion, conditioning waste areas, coast stabilization, reducing avalanche and landslide risk and soil improvement for landscape restoration (Braun and Fluckiger, 1998). Trees also have many advantageous effects on city aesthetics and contribute to city design, in many ways such as aesthetical sensibility, outlining, and surrounding, bordering, directing, avoiding stress, shadowing and providing safety (Aslanboga, 2002). Plants are primary material for prescription drugs, a number of plants discovered in tropical rainforests or other wildlife areas made significant contributions to treat serious diseases. According to Dilaver (2013) species might have important roles in controlling floods, regulating rainfall, producing oxygen and storing carbon, as well as affecting both regional and global climate.

Plant evaluating methods can vary between gardens. Most are based on a subjective rating system that includes one or a few trained horticulturists making assessment of selected plants based on their own expertise (Anderson, 2006). Several researches have been conducted to estimate the aesthetic value and use in landscape for ornamental plants,(Irmak 2008,Irmak and Yilmaz 2008, Seyidoğlu 2009, Irmak 2013, Dönmez 2016 andSurat and Eminağaoğlu 2018).

Egypt lacks natural forests and landscape because of the lack of rain and most of its area is desert lands devoid of agriculture and population. In recent decades,

Table 1. Distribution of evaluated species located in Cairo Festival City gardens based on families

Families	Number of species	Families	Number of species	Families	Number of species
Anacardiaceae	1	Lamiaceae	2	Plumbaginaceae	1
Apocynaceae	6	Leguminosae	13	Polygalaceae	1
Araliaceae	1	Lythraceae	3	Proteaceae	1
Araucariaceae	1	Malvaceae	4	Rhamnaceae	1
Arecaceae	9	Meliaceae	1	Rosaceae	2
Asparagaceae	4	Moraceae	3	Rubiaceae	1
Berberidaceae	1	Myrtaceae	2	Rutaceae	1
Bignoniaceae	4	Nyctaginaceae	2	Salicaceae	1
Cupressaceae	2	Oleaceae	4	Sapindaceae	2
Cycadaceae	1	Pandanaceae	1	Solanaceae	1
Euphorbiaceae	2	Pittosporaceae	1	Verbenaceae	3

Fig.1. Percentage of surveyed species according their groups

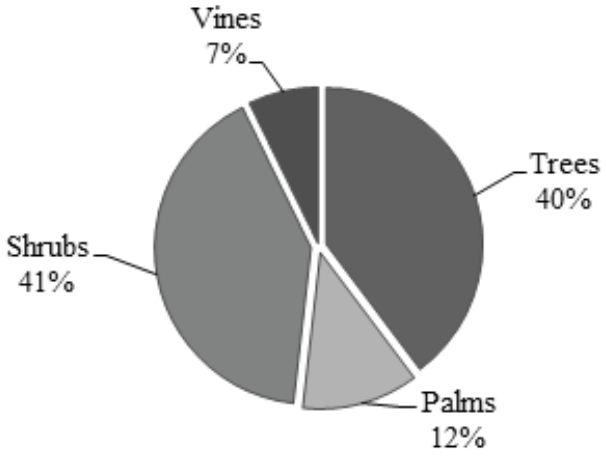


Fig.2. Percentage of surveyed species according their aesthetical values

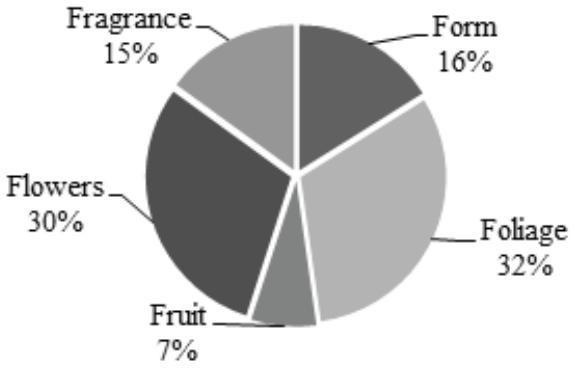
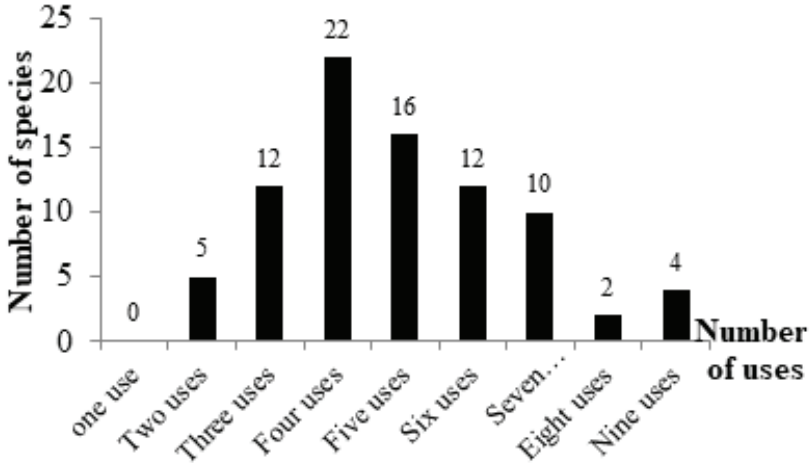


Fig.3. Relationship between number of species and the number of landscape uses



urban expansion began to capture people from the valley and delta regions, and new residential areas appeared with their attractive designs and gardens, the study area (Cairo Festival City) is one of these expansions.The aim of this study is to determine the aesthetic value and landscape use of woody ornamentals which surveyed in Cairo Festival City gardens.

MATERIALS AND METHODS

Study location

Study material included woody ornamentals that grown in Cairo Festival City gardens during 2018 and 2019. The study area underreview,Cairo Festival City located east of the ring road in New Cairo, Egypt, north of 90 St., south of Orouba Square and Ganoob El-Academia and west of Ministry of Interior. It extends over a land area about 300 hectare and situated between latitude (30˚ 0' 59" - 30˚ 2' 15" N) and (31˚ 24' 16' ' - 31˚ 25' 18" E) longitude with average altitude about 218.5 m while some peaks exceed the height of 255m from the mean sea level. The studied city comprises residential parts, business districts, international schools, and office spaces.Meteorological data for the study area were obtained during 2018 and 2019 from the closest weather station from the site, where the highest average temperature reached 30.4˚ for the year 2018 during July and 30.3˚ for 2019 during the months of July and August, while the lowest value was 15.7˚ and 14˚ for 2018 and 2019, respectively, were in January, while the

Table 2. Scientific name, family, landscape value and aesthetical use of surveyed species at Cairo Festival City gardens

Scientific Name	Family	Aesthetical value					Landscape use
		Form beauty	Ornamental foliage	Ornamental fruit	Ornamental flowers	Fragrance	
*Acacia farnesiana (*L.*) Willd.*	Leguminosae				+	+	2, 9, 13, 19
Acalypha wilkesianaMüll.Arg.	Euphorbiaceae	+	+				11, 13, 14, 15, 17, 19, 20
*Acokanthera oblongifolia (*Hochst.*) Benth. & Hook.f. exB.D.Jacks.*	Apocynaceae		+		+	+	9, 14, 19
*Albizia lebbeck (*L.*) Benth.*	Leguminosae		+		+	+	9, 18, 19
*Araucaria columnaris (*G.Forst.*) Hook.*	Araucariaceae	+	+				15, 19, 20
Bauhinia variegata L.	Leguminosae		+		+	+	4, 9, 18, 20
Bombax ceiba L.	Malvaceae	+			+		4, 9, 13, 19
Bougainvillea glabra Choisy	Nyctaginaceae				+		2, 5, 9, 10, 14, 17, 21
Bougainvillea spectabilis Willd	Nyctaginaceae				+		2, 5, 9, 10, 14, 17, 19, 21
*Caesalpinia gilliesii (*Hook*) D.Dietr*	Leguminosae		+		+		2, 9, 13, 14, 19
Calliandra haematocephala Hassk.	Leguminosae				+		9, 13, 14, 17, 19
*Callistemon lanceolatus (*Sm.*) Sweet*	Myrtaceae		+		+		11, 13, 16, 17, 19
*Callistemon viminalis (*Sol. ex Gaertn.*) G.Don*	Myrtaceae	+	+		+		9, 11, 13, 16, 17, 19
*Carissa macrocarpa (*Eckl.*) A.DC.*	Apocynaceae		+		+	+	2, 3, 9, 13, 14
Caryota mitis Lour.	Arecaceae	+	+				17, 19, 20
Cassia fistula L.	Leguminosae		+	+	+		4, 9, 18, 19
*Cassia javanicasubsp.nodosa (*Roxb.*) K.Larsen*	Leguminosae	+			+	+	9, 18, 19
*Ceiba speciosa (*A.St.-Hil.*) Ravenna*	Malvaceae	+	+		+		4, 9, 13, 18, 19
Cestrum nocturnum L.	Solanaceae				+	+	9, 13, 14, 17, 19, 21
Chamaerops humilis L.	Arecaceae	+	+				17, 19
Clerodendrum splendens G.Don	Lamiaceae		+		+		5, 8, 9, 10, 14
*Cordyline fruticosa (*L.*) A.Chev*	Asparagaceae	+	+				13, 15, 19, 20
Cupressus macrocarpa Hartw.	Cupressaceae	+	+			+	1, 11, 13, 14, 17, 19, 20
Cupressus sempervirens L.	Cupressaceae	+					1, 11, 13, 14, 17, 19, 20, 21, 23
Cycas revoluta Thunb.	Cycadaceae	+	+				11, 15, 19, 20
*Delonix regia (*Hook.*) Raf.*	Leguminosae	+		+	+		4, 9, 18, 19
*Dodonaea viscosa (*L.*) Jacq.*	Sapindaceae		+				3, 13, 14, 17, 19
*Dracaena draco (*L.*)* L.	Asparagaceae	+					11, 16, 19, 20
*Dracaena fragrans (*L.*) 'Santa Rosa'*	Asparagaceae	+	+				15, 19, 20
Duranta erecta L.	Verbenaceae		+	+	+	+	3, 9, 13, 14, 17, 19, 20, 21
*Dypsis decaryi (*Jum.*) Beentje & J.Dransf.*	Arecaceae	+	+				4, 17, 19
*Dypsis lutescens(*H.Wendl.*) Beentje & J.Dransf*	Arecaceae	+	+				13, 15, 17, 19, 20
*Enterolobium cyclocarpum (*Jacq.*) Griseb.*	Leguminosae			+	+		4, 9, 18, 19
Erythrina humeana Spreng.	Leguminosae				+		4, 9, 18, 19
Ficus benjamina L.	Moraceae	+	+				1, 4, 13, 14, 15, 17, 19, 20, 21
Ficus lyrata Warb.	Moraceae		+				15, 19, 20
Grevillea robusta A.Cunn. ex R.Br.	Proteaceae		+				13, 19

Scientific Name	Family	Aesthetical value					Landscape use
Hamelia patens Jacq.	Rubiaceae		+		+		6, 7, 9, 12, 13, 14, 20
Hedera helix L.	Araliaceae		+		+		5, 6, 10, 15, 16, 20, 22
Hibiscus rosa-sinensis L.	Malvaceae		+		+		9, 11, 13, 14, 17, 19, 20
Jacaranda mimosifolia D.Don	Bignoniaceae				+	+	1, 4, 9, 17, 19
Jasminum azoricum L.	Oleaceae		+		+	+	5, 8, 9, 10, 14, 17
Jasminum grandiflorum L.	Oleaceae		+		+	+	5, 8, 9, 10, 14, 17
*Jasminum sambac (*L.*) Aiton*	Oleaceae				+	+	3, 5, 9, 13, 15, 19, 20
Jatropha curcas L.	Euphorbiaceae		+		+		13, 14, 19
*Khaya senegalensis (*Desv.) *A.Juss.*	Meliaceae		+				4, 18
Koelreuteria paniculata Laxm.	Sapindaceae		+		+		4, 13, 18, 19
Lagerstroemia indica L.	Lythraceae		+		+	+	4, 9, 13, 14, 17, 19
Lantana camara L.	Verbenaceae				+	+	3, 6, 9, 13, 16, 20, 22
*Lantana montevidensis (*Spreng.*) Briq.*	Verbenaceae				+	+	6, 7, 9, 10, 12, 16, 20
Lawsonia inermis L.	Lythraceae				+	+	4, 13, 14, 17, 19
Morus alba L.	Moraceae	+	+				18, 19
*Murraya paniculata (*L.*) Jack*	Rutaceae			+	+	+	3, 9, 13, 17, 20, 21
Nandina domestica Thunb.	Berberidaceae		+	+	+		13, 14, 17, 19, 20
Nerium oleander L.	Apocynaceae		+		+	+	4, 9, 14, 17, 19
Olea europaea L.	Oleaceae	+	+				4, 18, 19, 21
Pandanus utilis Bory	Pandanaceae	+	+				16, 19, 20
Peltophorum africanum Sond.	Leguminosae			+	+		4, 9, 18, 19
Phoenix dactylifera L.	Arecaceae	+	+	+			1, 4, 13, 19
*Pittosporum tobira (*Thunb.*) W.T.Aiton*	Pittosporaceae				+	+	3 ,9, 13, 14, 17, 19, 20
Plumbago auriculata Lam	Plumbaginaceae		+		+		5, 6, 7, 9, 12, 13, 14, 17
Plumeria alba L.	Apocynaceae	+	+		+	+	9 ,19, 20
Polygala myrtifolia L.	Polygalaceae		+		+		9, 13, 14, 16, 19, 20
Populus alba L.	Salicaceae		+				4, 13, 17, 18
Punica granatum L.*"nana"*	Lythraceae		+	+	+		3, 9, 13, 14, 19, 20
Rhapis humilis Blume	Arecaceae	+	+				13, 15, 17, 19, 20
Rosa centifolia L	Rosaceae				+	+	9, 11, 13, 15, 19, 20
Rosa polyanthaSiebold & Zucc.	Rosaceae				+	+	3, 9, 13, 15, 19, 20
Schinus molleL	Anacardiaceae	+	+	+		+	2, 17, 19, 23
*Senna surattensis (*Burm.f.*)H.S.Irwin & Barneby*	Leguminosae			+	+		4, 9, 17, 19
Spathodeacam panulata P.Beauv.	Bignoniaceae				+		4 9, 18
*Syagrus romanzoffiana (*Cham.*) Glassman*	Arecaceae	+	+	+			1, 4, 13, 19
Tabernaemontana divaricata R.Br. ex Roem. & Schult.	Apocynaceae				+	+	9, 13, 14, 17, 19, 20
*Tecoma capensis (*Thunb.*) Lindl.*	Bignoniaceae		+		+		5, 6, 7, 9, 12, 14, 17, 21, 22
*Tecoma stans(*L.*) Juss. ex Kunth*	Bignoniaceae				+		4, 9, 13, 14, 17, 19,
*Thespesia populnea(*L.*) Sol. ex Corrêa*	Malvaceae		+		+		4, 9, 14, 18, 19
Thevetia neriifoliaJuss. ex Steud.	Apocynaceae		+		+	+	9, 11, 17, 19, 20
*Tipuana tipu(*Benth.*) Kuntze*	Leguminosae		+		+		4, 9, 18, 19

Scientific Name	Family	Aesthetical value					Landscape use
Vitex agnus-castus L.	Lamiaceae		+		+	+	9 14, 19, 20
*Washingtonia filifera (*Linden ex André*) H.Wendl. ex de Bary*	Arecaceae	+	+				1, 4, 13, 19
Wodyetia bifurcataA.K.Ir vine	Arecaceae	+	+				1, 4, 13, 19
Yucca aloifolia L.	Asparagaceae	+	+				11, 15, 16, 19, 20
*Ziziphus spina-christi (*L.*) Desf.*	Rhamnaceae		+	+			2, 19

Avenue (1), Barrier (2), Borders (3), Street (4), Covering buildings (5), Covering slopes (6), Erosion control (7), Arbour/pergolas (8), Flowering (9), Trellis/pillar/wall (10), Foundation (11), Ground covers (12), Group planting (13), Hedge (14), House planting (15), Rock gardens (16), Screening (17), Shade (18), Specimen (19), Containers (20), Topiary (21), Under trees (22), Wind break (23).

average rainfall was 17.1 mm and 17.7 mm during January 2018 and December 2019 respectively.

Evaluation methods

In the scope of the study, woody ornamentals(trees, palms, shrubs and woody vines)grown in Cairo Festival City gardens were listed depending on field visits. Data about the plant materials was obtained through observations and with the help of horticultural experts.

1. Evaluation was based on the landscape use of plant species which already used or other potential uses.

2. Other method of evaluation was based on aesthetical/landscapevalues(adapted from Irmak, 2013 and Dönmez, 2016):

a) Form beauty: natural plant shape and branches sequence.

b) Ornamental foliage: leaf color, shape and size, its being attractive in vegetation period and in autumn.

c) Ornamental fruit: its being attractive in terms of structure, size and color.

d) Ornamental flowers: Suitable for using in landscape architecture in terms of florescence structure, number and sequence.

e) Fragrance: Leaf, flower and fruits having a nice scent concretely.

RESULTS AND DISCUSSION

It was found as a result of the research that totally 83 woody plant species belonging to 33 families are grown inCairo Festival City gardens. The highest families in number of species were Leguminosae (13), Arecaceae (9) and Apocynaceae (6). Also sixteenfamilies had only one species for each, seven families had two species for each, three families hadthree species for each and four families hadfour species for each (Table 1).Also Fig. 1 showed the distribution of surveyed species according to their plant groups as follows: trees (33 species) 40%, palms (10 species) 12%, shrubs (34 species) 41%, and vines (6 species) 7%.

Aesthetical/landscape value:

For aesthetical value of surveyed species, form beauty, ornamental foliage, fruitand flowers and fragranceparameters were taken into consideration. Plants revealing the parameters of aesthetical value are signed by "+" as shown in Table 2, at minimum one aesthetical value parameter observed for each species while three species attractive for four parameters (*Schinus molle, Plumeria alba, Duranta erecta*), twenty one species have three parameters (*Acokanthera oblongifolia, Carissa macrocarpa, Nerium oleander, Thevetia neriifolia, Phoenix dactylifera, Syagrus romanzoffiana, Nandina domestica, Cupressus macrocarpa, Vitex agnus-castus, Albizia lebbeck**….etc.***) and forty six species have two parameters (*Tabernaemontana divaricate, Hedera helix, Araucaria columnaris, Caryota mitis, Chamaerops humilis, Dypsis decaryi, Dypsis lutescens, Rhapis humilis, Washingtonia filifera, Wodyetia bifurcate**,…etc.***). Moreover, it has been found that there are 57 species (32%) are attractive for their ornamental foliage, 54 (30%) for ornamental flowers, 29(16%) for form beauty, 27 (15%) for fragrance and 13 (7%) species for their ornamental fruit (Fig. 2).

Landscape use

Table 2 and Fig. 3 revealed that *Tecoma capensis, Cupressus sempervirens, Ficus benjamina, Plumbago auriculata* are detected to be in nine different landscape uses, Bougainvillea spectabilis and Duranta erecta are noticed in eight position for landscape aims while Chamaerops humilis, Khaya senegalensis, Morus alba, Grevillea robusta, Ziziphus spina-christi are detected to be in two position in landscape. Furthermore, among identified species 68 species (Schinus molle, Plumeria alba, Caryota mitis, Jacaranda mimosifolia, Cupressus macrocarpa, Cupressus sempervirens, Cycas revolute, Bombax ceiba, Ceiba speciosa, Callistemon lanceolatus,….etc.)are used as specimen, 48 species (Acokanthera oblongifolia, Tabernaemontana divaricata, Thevetia neriifolia, Jacaranda mimosifolia, Tecoma stans, Cassia javanica subsp. nodosa, Delonix regia, Jasminum grandiflorum,….etc.) are used for flowering and 42 species (Tabernaemontana divaricate, Dypsis lutescens, Cupressus sempervirens, Caesalpinia gilliesii, Lagerstroemia indica, Hibiscus rosa-sinensis, Callistemon viminalis, Phoenix dactylifera, Ceiba speciosa,….etc.) are used in group

plantingwhile the minimum uses were wind break (Schinus molle, Cupressus sempervirens) and coveringarbour/ pergolas(Clerodendrum splendens, Jasminum azoricum, Jasminum grandiflorum).

Lantana montevidensis, Tecoma capensis, Plumbago auriculata and Hamelia patens are used as ground cover and erosion control while Hedera helix, Dracaena draco, Yucca aloifolia, Callistemon lanceolatus, Callistemon viminalis, Pandanus utilis, Polygala myrtifolia, Lantana camara and Lantana montevidensis are used in rock garden. Other uses illustrated in Table 2.

REFERENCES

Akbari, H., M. Pomerantz and H. Taha (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Solar Energy*, 70 (3): 295-310.

Anderson, O. N. (2006). Flower Breeding and Genetics: Issues, Challenges and Opportunities for the 21st Century. Springer Science and Business Media.pp. 822.

Aslanboğa, D. (2002). Planning of functional design, application and maintenance of the plantation with woody plants. Aegean Forestry Research Directorate, Izmir, 100-127.

Braun, S. and W. Fluckiger (1998).Soil amendments for plantings of urban trees. *Soil and Tillage Research*, 49 (3): 201-209.

Dilaver, Z. (2013). Conservation of natural plants and their use in landscape architecture. In: Advances in Landscape Architecture, M. Ozyavuz (ed), IntechOpen, 885-904.

Dönmez, Şirin (2016).Uses of some medicinal and aromatic plants in the landscape architecture grown in the lakes district. 4: 30-36.

Heisler, G. M., and R. H. Grant (2000).Ultraviolet radiation in urban ecosystems with consideration of effects on human health. *Urban Ecosystems*, 4(3), 193-229.

Irmak, M. A. (2008). Evaluation of Erzurum and its close proximity for the potentials of flora tourism. Ph.D. Thesis, Graduate School of Natural and Applied Sciences, Atatürk University, *Erzurum*, Turkey, pp 249.

Irmak, M. A. (2013). Use of native woody plants in urban landscapes. *Journal of Food, Agriculture & Environment,* 11 (2): 1305-1309.

Irmak, M. A. and H. Yilmaz (2008).Determination of the usability of woody plant species in Tortum-Creek Watershed for functional and aesthetical uses in the respect of landscape architecture. *Biological Diversity and Conservation*, 1 (1): 1-12.

Novak, D. J. and D. E. Crane (2002).Carbon storage and sequestration by urban trees in the USA. *Environmental Pollution*, 116 (3): 381-389.

Seyidoğlu, N. (2009). Researchs on the usage and production of some geophytes in landscape regulations.Ph.D. Thesis, Istanbul University, Institute of Science and Technology, Istanbul.

Surat, H. and Ö. Eminağaoğlu (2018).Determination of the aesthetical and functional use of certain natural plants in Hatila valley national park in landscape architecture. *International Journal of Ecosystems and Ecology Science,* 8 (1): 113-134.

Walker, T. D. (1991). Planting Design. Van Nostrand Reinhold, New York, pp. 196.