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Status and Diversity of Ornamental Plants in King Saud University Campus at Riyadh, Saudi Arabia

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Abstract: A Survey of ornamental plants in the Main King Saud University Campus at Riyadh, Saudi Arabia was carried out in order to explore their diversity and adaptability. Planting the ornamental plants in KSU Campus has started by the end of the construction of the main buildings in 1985. The Afforestation Directorate is one of the units of the Vice Presidency for Projects in KSU and it concerns with carrying out landscape projects within KSU, participating in society service, preserving the environment within the University. The survey shows that the trees and shrubs represent about 45% of the total number of ornamental plant species in the KSA Campus, followed by the succulents and indoor plants with 25%, then the annuals with about 20%. The other ornamental plants such as palms, climbers and ground cover plants accounted for less than 5% each. The ornamental plants in the KSU Campus comprise 107 ornamental plant species belonging to 94 genera and 51 families that distributed around the Campus. The present study offers the basic information on plant diversity that helps any future biodiversity studies and management plans in the university campus.

Key words: Biodiversity · Campus · King Saud University · Ornamental plants · Survey

INTRODUCTION

King Saud University is a public university, the first and largest university in Saudi Arabia where it was founded in 1957. Since that time, KSU has gone through many stages of developments and its administrative organization has developed and adapted according to the diverse needs and expanding role of the nation. The university has developed in different aspects including buildings, administration, the number of students, regulations, facilitates and others. King Saud University is one of the largest universities in the world in terms of area. It is one of the best 300 universities around the world according to the famous world university ranking ARWU 2012 [1]. Recently, Webometrics gave it rank 237 around the world for July 2012, 25 for Asia and the first in the Arab World [2].

The university was occupying several spaced buildings in Riyadh City from its beginnings until 1985 where it moved to the new recent campus on the outskirts of Riyadh City near the historical district of Diriyah. The main campus has an area of nine million square meters and has been allocated to the boys' section. Therefore, the KSU Campus has been considered one of the districts of Riyadh City. There are also two large sections for girls situated outside the main campus and in spaced locations comprise the academic and humanitarian departments. In addition, there are a number of colleges, research centers and stations and a university hospital outside the main campus either in Riyadh region or in other regions of the country. All these sections have many buildings including departments, centers and housing.

King Saudi University comprises 23 colleges, 135 academic departments, 12 deanships, 31 institutes and centers with 6558 Faculty members and 11144 Employees [3]. In the academic year 2010/2011, KSU enrolled 67404 undergraduate and 7827 postgraduate students [4].

It is also includes the following sections: Television Production Center, Central Library, Central Printing Press, Central Lecture Hall, Great Lecture Halls, other lecture halls, stores, gym closed, Faculty Club, swimming pool and open playgrounds, dining halls, mosques, roofed corridors, workshops and others [4].

King Saud University has not limited its roles to teaching and research, but extended and is still extending practical and vital functions in areas of health care, economy and business and the needs of the private sector. KSU, therefore, has always been committed to the

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values of learning and excellence in research, developing an open, ethical and caring community that promotes honesty, integrity, respect, fairness, trust, civility and diversity. This community has created a culture based on fundamental values that include intellectual vitality, academic freedom, the well-being of its members and the extension of service to others [5].

The university provides the students, researchers and employees with a great number of resources to support their tasks and encourage a comfortable work environment. Growing plants within a landscaping frame and cosmetically works is one of these encouraging factors.

Landscaping is an integral part of our culture and plays an essential role in the quality of our environment, affecting our economic well-being and our physical and psychological health. Landscaping is one of the most cost effective tools for improving and sustaining the quality of life, whether in the city, the suburbs, or the country. Gardner [6] summarized the importance of landscaping as it has already been shown to increase community health and vitality through civic involvement in beautification projects. These represent a sense of pride and value by residents and businesses. Plants stabilize soil and reduce runoff in open spaces. Natural habitats protect biodiversity. Low maintenance open spaces and xeriscaping reduce maintenance costs. Evergreen trees reduce the impact of cooling wind in winter and deciduous trees provide shade in the summer.

Ornamental plants are used to provide greenery in cities and other inhabited areas, in gardens and parks and outside of public buildings and residences. They are distinct because of their attractive shapes and the different colors of their flowers, leaves and fruits [7].

Moreover, The use of woody plants within planting arrangements on university campuses serve a critical role as these plants have both an educational value in addition to their ecological function [8]. Ornamental plants are grown mainly for its aesthetic qualities but may have certain secondary benefits such as providing shade, privacy, wind protection, … *etc* [9].

Therefore, the present work aims at shedding light on the ornamental plants at the main King Saud University Campus in Riyadh, Saudi Arabia in order to explore their diversity and adaptability.

MATERIALS AND METHODS

Site Description: King Saud University main Campus spreads over about 9 square kilometers of land. It is located 9 kilometers to North West Riyadh City Center and away 40 km from King Khalid International Airport. The coordinates of the KSU main Campus are 24°42'41" N Latitude 46°37'15" E Longitude. The campus area is encompassed by a wall all around it. The soil of the university campus composed of sedimentary layers of calcareous rocks, punctuated by streams Seoul [10].

The climate in Riyadh City is marked by extremes of temperature, with low humidity throughout the year, particularly in the summer season. The temperature varies greatly between night and day. In summer, the highest average temperature ranges between 40°C-43°C. Humidity ranges from 10 to 13%. In winter it is cold, with the highest temperature ranging between 20 and 28°C and the lowest between 8 and 14°C. The temperature occasionally declines to -2°C, while the humidity ranges between 40 and 49%. Rainfall ranges from 10 to 13.1 cm [11].

Field Survey: A survey of ornamental plants has been conducted at King Saud University Campus during the spring of 2012. The team who conducted the survey was chosen from the technicians of the Afforestation Directorate. The Afforestation Directorate is one of the units of the Vice Presidency for Projects in KSU; and its mission is to spread plants in the KSU Campus and other related centers for shade, beautify and improve the environment using the most advanced techniques. It concerns with carrying out landscape projects within KSU through afforestation projects, participating in society service, preserving the environment within the University.

This survey covers every kind of ornamental plant currently being cultivated on the main campus of KSU. In terms of biological properties and agrotechnical requirements, ornamental plants are divided into several groups, such as trees and shrubs, perennials, biennials, annuals, grasses and bulbs [7]. However, for the purpose of gardening they are divided into groups include lawns, ground covers, trees, shrubs, palms, fences, indoor plants, annual plants, perennial plants, climbers, cactus and others.

The places where plants are planted in KSU include main roads, squares, lateral roads, entrances of buildings, inside buildings (offices, corridors, clinics,…*etc*.). For instance, trees and shrubs are planted on both sides and in the middle of the roads, in the roundabout, in the entrances of buildings, around the green grass strips and as a specimen (Fig. 1).

In revising the scientific names of plants we relied on Integrated Taxonomic Information System [12] and National Genetic Resources Program/ Germplasm Resources Information Network [13].

The Present Status of Gardening in KSU Campus: The Afforestation Directorate of KSU responsible for

Fig. 1: The planted areas in King Saud University Campus at Riyadh, Saudi Arabia.

landscaping and gardening. It comprises two units; namely Afforestation Unit and Support Unit, each of them has several sections working together to achieve the mission of the Directorate. The Afforestation Unit has Landscape, Academic area and Faculty housing Sections, while the Support Unit includes Nursery Section and Irrigation Section. There is also other sectors concern with growing plants within the KSU Campus. There is the Educational Farm of the Faculty of Food and Agriculture Sciences in which the students receive training in different disciplines such as Agricultural Engineering, Horticulture, Forestry, Agronomy, Entomology and others. This Farm includes workshops, laboratories, greenhouses, fields, meteorological station and other facilities. The botanical garden of the Department of Botany and Microbiology at the College of Science was founded in 1993 and aims at identifying the different plant species grown in the Kingdom of Saudi Arabia. It is also concerns with preserving the most threatened desert plants and helps the researchers and specialists to get plant materials for conducting scientific research. This garden includes greenhouses, seed stores and seed beds and accommodates about 100 wild plant species. There also the Research Farm that belongs to the College of Pharmacy. It is comprises a collection of medicinal plants used for giving information to the students about the way by which they are cultivated to gain a maximum amount of the active ingredient from them.

Irrigation: Irrigation is the most important process in landscape and gardening in KSU especially with the high summer temperatures. landscape irrigation is a very specialized technical field includes the source of water, the quality of water, the amount of water, irrigation type, equipments, maintenance, … *etc*.

More than one type of irrigation of plants is implemented in KSU depending on the places where the plants are grown. Manual irrigation using watering cans is applied for some of the plants in greenhouses and offices. In some outdoor areas, plants are irrigated using

the house of vehicle water tanks which bring water suitable for irrigation from outside the university. Most of the planted areas in KSU Campus are irrigated through installed trickle or center pivot irrigation networks. These networks are served by a regular maintenance program include cleaning, checking for proper performance, changing parts of the network, installing new lines, … *etc*.

The water used in irrigation of plants in KSU Campus comes from three sources mainly secondary treated wastewater from a domestic plant, water supplied by contractors from outside the university using vehicle water tanks and ground water through surface wells dug within the campus. In Riyadh several governmental bodies like King Saudi University, The Ministry of Foreign Affairs (Housing Project), King Khalid International Airport, The Diplomatic Quarter, King Abdulaziz City for Science and Technology utilizes treated wastewater for landscape irrigation [14]. The domestic wastewater treatment plant at KSU Campus produces 3000 cubic meters of treated water per day; two third of which are allocated for irrigating the plants grown within the campus.

Constraints to Irrigation: Although irrigation of plants in KSU Campus depends mainly on wastewater from the domestic plant, unfortunately the amount of treated water produced from the plant decreases to only 1000 m^3/d due to the summer vacation and for almost four months. Most of the inhabitants of the campus (students, faculty, employees and others) leave to spend their summer vacation. It is a frequent problem facing the Afforestaion Directorate every summer and results in different negative effects on the plants, particularly those are sensitive to water deficit. In summer therefore, extra efforts are presented by the Afforestation Directorate to minimize the effects of irrigation water deficit. These include directing the available water to irrigate the most sensitive plants and increase the water supplied by contractors from outside the university using vehicle water tanks. This problem is going to be solved by the beginning of the next academic year (2013/2014) through increasing the number of inhabitants in KSU Campus, where a female student city will open for about 25.000 students to study and live within the KSU Campus. Moreover, new apartments and villas for the staff are under furnishing now for accommodating more people. The new housing project comprises 340 villas and 555 apartments, in addition to 461 villas and 672 apartments that were built in the past. Also, there are a number of large water tanks under construction now to store water in order to avoid any shortage in irrigation in the future.

Nurseries: The Afforestation Directorate has two nurseries, one in the main campus and the other in the Research and Experimental Station of King Saud University in Dirab, 50 km away from the main campus. The mission of the nursery is to grow up all the kinds of ornamental plants required by the different units of the Afforestation Directorate to be planted in the KSU Campus. These plants should be provided by the nursery at the proper timing and the desired quality. Of the other tasks that the nursery is responsible for propagating the ornamental plants and keep some of them as mother plants (*i.e.* to remain as a source of propagation). The nursery also responsible of collecting seeds from the planted species in KSU Campus or outside it.

The main nursery of the Afforestation Directorate in KSU Campus includes 16 greenhouses; eight of them are completely shaded greenhouses used for propagation of trees and shrubs, ground covers and climbers, hardening of annuals, singling trees and shrubs and preparing plants for special events. The rest of the greenhouses are Air-conditioned and devoted for propagation and breeding of indoor plants and production of annuals.

The other nursery has eight greenhouses; five of them are shaded greenhouses in which trees and shrubs are propagated, transplanted and hardened. While the other three are controlled ones allocated for the propagation of indoor plants and production of cut flowers.

Agricultural Practices: Agricultural practices for landscape in KSU Campus are vital actions. The technicians of the Afforestation Directorate do the usual agricultural services for the planted areas, maintain the plants and take care of them. The usual agricultural services include irrigation, fertilization, pest control, meadow cutting, pruning,... *etc*. They are done daily, weekly, monthly or one-time. The timed-practices are done regularly according to a schedule. The other agricultural processes such as caring of flower beds, cutting flowers, caring of, mowing, edging turf, cleaning-up and removing debris, pest and weed control, …*etc*. are taken place on time determined by the specialized supervisor.

RESULTS AND DISCUSSION

The results of the survey of ornamental plants in KSU Campus show that the places where the ornamental plants are planted are streets, squares, circular road, main entrances of the colleges and other buildings, the corridors inside the buildings, faculty housing, student housing and others. The Afforestation Directorate concerns with planting different kinds of ornamental plants in the KSU Campus in right places according to a previous prepared design. It also concerns with landscape in the streets, passageways, yards and other places in the campus.

Table 1: Botanical families of the ornamental plants in the KSU Campus

No.	Family	No.	Family
1	Acanthaceae	26	Cupressaceae
2	Agavaceae	27	Cycadaceae
3	Aizoaceae	28	Euphorbiaceae
4	Amaranthaceae	29	Fabaceae
5	Anacardiaceae	30	Labiatae
6	Anthericaceae	31	Lamiaceae
7	Apocynaceae	32	Liliaceae
8	Araceae	33	Lythraceae
9	Araliaceae	34	Malvaceae
10	Arecaceae	35	Moraceae
11	Asparagaceae	36	Musaceae
12	Asteraceae	37	Myrtaceae
13	Begoniaceae	38	Nephrolepidaceae
14	Bignoniaceae	39	Nyctaginaceae
15	Boraginaceae	40	Oleaceae
16	Brassicaceae	41	Polygonaceae
17	Cactaceae	42	Portulacaceae
18	Campanulaceae	43	Rhamnaceae
19	Cannaceae	44	Rosaceae
20	Chenopodiaceae	45	Sapindaceae
21	Combretaceae	46	Scrophulariaceae
22	Commelinaceae	47	Solanaceae
23	Compositae	48	Tropaeolaceae
24	Convolvulaceae	49	Verbenaceae
25	Cruciferae	50	Xanthorrhoeaceae

Table 2: Trees grown in KSU Campus.

Scientific name	Family
Acacia ampliceps Maslin	Fabaceae
Acacia farnesiana (L.) Willd.	Fabaceae
Acacia salicina Lindl.	Fabaceae
Albizia lebbeck (L.) Benth.	Fabaceae
Conocarpus erectus L.	Combretaceae
Cordia mixa Hochst. ex A. Rich. p.p, non Linn.	Boraginaceae
Cupressus sempervirens L.	Cupressaceae
Delonix regia (Bojer) Raf.	Fabaceae
Eucalyptus microtheca F. Muell.	Myrtaceae
Ficus altissima Blume	Moraceae
Ficus benghalensis L.	Moraceae
Ficus retusa auct	Moraceae
Ficus religiosa L.	Moraceae
Musa acuminata Colla	Musaceae
Olea europaea ssp. *africana* (Mill.) P. Green.	Oleaceae
Parkinsonia aculeata L.	Fabaceae
Pithecellobium dulce (Roxb.) Benth.	Fabaceae
Prosopis juliflora (Sw.) DC.	Fabaceae
Schinus molle L.	Anacardiaceae
Schinus terebinthifolius Raddi	Anacardiaceae
Tecoma stans (L.) Juss. ex Kunth	Bignoniaceae
Zizyphus spina-christi (L.) Willd.	Rhamnaceae

Table 3: Shrubs grown in KSU Campus.

Scientific name	Family
Acalypha wilkesiana Müll. Arg.	Euphorbiaceae
Adhatoda vasica Nees.	Acanthaceae
Althea rosea Cav.	Malvaceae
Buddlia asiatica Lour.	Scrophulariaceae
Callistemon lanceolatus DC	Myrtaceae
Callistemon viminalis (Gaertn.) G. Don	Myrtaceae
Canna indica L.	Cannaceae
Cestrum elegans (Brongn. ex Neumann) Schltdl.	Solanaceae
Clerodendrum inerme (L.) Gaertn.	Lamiaceae
Dodonaea viscose Jacq.	Sapindaceae
Euphorbia pulcherrima Willd. ex Klotzsch	Euphorbiaceae
Hibiscus rose – sinensis L.	Malvaceae
Hibiscus tiliaceus L.	Malvaceae
Lantana camara L.	Verbenaceae
Lawsonia inermis L.	Lythraceae
Myrtus communis L.	Myrtaceae
Nerium Oleander L.	Apocynaceae
Plumeria acutifolia Poir.	Apocynaceae
Punica granatum f. *plena* 'Rubrum Flore Pleno' L.	Lythraceae
Rosa × *damascene* Mill.	Rosaceae
Rosmarinus oficinalis L.	Lamiaceae
Tecoma capensis (Thunb.) Lindl.	Bignoniaceae
Thevetia peruviana (Pers.) K. Schum.	Apocynaceae

Table 4: Succulents plants grown in KSU Campus

Scientific name	Family
Agaves pp. L.	Asparagaceae
Aloe perfoliata L. var. *vera* L.	Xanthorrhoeaceae
Echinocactus grusonii Hildm.	Cactaceae
Euphorbia tirucalli L.	Euphorbiaceae
Gymnocalycium mihanovichii (Fric and Guerke) Britton and Rose	Cactaceae
Opuntia (L.) Miller *spp.*	Cactaceae
Sansevieria Thunb. *spp.*	Asparagaceae
Yucca L. *spp.*	Agavaceae

The survey of the ornamental plants in KSU Campus also shows that it comprises 107 ornamental plant species belonging to 94 genera and 51 families that distributed around the campus (Table 1). The trees and shrubs represent about 45% of the total number of ornamental plant species in the KSA Campus (Table 2) and (Table 3), followed by the succulents and indoor plants with 25% (Table 4) and (Table 5), then the annuals with about 20% (Table 6) and (Table 7). The other ornamental plants (*i. e.* palms, climbers and ground cover plants) do not exceed 5% each (Table 8, 9 and 10). The high percentage of trees and shrubs in KSU Campus reflects adopting the idea that they help modify microclimates around buildings and are not difficult to establish and maintain. This is true as beautiful landscapes begin with a strong foundation of woody trees and shrubs [15]. On the other hand, indoor plants receive a special concern in KSU Campus as they

Table 5: Indoor plants grown in KSU Campus.

Scientific name	Family
Adhatoda vasica Nees (Syn. *Justicia adhatoda* L.)	Acanthaceae
Asparagus plumosus Baker	Asparagaceae
Asparagus sprengeri Regel.	Asparagaceae
(Syn. *Asparagus aethiopicus* L.)	
Aspidistra lurida Ker Gawl.	Liliaceae
Begonia semperflorens Link and Otto	Begoniaceae
(Syn. *Begonia cucullata* Willd. var. cucullata	
Chlorophytum macrophyllum (A.Rich.) Asch.	Anthericaceae
Codiaeum variegatum (L.) A.Juss.	Euphorbiaceae
(syn. *Croton variegatum* L.)	
Coleus blumei Benth. (Syn. *Plectranthus*	Lamiaceae alt.
scutellarioides (L.) R. Br.)	Labiatae
Dieffenbachia picta Schott	Araceae
Dracaena sanderiana hort. Sander ex Mast.	Asparagaceae
Ficus benjamina L. 'Natascha' (cultivar)	Moraceae
Ficus elastica Roxb. ex Hornem.	Moracaea
Ficus lyrata Warb. (syn. *Ficus pandurata*)	Moraceae
Monstera deliciosa Liebm.	Araceae
Nephrolepis Schott, 1834	Nephrolepidaceae
Philodendron Schott 1832	Araceae
Pothos aureus Linden and André	Araceae
Schefflera sp. nov. 'nanocephala'	Araliaceae
(Md. Nur SF 32832, K)	
Syngonium auritum (L.) Schott	Araceae

Table 6: Winter annuals flowers grown in KSU Campus

Scientific name	Family
Alyssum maritimum (L.) Desv. (=*Alyssum maritimum* (L.) Lam.	Brassicaceae
Antirrhinum majus L.	Scrophulariaceae
Brassica oleracea L.	Brassicaceae
Calendula officinalis L.	Compositae
Lobelia erinus L.	Campanulaceae
Matthiola incana (L.) W.T.Aiton	Cruciferae
Petunia × Hybrid	Solanaceae
Tropaeolum majus L.	Tropaeolaceae
Vinca rosea L. (=*Catharanthus roseus* (L.) G.Don)	Apocynaceae

Table 7: Winter annuals flowers grown in KSU Campus

Scientific name	Family
Amaranthus caudatus	Amaranthaceae
Celosia argentea L.	Amaranthaceae
Cosmos atrosanguineus	Compositae
Gomphrena globosa	Amaranthaceae
Helianthus annuus L.	Asteraceae
Kochia scoparia	Chenopodiaceae
Portulaca grandiflora Hook.	Portulacaceae
Tagetes erecta L.	Asteraceae
Zinnia elegans Jacq.	Asteraceae

Table 8: Palm trees grown in KSU Campus.

Scientific name	Family
Areca lutescens hort.	Arecaceae
Cycas revolute Thunb.	Cycadaceae
Phoenix canariensis Chabaud	Arecaceae
Phoenix dactylifera L.	Arecaceae
Sabal palmetto (Walter) Lodd. ex Schult. and Schult. f.	Arecaceae
Washingtonia filifera (Lindl.) H.Wendl.	Arecaceae

Table 9: Climbing plants grown in KSU Campus

Scientific name	Family
Antigonon leptopus Hook. and Arn.	Polygonaceae
Bougainvillea glabra Choisy	Nyctaginaceae
Ipomoea palmata Forssk.	Convolvulaceae
Jasminum officinale var. *grandiflorum* (L.) L.H. Bailey	Oleaceae

Table 10: Ground cover plants grown in KSU Campus

Scientific name	Family
Alternanthera bettzichiana (Regel) Voss	Amaranthaceae
Carissa grandiflora (E. Mey.) A. DC.	Apocynaceae
Gazania rigens (L.) Gaertn.	Asteraceae
Sesuvium portulacastrum (L.) L.	Aizoaceae
Setcreasea pallida Rose.	Commelinaceae
Wedelia trilobata (L.) A.S. Hitchc.	Asteraceae

can provide psychological benefits such as stress-reduction and increased pain tolerance [16]. Planting the ornamental plants in KSU Campus has started by the end of the construction of the main buildings in 1985. Thereafter, it passed through several stages included adding new areas and places for what was existed, changes in the planted species, adopting new methods in irrigation and other technical agricultural services. For instance, there was a group of *Phoenix dactylifera* at the entrances of each college building but they deteriorated due to more than a reason. Also, there were many *Eucalyptus camaldulensis* Dehnh. trees planted on the circular road and other places but they died as a result of the high summer temperature when they were at 13 years old.

Over 28 years represent the period since the date of opening the KSU Campus; the existed plants show a sensible degree of acclimation to the local environmental conditions. The plants that were existed at the time of opening the KSU Campus passed through a series of climate variability resulted in failure of some and survival of the others. This result was not surprising as climate is a major determinant for the phenology, physiology, distribution and interactions of plants [17].

In 2011, the ornamental plants produced by the Afforestation Directorate and used within KSU Campus

accounted for 37440 bouquets of flowers, 60,000 cut flowers, 200,000 annual plants, 15,000 trees and 20,000 ground cover plants. Moreover, there are about 450,000 square meters of lawns distributed throughout the KSU Campus. The number of grass cutting in different locations of the KSU Campus during the academic year 2011/2012 ranged between 27 and 37 times.

In the near future there will be an increase in the number of the ornamental plant species in KSU Campus as a project for ornamentation of the main entrances of the colleges is being carried out right now.

CONCLUSIONS

The present study represents the first record of the current biodiversity on King Saud University Campus. Therefore, it offers the basic information on plant diversity that helps any future biodiversity studies and management plans in the university campus. The survey of the ornamental plants in KSU Campus shows that it comprises 107 ornamental plant species belonging to 94 genera and 51 families that distributed around the Campus. The trees and shrubs represent about 45% of the total number of ornamental plant species in the KSA Campus, followed by the succulents and indoor plants with 25%, then the annuals with about 20%. The other ornamental plants such as palms, climbers and ground cover plants do not exceed 5% each.

REFERENCES

1. Shanghai Ranking, 2011. Academic Ranking of World Universities. http://www.shanghairanking.com/ARWU2011.html.
2. Webometrics. info., 2012. Ranking Web of World universities: Home. http://www.webometrics.info.
3. Statistics and Information Administration, 2012. King Saud University in Numbers (1433 H). Statistics and Information Administration, Vice Presidency for Development and Quality, King Saudi University, Riyadh, Saudi Arabia, pp: 70.
4. King Saud University Portal, 2010. KSU Portal. http://ksu.edu.sa/AboutKSU/Pages/KSUPortalInitiative.aspx.
5. Ministry of Higher Education, 2010. Study in KSA, Government Universities: King Saud University. Available at the Portal of the Ministry of Higher Education: http://www.mohe.gov.sa/en/studyinside/Government-Universities/Pages/KSU.aspx.
6. Gardner, S., (Ed.), 2006. Effective Landscaping Design Helps Solve Municipal Issues. Municipal World, May, pp: 17-20.
7. Tsitsin, N.V., 2010. Ornamental Plants. The Great Soviet Encyclopedia, 3rd Edition (1970-1979). © 2010 The Gale Group, Inc. http://encyclopedia2.thefreedictionary.com/Ornamental+Plants.
8. Qing, C., 2010. A study of the species diversity of landscape trees on three university campuses from Inner Mongolia. In: ISHS Acta Horticulturae 937: XXVIII International Horticultural Congress on Science and Horticulture for People (IHC2010): International Symposium on Advances in Ornamentals, Landscape and Urban Horticulture.
9. Davidson, J.A. and D.R. Miller, 1990. Ornamental Plants (3.9.8). *In*: D. Rosen (Editor), The Armored Scale Insects, Their Biology, Natural Enemies and Control, Vol. B. Elsevier Science B.V. Publishers, Amsterdam, The Netherlands.
10. High Commission for the Development of ArRiyadh City, 2011a. Riyadh Geography. Geomorphology. ArRiyadh City Web Site. http://www.arriyadh.com/ar/ AboutArriy/Left/History/getdocument.aspx?f=/openshare/ar/AboutArriy/Left/History/Geo.doc_cvt.htm.
11. High Commission for the Development of ArRiyadh City, 2011b. Climate of ArRiyadh. ArRiyadh City Web Site. http://www.arriyadh.com/Eng/Ab-Arriyad/Left/CityInfo/getdocument.aspx?f=/openshare/Eng/Ab-Arriyad/Left/CityInfo/Climate.doc_cvt.htm.
12. Integrated Taxonomic Information System, ITIS., 2013. Authoritative taxonomic information on plants of North America and the world. Available at: http://www.itis.gov.
13. National Genetic Resources Program / Germplasm Resources Information Network NPGS/GRIN, 2013. USDA, ARS, National Genetic Resources, Germplasm Resources Information Network-(GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland, USA. URL: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?15963.
14. Arar, A., 1989. The future role of the use of sewage effluent for irrigation in the Near East. *In*: R. Bouchet (Ed.), Reuse of low quality water for irrigation, Bari: CIHEAM, 1989. pp: 59-72 (Options Méditerranéennes: Série A. Sémin aires Méditerranéens; no. 1).

15. Wilson, M., 2013. Smart trees and shrubs for Michigan landscapes. Michigan State University Extension: Smart Gardining. http://msue.anr.msu.edu/uploads/files/AABI/Trees_and_shrubs.pdf.
16. Bringslimark, T., T. Hartig and G.G. Patil, 2009. The psychological benefits of indoor plants: A critical review of the experimental literature. Journal of Environmental Psychology, 29(4): 422-433.
17. Walther, G.R., 2003. Plants in a warmer world. Perspectives in Plant Ecology, Evolution and Systematics, 6: 169-185.