Developments in Engineering and Architecture

Editors

Boyko RANGUELOV
Zharas G. BERDENOV
Recep EFE

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CONTENTS

Preface

The book includes 20 scientific articles, which are presented in English in a volume of 324 pages. The chapters examine a wide range of current issues of architecture and engineering. The book includes the following topics:

Rain water harvest and application methods in cities, the relation between permaculture and urban landscape resilience, the assessment methods of river habitats, participation in urban management, urban identity through art and aestheticism, ecological site classification and mapping studies in forest ecosystems, campus open spaces and "triangulations, the intended use of plants in campus open green spaces, the elements of landscape in Islamic garden design, smart urban agriculture, environmental residential design project process in online education, antique revivalism: the empire style in Ottoman architecture, floating structural system design in response to effects of climate change on coastal areas, evolution of the courtyard house in the pre-Islamic period in Mesopotamia, the place of urban furniture in the formation of historical environmental identity, conflict analysis in natural resources, buildings and their surroundings in the context of an interior-exterior spatial relationship, in search of blind and active faults to the north Bulgarian Black Sea costal area and electrophoretic analysis of total protein profiles of some pluteus species.

This book contains current and important studies in education sciences. Each chapter is written by academicians who are experts in the subject. Therefore, we hope that it will be useful to health sciences professionals, students and other experts.

We would like to thank the authors who made important contributions to the publication process of the book and made a good cooperation with us.

Especially we owe a debt of gratitude to the St. Kliment Ohridski University Publishing House for this opportunity they gave us and the preparation of the book for publication.

May, 2021 -----The Editors

SECTION 1

LANDSCAPE ARCHITECTURE

Chapter 8

The Elements of Landscape in Islamic Garden Design

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INTRODUCTION

Islamic gardens have appeared as a unique art of landscape influenced by the religion, climate and the affiliated geography and shaped since 7th Century in accordance with the culture and traditions of various societies. The development of the gardens throughout the history of art of landscape has been influenced by the local and regional natural conditions such as soil formation, climate, flora and ecology. Overall, the Islamic gardens, in consideration of the geographies that Islam has expanded, have been shaped within the regions with hot, arid and mild rainy climate conditions. Islamic gardens have always been perceived as a representation of heaven and further designed as spaces and localities of daily life.

Naissance of Islamic Art of Garden Landscape

The Islam Empire, starting from the establishment of the first Islamic state in Medina, has sustained its existence for centuries until the peak period of the Ottoman Empire in the 16th Century (Md Jani, Harun, Mansor, & Zen, 2014).

Spreading with the great pace and covering almost the half of the entire world, Islam Civilization has dominated an era hosting many nations within and shaping the history of the humankind. In this era, Islamic landscape shaped under the influence of Islam circled around a society representing the incarnated form of Islamic principles and values, reflecting the spirit of religion of Islam in terms of form, design and functionality and inhering functionality (Spahic, 2005).

Therefore, it would not be accurate and right to attribute Islamic culture and art to a specific country or people, because Islamic culture has developed on the culture and art traditions of the aforementioned civilizations and emerged as an independent branch of art incorporating its essence and common features in the entire civilizations (Akdoğan, 1974).

Although we observe a substantial influence of the philosophy of the religion of Islam on the shaping of the Islamic landscape (architectural, garden, etc.), the geography of Islamic expansion having hot and arid climate conditions has exerted an influence on this process.

Significant Islamic gardens have been designed in West Asia (Iran, Turkey and Arabian Peninsula), Southeastern Asia (India, Pakistan, Kashmir, Uzbekistan and Afghanistan), Middle East (Syria, Lebanon, Iraq, Palestine, Egypt, Morocco and Tunisia) and Europe (Granada, Cordova, Sevilla and Toledo) under the influence of Islamic monarchs reigned during this period (Md Jani, Harun, Mansor, & Zen, 2014).

Islamic gardens have been designed to be the representation of heaven on earth, and this term has first revealed in the seventh century during the establishment of the Persian Gardens (Haaga, 2005). The description of heaven mentioned in the Qur'an has quite a significant place in the creation of the gardens. Heaven is the ultimate destination desired to be reached by both Muslims and the communities living within the entire eras, and it is the herald of the happiness for they have been waiting. Muslim communities endeavored to fulfill their longing for the paradise by establishing gardens representing and depicting the place of paradise in the realm they live in. These gardens established are shaped by the idea of a place of happiness.

As a result of the studies conducted, the opinion has been embraced that the Persian garden is considered as the foundation of the Islamic gardens and moreover, served as a source of inspiration for other notable Islamic gardens such as the Mughal gardens in Kashmir, India and the Al-Andalus and Generalife in Southern Spain.

Following the Persian gardens, the Islamic gardens in Spain have revealed its influence until the 20th Century. For instance, it is quite possible to witness such influences in California and Mexico. The Islamic gardens promotes the concept of simplicity and therefore the insight of the Islamic gardens have been adopted outstandingly throughout the world. Petruccioli (1998) highlights that the Islamic gardens primarily served as a source of inspiration for the European culture in the 17th Century.

The influence of the Islamic garden can be seen on certain landscape designs in Florence and the Royal Pavilion in the United Kingdom. The expansion of the influence of the Islamic garden has become a glamorous trend in the 19th Century and thus, has claimed its place as one of the official architectural styles in the Exhibitions of the World.

The influences of the Islamic garden before gradually getting disappeared due to contemporary trends, have been sustained throughout the 19th Century and by the early 20th Centuries (Md Jani, Harun, Mansor, & Zen, 2014).

The historical development of the Islamic gardens is as presented in the figure 1.

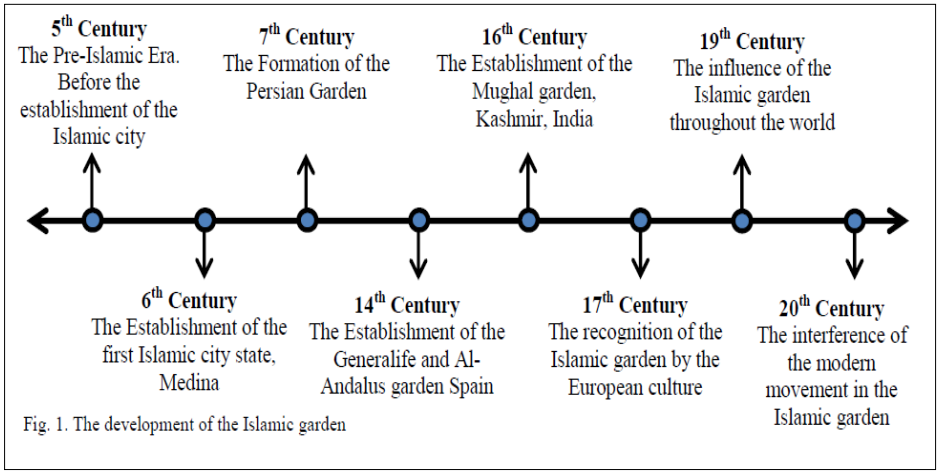

Figure 1. *The historical development of the Islamic gardens (Md Jani, Harun, Mansor, & Zen, 2014)*

Prior to establishment of the Persian garden, the gardens have been referred to only as a part of an outdoor area. However, after the development of the established Islamic city-state, certain Muslim rulers has begun to embed the Islamic concept in the garden design. For instance, the fourth Mughal Emperor Jahangir (1569-1627) had a black pavilion built in Kashmir (Kausar, 2005).

Seyyed Hossein Nasr et al. (1993) has highlighted the "Islamic" term of Gulzar Haider. Based on that, the foundation of an Islamic landscape or garden is not merely the development of patterns or structures. The atmosphere promoted by the garden is the core element defining the Islamic garden. It is an environment evoking the memory of God and displaying the values within the concepts such as Tawhid (Providential), Khalifa (Vicegerent), Creation (Landscape) Jihad (Dedication), Adl (Justice), Worship (Worship). Therefore, every garden promoting similar values is regarded as the Islamic garden (Gulzar Haider, 1984).

The first ones springing to minds regarding the Islamic gardens are Persians, Turks, Arabs and Spaniards and the gardens established by these nations expanded towards the major parts of the world. These gardens have been emerged as a result of mutual interaction of the traditions, customs and art apprehension of the aforementioned nations with the religion of Islam (Korkut, Şişman, & Özyavuz, 2010).

The remains of certain Islamic Gardens expanded from one region to another within the regions where these civilizations have been established, have managed to be preserved and have survived to the present day.

However, the physical remnants have been gradually diminished due to the changes in monarchs and particularly the termination of the sultan-khalifah reign in the final periods of the Ottoman Empire (Md Jani, Harun, Mansor, & Zen, 2014).

However, despite this situation, Generalife Alhambra in Spain, the Mughal garden and the Taj Mahal in India, palaces and pavilion gardens in various provinces of ours particularly the Topkapı Palace in Turkey are the gardens remaining as

legacies of the ascendant rulers reigning the Islam civilization and appreciated to the greatest extent, bearing the historical significance.

In the Pursuit of the Paradise on Earth

The etymon of the word garden is Persian meaning "minor vineyard". Overall, it is further defined as an allotment in where herbaceous and woody ornamental plants with certain visual qualification, fruits, vegetables and herbs are grown, and moreover, the beauties, verdant green and soothing and relaxing properties of nature are supervised by humans. Large or small scale, environmentally integrated, inward-oriented courtyards or gardens are the spaces reflecting the living conditions, economic and cultural qualities of societies in certain periods of history, and shaped in line with the characteristics of the region they are hosted. In this sense, Changes created by humans and the diversification in the purpose of garden landscaping have introduced many differences to the concept of garden in emotional and morphological terms (Aliasghari, Erdoğan, 2012).

Gardens, within the entire periods, referring a paradise lifestyle and dreams, which are inaccessible, are places people have tried to reach and dreamed of evading pain and stalemates through it.

Paradise is a locality aimed to be reached within the entire periods and thus, becoming the herald of happiness and serenity long waited by the humans.

These opinions have a decisive influence on the themes of the structures and garden culture of the western civilization. In this context, it is of utmost importance that the words "garden" and "heaven" have a common origin of language. The lexical meaning of heaven is pairi-dae`-za in Persian, which in fact, is synonymous with paradise. An ancient word of "paradisu" is another expression of pairi-dae`-za and solely means a confined or a walled and fenced area. "Pardes" in Hebrew and "Paradeisos" in Greek are also other synonyms and characterize the gardens of pleasure of the Persian rulers (Aliasghari, Erdoğan, 2012).

Gardens, following the emergence of the religion of Islam in the 7th Century, have been defined as the metaphor of Heaven, Paradise or El-jannah (garden). When paradise is mentioned in the sacred verses of the Quran, it is described with flowing water and fruit bearing trees. It is highlighted that there are shadow-forming trees, flowing waters, sweet fruits (garden) and fragrant flowers (gulistan).

The concept of Islamic garden is based on the depiction of paradise in the Quran. "flowing waters, blossoming trees and all sorts of fruits" indicated in the verses have formed the thought of a place of happiness.

Although the Islamic gardens in Spain, Iran and India reveal common religious characteristics, their roots are based on different cultures, climate and soil structure. Islamic gardens in India have been designed to include large areas, depending on an entirely symmetrical order with the water conduits and ponds.

The Islamic gardens in Spain have been adorned with cypress and hanging gardens on terraces built on hills and slopes as a response to the challenges introduced by the topography.

Persian gardens, on the other hand, have been designed in a formal order in hot and arid regions, with ponds and flowerbeds formed by four water conduits vertically

intersecting each other, known as “Chahar Bag” (Kluckert, 2000).

Humans value the nature and furthermore, establish intercorrelation with the landscape and the elements of landscape based on principles and values originating from their ethos.

Therefore, it is of utmost importance to recognize and describe the state of elements of landscape depending on the belief and culture of the society. According to the Iranian-Islamic culture and belief, elements of landscape such as water and plants are considered divine verses and symbols, and this condition is frequently observed in Islamic documentation due to its significance.

The most beautiful physical incorporation of water and plants reveals itself in the Persian art of landscape. The art of landscape in Iran has precious traditions and a spiritual power (Hobhouse, 2004).

Water and plants in such gardens have been used in three ways as “conceptually, functionally and aesthetically”. The use of water is among the substantial elements standing out in the Persian. The ponds are placed in the most notable part of the courtyard or the garden. Numerous pond structures in the garden and their interconnection with the conduits provide sensation of coolness and flow of air and water with music. The ponds built on a slight slope ensures the water to overflow from the pond and thus forming small cascades. Colored ceramics have generally been used in the decoration of the small conduits surrounding the pools. The use of colored ceramics in the ponds is another typical feature of Persian Islamic gardens (Aliasghari, Erdoğan, 2012).

The word “Heaven” or “Paradise” is named by the following 7 different expressions based on the verses of Quran;

- Jannatu -al Kjaled (al-furgan) “garden of eternity” or “garden of eternity”,
- Darul-us -Salam (el-anam, 6: 127), "Land of Peace"
- Darül-El-Qarar (el Mu'min, 40:42), “Garden” or “Garden of Happiness”,
- Jannatu-al-adn (el-Bara'ah, 9: 72-73), "Garden of Eden" or "Garden of Eternal Happiness”,
- Jannaty-al-Ma'wa (el-Sajdah, 32: 19), "Garden of Hospitable Houses",
- Jannatu-al-naim (el-Maidah, 5:70) "Paradise",
- Jannatu-al-firdaus (el-kahf, 18: 107), " Garden of Eden" (Ansari, 2012).

Characteristic Features of the Islamic Gardens

The Islamic gardens rememorate the phenomenon of paradise as a perfect place for living and resting. Islamic gardens have emerged as a distinctive and unique garden art since the 7th Century, shaped in line with the cultural and traditional aspects of various societies, depending on the influence of religion, climate and the geography. However, although the gardens are located in various countries, they have been built in accordance with the common design criteria. The basis of the Islamic gardens comprised of “Chahar Bagh” or water conduit system. The central point of the garden is formed by the intersection of two water conduits within the “Chahar Bagh” system. Generally, the main pond or structure is located at the intersection point.

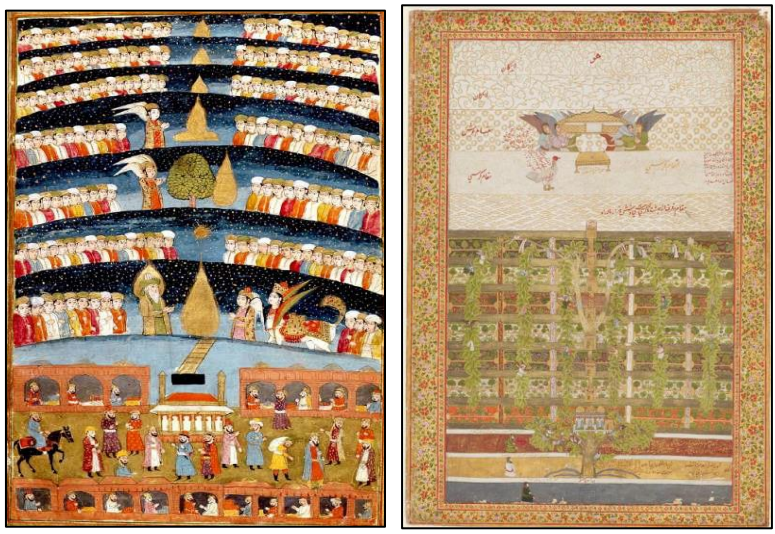

Figure 2. *Depiction of Garden of Eden (Göker and Tuna, 2017)*

"Chahar Bagh" forms four symmetrical parts and thus introduces a formal layout. The structure, with respect to the use of conduit system, is placed on the land overlooking towards the panorama and water conduits and water bowls or ponds interconnecting these conduits are located in front of the structure. Privacy has always been prioritized and in the foreground in the Islamic gardens. The area is encircled with high walls and consisting of various courtyards within. The indispensable element of these gardens, generally having a formal layout scheme, is the water. Water is supplied to every part of the gardens through the ponds/conduits designed with the static or dynamic form.

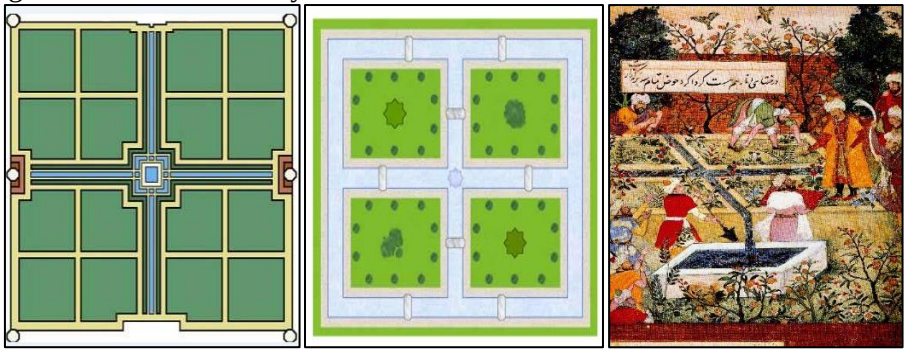

Figure 3. *Persian Gardens, Chahr-Bagh (Göker, Tuna, 2017)*

Although certain Islamic gardens are located within the regions of arid and hot climate, water is supplied through the gardens by means of employing various methods and through the underground conduits from the mountains. Walking trails are located around the water conduits as well as the formal layout dominating the garden. These trails provide the opportunity to thoroughly wander around the garden. A perspective imagery is revealed by the formation of an alley layout with the tall trees planted on trackside.

The most substantial difference at the Islamic gardens survived until today is the church or mosque within the area depending on the religious belief of the country hosting the garden. For instance; a church is located at the courtyard in where the Nasrid Palaces are built in the Royal Alhambra Palace.

Figure 4. *Church in the Royal Alhambra Palace (Original, 2019)*

Figure 5. *Royal Alhambra Palace, Granada/Spain (Original, 2019)*

Figure 6. *Shah Goli, Tabriz/Iran (Original, 2018)*

Structural and Botanical Materials Used **in the Islamic Gardens**

Although the Islamic gardens have made progress in accordance with the climatic conditions, cultural and historical values of each country, the use of structural and botanical materials reflecting common characteristics can be as follows;

- **Structures Within the Garden:**

The buildings located within the Islamic gardens are generally positioned within the outdoors or the garden/courtyard based on the qualifications thereof. Certain structures have been designed for residential purposes while some of them have been designed as summer pavilions.

For instance, the Generalife palace located within the Royal Alhambra Palace in Granada has been designed as a summer palace by Nasrid (1232-1492), ruler of the Nasrid Dynasty to spend his summer months. The Chehel Sotoun palace located at the Isfahan province of Iran has been used by Abbas I of Persia, the Safavid Shah for the purpose of hosting the entertainments and receptions.

Figure 7. *Generalife Palace, Alhambra (Original,2019)*

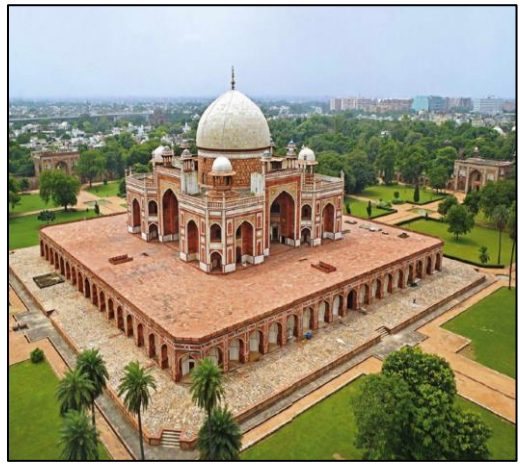

Figure 8. *Humayun's Tomb and Garden (Afzal, 2018)*

- **Floor Covering**

Sand-gravel mixture or stone cladding technique is generally employed for the outdoors. In certain the Islamic gardens survived to this day, it is determined that patterns have been created with the stone cladding technique, while in some, the marble or "zellige" has been used.

Figure 9. *El Palacio de Carlos V., Alhambra/Granada (Original, 2019)*

- **Water Structures**

Water is the fundamental element of the Islamic gardens. Water for the gardens has often been designed to provide contribution in both functional and aesthetic terms. However, various methods have been employed for water supply in countries with hot and arid climate. Apart from the rainy season, water is known to be supplied from water catchment basins, rivers, conduits and rainwater store reservoirs. Water supply has been provided to the palace gardens by means of the method most frequently employed, which was establishing surface conduits and providing water from the water resource on the sloping land by the gravity.

Figure 10. *Jardin del Generalife, Spain (Original, 2019)*

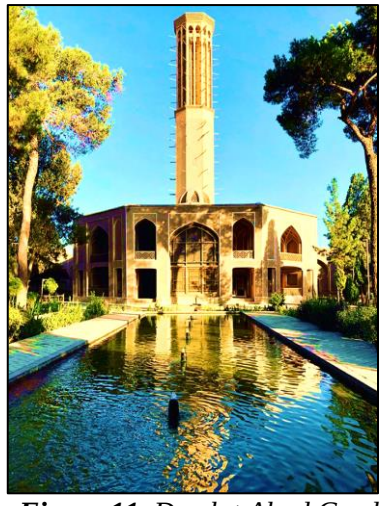

Figure 11. *Dowlat Abad Garden, Yazd, Iran (Original, 2019)*

Noria has been used in the event that the spot to where the water was intended to be conveyed was higher in elevation than the spring. Noria (water wheel) guides the flowing water to the conduit, and thus allowing the water to reach the desired area on the sloping land.

Qanat refers to the technique as the most prevalent conveyance method for the water on the arid lands.

As regards to this system, a well, lake or an underground reservoir cave with a water bearing geological layer is required. The underground conduit is exposed to the area where the water is to be supplied from the underground water source, and shafts are formed along the underground conduit for the purpose of creating an air supply and not to pose a danger during the construction phase of the conduits. The qanat system has often be utilized as the Persian Islamic gardens are located in the arid and desert region.

- **Botanical Materials within the Islamic Gardens:**

In consideration of the botanical material used in the Islamic gardens, it is observed that evergreen trees are generally used, taking into account the geography and climate conditions. It is further observed that the botanical design is applied around the pathways and water elements for the purpose of bringing out the geometry and the formal landscape dominating the garden. Fruit trees were also used in addition to the said botanical elements in order to create functional areas.

Figure 12. *Bag-e Chehel Sütun, Isfahan, Iran (URL 1)*

Figure 13. *Bagh-e Shahzadeh, Kerman, Iran (URL 2)*

Figure 14. *Royal Alhambra Palace Gardens, Granada, Spain (Original, 2019)*

Table 1. *Botanical Materials within the Islamic Gardens (Drawn up by the authors, 2020)*

Evergreen Plants	
Latin Name	**Turkish Name**
Taxsus baccata	Porsuk
Cedrus sp.	Sedir
Washingtonia robusta	Yelpaze Palmiyesi
Cupressuss sempervirens	Akdeniz Servisi
Buxus sempervirens	Şimşir
Phoenix dactylifera	Hurma
Chamaerops humilis	Bodur Palmiye
Olea europaea	Zeytin
Nerium olender	Zakkum
Ilex aquifolium	İngiliz Çoban Püskülü
Citrus sinensis	Portakal
Non-Evergreen Trees/Briers	
Platanus orientalis	Çınar
Carpinus betulus	Gürgen
Philadelphus coronarius	Filbahri
Myrtus communis	Mersin
Crateagus monogyna	Yemişen
Hibiscus syriacus	Ağaç Hatmi
Plumbago auriculata	Mavi Yasemin
Prunus avium	Kiraz
Punica granatum	Nar
Ficus carica	İncir
Bulbous Plants	
Narcissus sp.	Nergis
Hyacinthus sp.	Sümbül
Tulip sp.	Lale
Iris sp.	Süsen
Lilium sp.	Zambak

CONCLUSION

The beliefs of the religion of Islam, the climatic and characteristic properties of the geography where Islam has expanded have been influential to the greatest extent in the emergence and development of the art of the Islamic Garden. Any and every civilization reigning in the geography of Islamic expansion in particular, have introduced new contributions to the art of the Islamic Garden in concordance with its own geography and lifestyle without neglecting and ignoring the beliefs of the faith of Islam.

Although Islamic civilizations have taken into considerations the characteristics of the geographies they have been settled on, they have not desisted from considering the rules required to be abode in terms of the religion of Islam in their designs. They have established outing and recreational areas in the gardens to experience the feeling of paradise depiction on earth mentioned in Quran by using water and plants together for the purpose of benefiting from the gardens while prioritizing the concept of privacy and often featured the formal layout in their designs.

As stated in our study, it has been observed when the importance of water in the sense of the religion of Islam and the Islamic geography are considered that Islamic civilizations, when establishing the garden designs, have utilized water accomplishedly in both aesthetic, functional and spiritual terms. They have also frequently benefited from the musical features of water. The conditions prevailing in their times and the religious belief have rendered them to become a substantial artisan regarding use of water. Provision of benefit has influenced their plant preferences while the imagery and fragrance of flowers have been key features for the depiction of the paradise on earth.

Shaped and formed under the influence of Islam civilization dominating an era having an important role in the making of the history and prevailing in almost half of the entire world, the Islamic gardens are quite pivotal due to their ability to reflect the era of their creation and the emphasize placed by the religion of Islam on the nature in consideration of the conception of the paradise on earth. Islamic gardens have influenced the garden designs of many cultures primarily the civilizations settled on the immediate environment with their design layouts and functionality and have become substantial constituents and milestones of the art history of garden and landscape.

ACKNOWLEDGMENT

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