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Determination of Some Natural Plants to Be Used in Vertical Garden Applications in the Mediterranean Region

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Abstract: *Vertical gardens are design cases that emerged as a result of the search for an alternative green space, along with a decrease at urban green spaces and associated with environmental problems. The vertical garden is one of the gardens that cover façade walls with using various plant species by systems. One of the most important components in ensuring the sustainability of vertical gardens is plant material. It is preferred that natural plant species, which adapt optimum on environmental conditions of application area, are used for systems of the vertical garden. In this research, plant species, which are used for vertical garden applications in Turkey, have been determined natural or exotic. In addition, it is aimed to determine natural plant species for vertical gardens which will be applied in the Mediterranean Region. As a result, it has been determined that the majority of the plant species, which commonly used for vertical garden applications in Turkey, are exotic species, and suggestions have been made for natural species that can be used in vertical garden applications in the Mediterranean Region.*

Keywords: Vertical Garden, Mediterranean Region, Exotic, , Natural

1. INTRODUCTION

Urbanization, one of the biggest problems in 21st Century, causes many environment problems such as structure areas and population increase. As the rate of structuring increases, the green areas are rapidly decreasing. In recent years, many studies have been carried out in order to determine the amounts of urban green areas. For example, the amount of green space in London was %38.4 in 2003 but it was %33 in 2013. In the same way, the amount of green space in Hong Kong was %41 in 2012 but after three years it was %40 [1,2]. When these numerical values are examined, it is seen that the amount of public open green areas (parks and gardens) in cities is decreasing. The decrease in the amount of green areas in the cities and the inadequacy in the face of the rapidly increasing urbanization has led to the search for alternative green areas. In line with this requirement, studies in order to integrate nature into construction are called as “vertical garden”. The vertical gardens are defined as gardens that cover façade walls with using various plant species by systems.

The vertical gardens increase not only green areas at urban but also have some functions such as increasing biological diversity and creating a natural habitat, sound and heat isolation, energy productivity, air quality improvement, heat island reduction, location acquisition, creating agricultural area, aesthetics occurrence, and positive contribution to human psychology [3,4,5,6,7,8,9].

Vertical gardens are created by using different systems together. Systems that forms vertical garden are; carrier, irrigation, insulation, media, plant and lighting. Among these components, the plant material is the most affected by the time dimension and showing positive or negative development in this direction. Therefore, the correct selection of plant material is very important in terms of ensuring the sustainability of vertical gardens.

Our country has a diversity of flora thanks to having three different floristic regions, different geographical

features and different climate varieties. While the European continental flora has close to 12,000 species, this number is about 9,500 in our country. Furthermore, while the number of endemic plant species in the continental flora of Europe was around 2.750, approximately 3.700 of the species in our country are endemic [10].

Vertical gardens emerging as alternatives to green areas at urban and they are considered as suitable areas for the growth of natural plant species. Yeung [11], emphasized that green wall panel systems provide suitable environments for the growth of natural plant species.

As in all the landscape architecture works one of the most important factors for sustainable vertical gardens is plant material. It is preferred that natural plant species, which adapt optimum on environment conditions of application area, are used for systems of vertical garden. The use of natural plant species will also be effective in protecting the ecological integrity of the region. The use of natural plant species will contribute to ecological integrity by preventing possible diseases and pests which can be potentially moved to the area with exotic plants. Use of plant species with similar request will facilitate maintenance work that must be done regularly after the application.

In this research, plant species, which are used for vertical garden applications in Turkey, has been determined natural or exotic. And also it is aimed to determine natural plant species for vertical gardens which will be applied in the Mediterranean Region.

2. MATERIAL AND METHOD

The main material of the study is plant species used in vertical garden applications. Plant species widely used in vertical garden applications in our country have been determined by verbal information obtained from interviews with vertical gardening companies operating in this sector and by examining existing applications in

our country. And the fact that these plants are natural or exotic has been examined first.

The importance of using natural plant species in vertical garden applications has been emphasized and suggestions have been made about natural plant species that can be used in vertical garden applications in the Mediterranean Region.

3. RESULTS

Plant species widely used in vertical garden applications in Turkey have been determined by verbal information obtained from interviews with vertical gardening companies operating in this sector and by examining existing applications in our country. Natural or exotic states of plant species used in vertical gardens in Turkey are shown in Table 1.

Table 1. Plant species used in vertical garden applications in Turkey [M.Seçkin, 2016, written interview; 12]

Family	Scientific Name	Common Name	Status of Plants (Natural or Exotic)
Amaranthaceae	<i>Iresine herbstii</i> Hook.	Herbst's bloodleaf	Exotic
Amaranthaceae	<i>Alternanthera dentata</i> Scheygrond	Joseph's coat	Exotic
Apocynaceae	<i>Vinca minor</i> L.	Common periwinkle	Natural
Apocynaceae	<i>Vinca major</i> L.	Greater periwinkle	Natural
Araliaceae	<i>Hedera helix</i> L.	English ivy	Natural
Asteraceae	<i>Ophiopogon japonicus</i> 'Nigrescens'	Mondo grass	Exotic
Asteraceae	<i>Senecio cineraria</i> DC.	Dusty miller	Exotic
Begoniaceae	<i>Begonia semperflorens</i> Link & Otto	Begonia	Exotic
Buxaceae	<i>Buxus sempervirens</i> var. <i>rotundifolia</i> Baill.	German boxwood	Exotic
Celastraceae	<i>Euonymus japonicus</i> Thunb.	Japanese euonymus	Exotic
Convolvulaceae	<i>Dichondra argentea</i> 'Silver Falls'	Dichondra	Exotic
Crassulaceae	<i>Sedum reflexum</i> L.	Crooked yellow stonecrop	Exotic
Lamiaceae	<i>Lavandula angustifolia</i> Mill.	Lavender	Natural
Lamiaceae	<i>Plectranthus scutellarioides</i> (L.) R. BR.	Coleus	Exotic
Lamiaceae	<i>Teucrium fruticans</i> L.	Shrubby Germander	Exotic
Lamiaceae	<i>Salvia officinalis</i> L.	Common sage	Exotic
Lythraceae	<i>Cuphea hyssopifolia</i> Kunth	False heather	Exotic
Plantaginaceae	<i>Russelia equisetiformis</i> Schldl. & Cham.	Fountain bush	Exotic
Poaceae	<i>Festuca glauca</i> Vill.	Blue fescue	Exotic
Poaceae	<i>Stipa tenuissima</i> Trin.	Mexican feather grass	Exotic
Verbenaceae	<i>Verbena laciniata</i> (L.) Briq.	Mock vervain	Exotic

It has been found that there are 21 plant species commonly used in vertical garden applications in Turkey. Only four of these species are natural, while others are exotic species.

Usage of natural plant in vertical garden applications is very important because of the protection of the ecological integrity of the zone, ensuring sustainability and reducing maintenance costs. Natural plant species that can be used in vertical garden applications in the Mediterranean Region are given in Table 2. In

determining the natural plant species that can be used for the vertical garden applications in the Mediterranean Region, the form, the texture and their altitude are considered. As a form; climbers, groundcovers and non-overgrown shrub species and as a texture; close textured plants and as an altitude species under the starting point 500 m. and below are preferred. For the Mediterranean Region, 16 natural plant species have been identified as species that can be used in vertical gardens. Cultivation and use of these species should be encouraged.

Table 2. Natural plant species that can be used in vertical garden applications in Mediterranean Region [12,13]

Family	Scientific Name	Common Name	Altitude (m.)
Araliaceae	<i>Hedera helix L.</i>	English ivy	0-1500
Aspleniaceae	<i>Asplenium onopteris L.</i>	Irish spleenwort	10-1700
Aspleniaceae	<i>Asplenium scolopendrium L.</i>	Hart's tongue fern	0-2100
Aspleniaceae	<i>Asplenium trichomanes L.</i>	Maidenhair trichomanes	20-2000
Caprifoliaceae	<i>Lonicera orientalis</i>	Honeysuckle	500-2790
Caryophyllaceae	<i>Dianthus anatolicus Boiss.</i>	Anatolian Pink	500-2200
Cistaceae	<i>Cistus salviifolius L.</i>	Sage-leaved rock rose	0-500
Cistaceae	<i>Cistus creticus L.</i>	Rock rose	0-1000
Convolvulaceae	<i>Calystegia sepium subsp. sepium</i>	Hedge bindweed	0-800
Crassulaceae	<i>Sedum caespitosum (Cav.) Dc.</i>	Broad-leaved stonecrop	0-1000
Crassulaceae	<i>Sedum litoreum Guss. var. litoreum</i>	Coastal stonecrop	0-300
Crassulaceae	<i>Sedum rubens L.</i>	Red stonecrop	360-1150
Dryopteridaceae	<i>Polystichum aculeatum (L.) Rothex Mert.</i>	Hard shield fern	0-1500
Lamiaceae	<i>Salvia ceratophylla L.</i>	Stag's horn salvia	300-2150
Poaceae	<i>Festuca valesiaca Schleich. ExGaudin</i>	Volga fescue	400-2800
Ranunculaceae	<i>Clematis vitalba L.</i>	Old man's beard	0-1500

4. DISCUSSION

Green areas' aesthetic and psychological contributions are very important in addition to contributions to the urban ecosystem. For this reason, the need for green areas is increasing day by day. In the vertical gardens, which emerge as a green space alternative in the cities, nature is integrated in the vertical plane to the structures and the urban areas that are getting darker day by day are able to get the greenery that it misses.

One of the most important components of vertical gardens is plant material. It is preferred that natural plant species, which adapt optimum on environment conditions of application area, are used for systems of vertical garden. This is the most important factor that will directly affect the long-term success of the application. Our country has a diversity of flora thanks to having three different floristic regions, different geographical features and different climate varieties. Despite this richness, the use of imported plant species increases the possibility of failure of applications. If exotic plant species should be included in plant design works, these plants should be investigated for their existence in the area and whether they can demonstrate proper development against existing climate conditions. Another benefit of choosing natural species is economic benefit. Plant species that can't adapt to environmental conditions disappear or can't demonstrate the desired improvement. The placement of new species in place of these species is a major factor in increasing maintenance costs. Therefore, the use of natural plant species should be promoted in vertical gardens. Furthermore, considering the richness of our country's flora, studies should be supported for the cultivation of natural plant species that can be used in vertical gardens.

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