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Integration of medicinal and aromatic plants in an urban landscape as a living heritage: an example in Malatya City (Turkey)

Aysun Tuna · Bilge Hatun Ay · Şükrü Karakuş

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Abstract This paper aims to determine the potential for using medicinal aromatic plants, which have been considered living heritage since prehistoric times, in urban landscapes. The area of study covers Malatya City and its counties, which are found in Eastern Anatolia, a region of importance in terms of the endemic species in Turkey. Malatya is specifically selected as the study area, as the city's geomorphological, hydrological and climatic characteristics favour a high floral diversity. The methods used in this paper consist of five stages: floristic field works conducted in Battalgazi county (Malatya) in the scope of the Scientific and Technological Research Council of Turkey (TUBITAK) Project No. 217O290, the identification of the plants by a taxonomist, the determination of the medicinal and aromatic species in other counties of Malatya based on literature review, the establishment of criteria for the application potential of the identified species in landscape designs and the assessment of the use of the identified species in landscape architecture according to the parameters set in the criteria. Aromatic medicinal species were analysed to generate planting designs in landscape projects; the aesthetic properties (flower, leaf and fruit characteristics), sensory properties (scent and texture), seasonal change characteristics (flowering period and colour change) and use areas (flower parterres, solitary plantings, live fences and site coverings) of the plants were analysed. As a result of ethnobotanical and floristic studies carried out within the boundaries of the study area, a total of 189 medical aromatic species were identified. A total of 157 of these species were herbaceous plants. In conclusion, it was determined that 80 aromatic medicinal species conform to the planting design criteria and could be used in landscape designs in Malatya City.

Keywords Medicinal aromatic plants · Living heritage · Planting design · Urban landscape · Malatya

A. Tuna (✉)
Faculty of Architecture, Department of City and Regional Planning, Bolu Abant Izzet Baysal University, Bolu, Turkey
e-mail: Aysuntuna17@Gmail.Com

B. H. Ay
Institute of Science and Technology, Inonu University, Malatya, Turkey

Ş. Karakuş
Faculty of Fine Arts and Design, Department of Landscape Architecture, Inonu University, Malatya, Turkey

Introduction

The progress of society from the prehistoric period to modern civilization advanced based on plant use. The variety and uses of plants play a major role in the lives and activities of individuals and societies (Dawa et al. 2018). The oldest known historical record related to the interaction between humans and medicinal plants is from 5000 to 3000 BC in the Alps. It is known that Ice Age humans used aromatic medicinal plants during these years (Inoue and Craker 2014). The use of medicinal plants by humans relied on trial and error from 5000 to 3000 BC and in the following years. Data collected during many archaeological excavations support the

hypothesis that previous human societies dried medicinal plants with increasing frequency and then cultivated these plants and engaged in production activities. It is known that marijuana was historically grown in Egypt (Cannabis 2017; Inoue et al. 2019) and opium poppy was grown in lower Mesopotamia in 3400 BC (Drug Enforcement Administration Museum 2018). Hippocrates, who founded medicine in ancient Greece, and his student Aristotle used medicinal plants to treat diseases. In ancient Greece, Theophrastus founded the "Herbs School", and 600 medicinal plants were cited in the encyclopaedia titled *De Materia Medica*, written by Pedanius Dioscorides in 75–45 BC (Lindberg Madsen and Bertelsen 1995; Zargari 1992; Jamshidi-Kia et al. 2018).

In modern medicine, medicinal and aromatic plants are currently used as the basic materials of pharmaceuticals for the prevention of diseases, health maintenance and the treatment of diseases. The parts of medicinal plants that may be used include the seeds, roots, leaves, fruits, skins, flowers or even entire plants. The active compounds in most parts of medicinal plants have direct or indirect therapeutic effects and are used as medicinal agents. In these plants, certain materials, referred to as active compounds (substances), are produced and stored; these compounds have physiological effects on living organisms (Phillipson 2001).

Currently, aromatic medicinal plants have extensive applications as pharmaceutical raw materials and dietary supplements or in the cosmetic product industry. In the past, local societies related aromatic medicinal plants (as sources of treatments) and the landscapes in which they occur to the religious rituals of the era by using approaches such as "sacred groves", "sacred species" and "sacred landscape", which are similar to the ecological methods used today (Kala 2010). In the ethnobotanical study of Kala (2010), it was argued that the meaning and significance of medicinal plants are based on the belief systems of various cultures. With the start of settled life and the inclusion of medicinal plants into societies, the use and growth of these plants in "gardens" were common in medieval Europe (500–1200 AD). In particular, these gardens were built in monasteries and consisted of aromatic herbs (Leszczynski 1997; Arslan 2010; Dönmez 2016). Warner (1994) reported that much activity took place in monastery gardens in medieval European gardens and that monastery gardens consisted of natural meadows, flowering plants and medicinal plants. He added that priests grew both aromatic plants and beautiful plants, including roses, lilies, sage and rosemary.

Today, medicinal and aromatic plants are grown in collection gardens, therapeutic herb gardens, botanical gardens, rock gardens, roof and terrace gardens, dry masonries and flower parterres and along roadsides due to their aesthetics and functional value. Home gardens, which are the oldest form of plant use and provide various ecosystem services, are one of the ways in which aromatic medicinal plants are integrated into contemporary city landscapes (Calvet-Mir et al. 2012). Kujawska et al. (2018) studied the effect of medicinal plants grown by local Paraguayan people in home gardens on landscape structure and pointed out that local landscape characteristics were reflected in the scale of home gardens and that landscape variables were influential on the richness of local plant species. In short, home gardens were social areas where local plants were preserved, the plant cultivation process was most feasible and individuals connected with nature; furthermore, of the garden types, home gardens contributed the most to biodiversity.

The use of medicinal and aromatic plants in sustainable landscape designs in contemporary city landscapes has increased due to their superior ability to adapt to different soils and low water demand. Furthermore, these plants protect areas against the development of dense housing due to rapid population increases in recent years. Effective plant compositions are generated in landscape designs by prioritizing the morphological characteristics of the selected plants (flowers, fruits, leaves) as well as their ecological functions and functional uses (Uprety and Asselin 2012). Medicinal and aromatic plants have great significance in terms of aesthetics and functionality, and they evoke sensations in people using the areas in which they are found (Arslan et al. 2018). In addition to their ecological contributions, medicinal and aromatic plants can contribute to local economies; for example, the use of natural species in landscape designs provides savings on water and labour and decreased maintenance costs and increases drought tolerance (Demirkan 2019). Kokkinou et al. (2016) reported that they found positive ecological, economic and aesthetic results in their study on green roof systems generated by using medicinal and aromatic plants.

There is great potential for the use of medicinal and aromatic plants in Turkey due to its geographical location and climatic properties. In a study by Guner

et al. (2012) titled "The List of Plants of Turkey", which they considered *our first national flora list*, a total of 11,707 species and subspecies were found (including foreign plants and cultivated plants), 3694 endemic taxa were found and 31.82% of the species found were endemic. The regions rich in endemic species were the Mediterranean, Eastern Anatolia and Central Anatolia (Acıbuca and Budak 2018). Ethnobotanical studies conducted in Turkey have shown that there are many species used for medicinal purposes by local people; however, only a few of these species were cultivated and grown. In light of this information, it was concluded that Turkey has great potential in this field (Kevseroğlu et al. 2014). This paper aimed to determine the potential of Malatya City, which is situated in Eastern Anatolia and a critical area for endemic species in Turkey, to grow medicinal and aromatic species and the possible applications of these plants in the city landscape.

Material and method

Study area

The study region was Malatya City and its counties. Malatya City is located in Eastern Anatolia (35° 54′ to 39° 03′ N, 38° 45′ to 39° 08′ E), a sub-region of the upper Euphrates on the southwestern edge of the depression zone covering the provinces of Adiyaman, Elazig, Bingol, Mus and Van. The province, with a surface area of 12.313 km^2, is surrounded by Elazig and Diyarbakir to the east, Adiyaman to the south, Kahramanmaras to the west and Sivas and Erzincan to the north (Fig. 1) (Atik et al. 2013). The climatic properties of the Malatya basin differ from the continental climate characteristics generally found in Eastern Anatolia. The average annual temperature in Malatya is 13.7 °C. The average temperature of January, the coldest month of the year, is − 1 °C; the average temperature of July, the hottest month, is 26.8 °C and the minimum temperature is − 22.2 °C. Daily and annual temperature differences are also great. Malatya City has four counties, one of which is the central county. Battalgazi is the most crowded county and is closest to the city centre and located in the Malatya lowland. The Euphrates and its tributaries are the major streams found in this region. Yesilyurt, one of the highly populated counties, is positioned in the Mahya Mountains and the Malatya lowland to the south. Its major stream is Derme Creek. Akcadag County is situated at the base of Nurhak Mountain, and its major streams are the Sultansuyu and Ebeler Creek. Arapgir County has historically hosted many civilizations and is positioned between Yama Mountain and Gul Mountain. Darende County is situated between the Hezanli Mountain, the Nurhak Mountains, the Akcababa Mountains and the Leylek Mountains and is irrigated by the Tohma Creek and Balikli Tohma Creek. The Sultan Creek and the Surgu Creek are found in Dogansehir County, which is surrounded by the Malatya Mountains. Doganyol County is established at the base of the Malatya Mountain. The main stream in Hekimhan County, positioned between the Ayran Mountain, Akcababa Mountain and Leylek Mountain, is the Kurucay. Kale County is the closest county to the Karakaya Dam reservoir, which is built on the Euphrates, and is formed of slightly rolling plains. Kuluncak County is the least populated county and is situated in the valley of Tohma Creek. Yazihan County is located in the Malatya lowland, and its major stream is the Kurucay. Puturge County is located in the most eastern area of Malatya City and is surrounded by the southeastern Taurus Mountains. Its major water sources are the Buyukcay, Siro and Caybogaz Creeks. The Malatya city centre and its counties are well known for their water sources and, particularly, their agricultural production activities. Apricots are the main agricultural product. Malatya provides 82.6% of Turkey's dried apricot export volume to the global market (Ministry of Economy of Turkish Republic 2017). This article was conducted based on the hypothesis that Malatya has a floristic variety due to its geomorphological and hydrological structure and climatic characteristics and has a high potential for the growth of medical aromatic plants.

Ethnobotanical and floristic studies

From the literature reviews, it was determined that there were no floristic studies carried out on the subject of medicinal and aromatic plants specifically in Malatya City. The doctoral thesis of Karakus (2016), titled "Flora of Malatya City", was viewed as the main resource in the scope of these floristic investigations. Furthermore, this article used the aromatic medicinal species identified in the floristic studies conducted in Battalgazi County in the scope of the scientific research project carried out in the TUBITAK 3501 Career Program. The local species collected as a result of floristic studies were

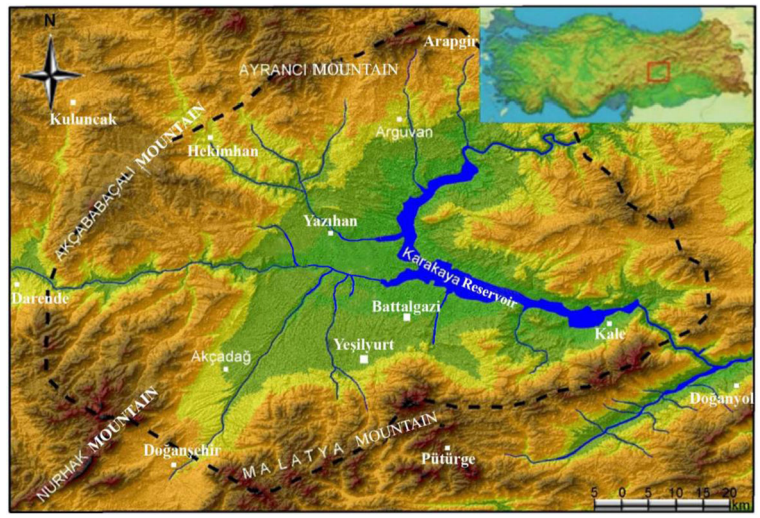

Fig. 1 Location of Malatya City and its counties (this map was prepared using a paper by Sunkar et al. (2013))

identified by Karakus, a taxonomist (a co-author of the present article). Moreover, ethnobotanical studies conducted in Eastern Anatolia were analysed. The following ethnobotanical and floristic studies were assessed: a study by Guler (2004) titled "Ethnobotanical Properties of Some Medicinal and Aromatic Plants Dispersed Naturally in Erzurum Locality", a study by Tetik et al. (2013) titled "Traditional Uses of Some Medicinal Plants in Malatya (Turkey)", a study by Kilic and Bagci (2013) titled "An Ethnobotanical Survey of Some Medicinal Plants in Keban (Elazig-Turkey)", a study by Uzun and Uzun (2014) titled "Methods and Principles to Be Used in Ethnobotanical Studies", a study by Akan and Bakir (2015) titled "Ethnobotanical Study of Kahta (Adıyaman) Center and Narince Village" and a study by Sezen et al. (2018) titled "Biodiversity and Urban Gardens: Medicinal and Aromatic Plants that Can Be Used in Erzurum (Turkey) Urban Gardens". From these resources, the medicinal and aromatic plant species growing within the Malatya city limits were determined.

Conformity assessment according to planting design criteria

The aromatic medicinal species which were identified as a result of literature review and field studies were analysed according to the criteria for planting designs in landscape projects, in terms of their aesthetic properties (flower, leaf and fruit characteristics), sensory properties (scent and texture), seasonal change characteristics (flowering period and colour change) and use areas (flower parterres, solitary plantings, live fences and site coverings). The criteria applied to generate planting designs and the parameters assessed by these criteria and the scoring types are summarized in Table 1. The criteria considered in the planting designs were based on the stipulations found as a result of the literature review by Sari and Karasah (2018).

Results

A total of 189 medicinal and aromatic plant species growing naturally in the Malatya city limits were identified from the ethnobotanical and floristic studies (literature review and field studies) conducted in the region and city. A total of 157 of these species were herbaceous plants. The possible applications of these herbaceous plants in the Malatya city landscape were analysed in the scope of their conformity to the planting design parameters (Table 2). The species conforming to the parameters listed in Table 1 are labelled with a (+) in Table 2. The list of local species in Table 2 was created as a result of literature review and field studies. Following the field work (conducted as part of the TUBITAK project), 39 different species (*Achillea arabica*, *Alliaria petiolata*, *Allium kharputense*, *Aquilegia olympica*, *Capsella bursa-pastoris*, *Capsicum annuum*, *Chenopodium album* subsp. album var. album, *Coronilla scorpioides*, *Crocus cancellatus* subsp. damascenus, *Eremogone ledebouriana*, *Fritillaria imperialis*, *Fumaria officinalis*, *Geranium tuberosum*, *Gladiolus atroviolaceus*, *Gundelia tournefortii* var. *tournefortii*, *Hypericum lydium*, *Hypericum scabrum*,

Table 1 Conformity of the aromatic medicinal plant species found in Malatya City to the planting design criteria

Planting design criteria	Assessment criteria	Parameter	Scoring (according to the parameters)
Aesthetic properties of the plant species	Flower characteristics	1-Cluster 2-Composite 3-Colour, texture and form	1–3 or 2–3
	Fruit characteristics	1-Cluster 2-Composite 3-Colour, texture, form	1–3 or 2–3
	Leaf characteristics	1-Deciduous (evergreen) 2-Colour, texture and form	1–2
Sensory properties of the plant species	Flower, leaf and fruit characteristics	1-Scent 2-Texture 3-Edibility	1 or 2 or 3
Seasonal change properties of the plant species	Flower, leaf and fruit characteristics	1-Period of blooming (3 months or longer) 2-Colour change	1–2
Use areas of the plant species	Solitary use	1-Herbaceous plant height (< 20 cm), tree height (< 5 m) 2-Trunk and branch arrangement type 3-Flower characteristics	1–2–3
	Use in flower parterres	1-Plant height (< 10–20 cm) 2-Period of blooming 3-Flower size and colour effect	1–2–3
	Use as live fence	1-Plant height (< 50 cm) 2-Resistance to pruning 3-Leaf longevity and blooming period	1–3 or 1–2–3
	Use as site covering	1-Deciduous (evergreen) 2-Vegetation period 3-Rate of soil covering	1–2–3

Iris persica, *Lotus corniculatus*, *Malva neglecta*, *Melilotus officinalis*, *Melissa officinalis* subsp. officinalis, *Muscari comosum*, *Papaver dubium* subsp. dubium, *Papaver macrostomum*, *Papaver rhoeas*, *Potentilla recta*, *Reseda lutea* var. lutea, *Rumex scutatus*, *Rumex scutatus*, *Sanguisorba minor* subsp. lasiocarpa, *Saponaria officinalis*, *Satureja hortensis*, *Sedum album*, *Scabiosa argentea*, *Scorzonera tomentosa*, *Sophora alopecuroides*, *Vicia peregrina*, *Teucrium polium* subsp. polium, *Urtica dioica* subsp. dioica) were identified by Karakus and were transferred to the Inonu University (INU) Herbarium. The remaining 118 species identified through literature review had been listed in (co-author Karakus' PhD thesis (2016) and previously transferred to the Inonu University Herbarium.

The distributions of the plant species in Malatya City and its counties were assessed using a literature review and field studies. Based on this assessment, it was determined that there were 129 aromatic medicinal species in Akcadag County, 86 in Darende County, 43 in Yesilyurt County, 39 in Hekimhan County, 34 in Arapgir County, 33 in Dogansehir County, 27 in Arguvan County, 23 in Puturge County, 17 in Battalgazi County, 13 in Kale County, 9 in Doganyol County, 7 in Yazihan County and 2 in Kuluncak County. Based on the results, Akcadag County had the highest number of medicinal aromatic plant species, and Kuluncak County had the lowest number of medicinal aromatic plant species. In this study, there were 80 plant species with 4 or more out of the 8 parameters.

Twenty-five species out of the 157 herbaceous plant species analysed were endemic. Of the 25 endemic species, sixteen had 4 or more of the characteristics: *Onopordum polycephalum* Boiss., *Scorzonera tomentosa* L., *Helianthemum nummularium* (L.) Miller subsp. lycaonicum Coode & Cullen, *Geranium subacutum* (Boiss.) Aedo., *Marrubium parviflorum* Fisch. & C.A.Mey. subsp. oligodon (Boiss.) Seybold, *Salvia absconditiflora* (Montbret & Aucher ex Benth.) Greuter & Burdet, *Scutellaria orientalis* L. subsp. alpina (Boiss.) O. Schwarz var. glandulosissima O. Schwarz, *Scutellaria orientalis* L. subsp. bicolour (Hochst.) J.R. Edm, *Scutellaria orientalis* L. subsp. macrostegia (Hausskn ex Bornm.) J.R. Edm, *Scutellaria orientalis*

Table 2 Medicinal and aromatic plant species growing in the Malatya City region and their properties relative to the planting design criteria

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Alismataceae	*Alisma plantago-aquatica* L. subsp. plantago-aquatica	çoban düdüğü	+	-	+	-	-	-	-	-	+	-	-	Hydrophyte
Amaryllidaceae	*Allium kharputense* Freyn & Sint.	Harput soğanı	+	-	-	-	-	+	-	-	+	-	-	Bulbous
Apiaceae	*Foeniculum vulgare* Mill.	rezene	+	+	+	-	-	-	-	-	-	-	-	Perennial
Apiaceae	*Grammosciadium daucoides* DC.	kami	+	-	-	-	-	+	-	-	+	-	-	Perennial
Apiaceae	*Pastinaca sativa* L. subsp. urens (req. ex Gren. & Godr.) Čelak.	şeker havucu	+	-	-	-	-	-	-	-	-	-	-	Perennial
Asteraceae	**Achillea cappadocica* Hausskn. & Bornm.	gırtkesen	+	+	-	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Centaurea virgata* Lam.	acı süpürge	+	-	+	-	-	-	-	-	-	-	-	Perennial
Asteraceae	*Chrysophthalmum montanum* (DC.) Boiss	tutça	+	-	+	-	-	+	-	-	-	-	-	
Asteraceae	*Gundelia tournefortii* L. var. tournefortii	kenger	+	-	-	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Lapsana communis* L. subsp. intermedia (M.Bieb) var. intermedia	şebrek	+	-	+	-	-	-	-	-	+	-	-	Annual
Asteraceae	*Tripleurospermum sevanense* (Manden.) Pobed.	hanım gödesi	+	-	-	-	-	+	-	-	+	-	-	Perennial
Boraginaceae	*Anchusa strigosa* Banks & Sol.	gelezan	+	-	-	-	-	+	-	-	+	-	-	Perennial
Boraginaceae	*Asperugo procumbens* L	Nevazil otu	+	-	+	-	-	-	-	-	+	-	-	Annual
Boraginaceae	*Macrotomia densiflora* (Ledeb.) McBride	koca eğnik	+	-	+	-	-	-	-	-	+	-	-	Perennial
Brassicaea	*Barbarea vulgaris* R. Br. subsp. vulgaris	nicarotu	+	-	-	-	-	-	-	-	-	-	-	Perennial
Brassicaceae	*Capsella bursa-pastoris* (L.) Medik.	Çoban çantası	+	-	+	-	-	-	-	-	-	-	-	Annual
Brassicaceae	*Sinapis arvensis* L. var. arvensis	hardal	+	-	+	-	-	-	-	-	+	-	-	Perennial
Campanulaceae	*Asyneuma limonifolium* (L.) Janehen subsp. pestalozzae (Boiss.) Damboldt	tavşan ekmeği	+	-	-	-	-	-	-	-	+	-	-	Perennial
Campanulaceae	*Campanula rapunculoides* L.	elmacık	+	-	+	-	-	-	-	-	-	-	-	Perennial
Caryophyllaceae	** *Eremogone ledebouriana* (Fenzl) Ikonn.	iğne kumotu	+	-	+	-	-	-	-	-	-	-	+	Perennial
Caryophyllaceae	** *Minuartia anatolica* (Boiss.) Woronow var. lanuginosa McNeil	tıstısotu	+	-	-	-	-	+	-	-	+	-	-	Perennial
Caryophyllaceae	*Saponaria officinalis* L.	sabunotu	+	-	+	-	-	-	-	-	+	-	-	Perennial

The shaded lines indicate the plant species with 4 or more out of the 8 parameters.**Denotes endemic plants

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Caryophyllaceae	*Silene conoidea* L.	şıvanotu	+	-	+	-	-	-	-	-	-	-	-	Annual
Caryophyllaceae	*Silene vulgaris* (Moench) Garcke var. vulgaris	ecibücü	+	-	+	-	-	-	-	-	-	-	-	Annual
Convolvulaceae	***Convolvulus assyricus* Griseb.**	yastıkçık	+	-	-	+	-	+	-	-	-	-	+	Perennial
Caprifoliaceae	*Dipsacus laciniatus* L.	fesçitarağı	+	-	+	-	-	-	-	-	-	-	-	Perennial
Caprifoliaceae	*Scabiosa argentea* L.	yazı süpürgesi	+	-	+	-	-	-	-	-	+	-	-	Perennial
Caprifoliaceae	*Scabiosa columbaria* L. subsp. ochroleuca (L.) Čélak var. Ochroleuca	sarı uyuzotu	+	-	+	-	-	-	-	-	-	-	-	Perennial
Fabaceae	*Lotus corniculatus* L.	gazal boynuzu	+	-	+	-	-	-	-	-	+	-	-	Annual
Fabaceae	*Medicago x varia* Martyn	yaban yoncası	+	-	+	-	-	-	-	-	-	-	-	Annual
Fabaceae	*Melilotus officinalis* (L.) Desr.	Scentlu yonca	+	-	+	-	-	+	-	-	-	-	-	Annual
Fabaceae	*Ononis spinosa* L. subsp. antiquorum (L.) Briq	kayışkıran	+	-	+	-	-	-	-	-	-	-	-	Perennial
Fabaceae	*Ononis spinosa* L. subsp. antiquorum (L.) Sirj	demir delen	+	-	+	-	-	-	-	-	-	-	-	Perennial
Fabaceae	*Trifolium arvense* L. var. arvense	tavşan ayağı	+	-	-	-	-	+	-	-	-	-	-	Perennial
Fabaceae	*Trifolium pratense* L. var. pratense	çayır üçgülü	+	-	-	-	-	+	-	-	+	-	-	Perennial
Fabaceae	*Vicia peregrina* L.	kavli	+	-	+	-	-	-	-	-	-	-	-	Perennial
Fabaceae	*Cicer anatolicum Alef.*	nakaçe	+	-	+	-	-	-	-	-	-	-	-	Annual
Fabaceae	*Anthyllis vulneraria* L. subsp. boissieri Sag Born.	çoban gülü	+	-	-	-	-	-	-	-	+	-	-	Perennial
Geraniaceae	*Erodium cicutarium* (L.) L'Hér. subsp. cicutarium	iğnelik	+	-	+	-	+	+	-	-	-	-	-	
Iridaceae	*Gladiolus atroviolaceus* Boiss.	kıraç süseni	+	-	+	-	-	-	-	-	+	-	-	Bulbous
Iridaceae	***Crocus ancyrensis* (Herb.) Maw**	ankara çiğdemi	+	-	-	-	-	-	-	-	-	-	-	

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Iridaceae	*Crocus cancellatus* Herb. subsp. damascenus (Herb.) B. Mathew	pivok	+	-	+	-	-	-	-	-	+	-	-	Bulbous
Iridaceae	*Gladiolus italicus* Mill.	kılıçotu	+	-	+	-	-	-	-	-	+	-	-	Bulbous
Iridaceae	****Crocus danfordiae* Maw subsp. danfordiae**	ince çiğdem	+	-	-	-	-	-	-	-	-	-	-	Bulbous
Lamiaceae	****Salvia hypargeia* Fisch. C.A. Mey.**	siyahot	+	-	-	-	-	+	-	-	-	-	-	
Lamiaceae	*Salvia virgata* Jacq.	Fatma anaotu	+	+	+	-	-	-	-	-	-	-	-	Perennial
Lamiaceae	*Thymus fallax* Fisch. & C.A. Mey.	catri	+	+	-	-	-	-	-	-	+	-	-	Perennial
Lamiaceae	*Ziziphora clinopodioides* Lam.	dağ reyhanı	+	+	-	-	-	-	-	-	+	-	-	Perennial
Liliaceae	*Allium orientale* Boiss.	doğu soğanı	+	+	-	-	-	-	-	-	+	-	-	Bulbous
Liliaceae	*Fritillaria persica* L	. kırk lâle	+	-	-	-	-	+	-	-	+	-	-	Bulbous
Liliaceae	*Muscari coaleste* Fomin	kedi boncuğu	+	-	-	-	-	+	-	-	+	-	-	Bulbous
Lythraceae	*Lythrum salicaria* L.	hev hulma	+	-	+	-	-	-	-	-	-	-	-	Perennial
Malvaceae	*Malva neglecta* Wallr.	çoban çöreği	+	-	+	-	-	+	-	-	-	-	+	Perennial
Orobanchaceae	*Euphrasia pectinata* Ten.	gözotu	+	-	+	-	-	-	-	-	-	-	-	Parasitic
Orobanchaceae	*Orobanche aegyptiaca*	dinlendiren	+		+	-	-	-	-	-	-	-	-	Parasitic
Papaveraceae	****Glaucium acutidentatum* Hausskn. & Bornm.**	tavukgötü	+	-	-	-	-	-	-	-	-	-	+	Perennial
Papaveraceae	*Papaver dubium* L. subsp. Dubium	köpekyağı	+	-	+	-	-	+	-	-	+	-	-	Annual
Papaveraceae	*Papaver macrostomum* Boiss. & A. Huet	minimitçe	+	-	-	-	-	-	-	-	+	-	-	Annual
Papaveraceae	*Fumaria officinalis* L.	şahtere	+	-	-	-	-	+	-	-	+	-	-	Annual
Poaceae	*Hordeum vulgare* L.	arpa	+	-	-	-	-	-	-	-	-	-	-	Annual

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Polygonaceae	*Polygonum arenastrum* Boreau	bezmecеotu	+	-	+	-	-	+	-	-	-	-	-	Perennial
Polygonaceae	*Polygonum cognatum* Meissn.	madımak	+	-	+	-	-	+	-	-	-	-	-	Perennial
Polygonaceae	*Rumex acetosella* L.	kuzu kulağı	+	-	+	-	-	-	-	-	-	-	-	Perennial
Polygonaceae	*Rumex scutatus* L.	ekşimen	+	-	+	-	-	-	-	-	-	-	-	Perennial
Ranunculaceae	*(Anemone albana) Pulsatilla violacea* Rubra. subsp. armena (Boiss.) Luferov	yayla rüzgârgülü	+	-	-	-	-	+	-	-	+	-	-	Perennial
Ranunculaceae	*Aquilegia olympica* Boiss.	haseki küpesi	+	+	-	-	-	+	-	-	+	-	-	Annual
Ranunculaceae	*Ranunculus pinardii* (Steven) Boiss.	Gaz yağıotu	+	-	-	-	-	-	-	-	-	-	-	Annual
Resedaceae	*Reseda lutea* L. var. lutea	muhabbet çiçeği	+	-	+	-	-	-	-	-	-	-	-	Annual
Resedaceae	*Reseda tomentosa* (Boiss.) Chamberlain”	Havlı gerdanlık	+	-	+	-	-	-	-	-	-	-	-	Annual
Rosaceae	*Agrimonia eupatoria* subsp. asiatica (Juz.) Skalicky	fıtıkotu	+	-	+	-	-	-	-	-	+	-	-	Perennial
Rubiaceae	*Galium verum* L.	boyalık	+	-	+	-	-	-	-	-	+	-	-	Perennial
Rubiaceae	*Galium verum L. subsp. glabrescens* Ehrend.	sarı yoğurtotu	+	-	+	-	-	-	-	-	+	-	-	
Urticaceae	*Urtica dioica* L. subsp. Dioica	ısırgan	+	-	-	-	-	+	-	-	+	-	-	Perennial
Valerianaceae	*Valerianella locusta* (L.) Laterr.	nazlı kuzu gevreği	+	-	-	-	-	-	-	-	-	-	-	Annual
Verbenaceae	*Verbena officinalis* var. officinalis	Mine çiçeği	+	-	+	-	-	-	-	-	+	-	-	Annual
Acanthaceae	*Acanthus hirsutus* Boiss. subsp. Hirsutus	kıllı ayıpençesi	+	-	+	-	-	+	-	+	-	-	-	Perennial
Amaranthaceae	*Chenopodium foliosum* Asch.	cülek	+	-	+	-	-	+	-	-	+	-	-	
Asparagaceae	*Muscari comosum* (L.) Mill.	morbaş	+	-	+	-	-	+	-	-	+	-	-	Bulbous
Asteraceae	*Achillea arabica* Kotschy.	hanzabel	+	+	+	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Achillea santolinoides* Lag. subsp. wilhelmsii (K.Koch.) Greuter	kardaş kınası	+	+	+	-	-	+	-	-	+	-	-	Perennial

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Asteraceae	*Achillea setacea* Waldst. & Kit.	ayvabala	+	+	+	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Bellis perennis* L.	koyun gözü	+	+	+	-	-	+	-	-	+	-	+	
Asteraceae	*Cirsium arvense* (L.) Scop.	köy göçüren	+	-	+	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Eupatorium cannabinum*	koyun pıtrağı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Helichrysum plicatum* DC. subsp. plicatum	mantuvar	+	-	+	+	+	+	-	-	+	-	+	Perennial
Asteraceae	**Onopordum polycephalum* Boiss.	beyaz kangal	+	-	+	-	-	+	-	+	-	-	-	
Asteraceae	*Pulicaria dysenterica* (L.) Bernh. subsp. dysenterica	yaraotu	+	+	+	-	-	+	-	-	+	-	-	Perennial
Asteraceae	*Scorzonera mollis* M. Bieb. subsp. szowitzii	goftigoda	+	-	+	-	-	+	-	-	-	-	+	Perennial
Asteraceae	** *Scorzonera tomentosa* L.	alabent	+	-	+	-	-	-	-	+	+	-	-	Perennial
Asteraceae	*Solidago virgaurea* L. subsp. Virgaurea	altınbaşak çiçeği	+	+	+	-	-	-	-	-	+	-	+	Perennial
Boraginaceae	*Myosotis sylvatica* Hoffm. subsp. rivularis	keleş unutma beni	+	-	+	+	-	+	-	-	+	-	+	Perennial
Boraginaceae	*Alkanna orientalis* (L.) Boiss. var. orientalis	sarı sormuk	+	-	+	-	-	+	-	-	+	-	-	Perennial
Boraginaceae	*Heliotropium europaeum* L.	akrep otu	+	-	+	-	-	+	-	-	+	-	-	Annual
Brassicaceae	*Alliaria petiolata* (M.Bieb.) Cavara & Grande	Sarımsak hardalı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Caryophyllaceae	*Agrostemma githago* L.	buğday karamuğu	+	-	+	+	-	+	-	-	+	-	-	Annual
Caryophyllaceae	*Herniaria glabra* L.	atyaran	+	-	+	+	-	+	-	-	-	-	+	Perennial
Amaranthaceae	*Chenopodium album* L. subsp. album var. album	aksirken	+	-	+	-	-	+	-	-	+	-	-	Perennial
Cistaceae	**Helianthemum nummularium* (L.) Miller subsp. lycaonicum	çayır güngülü	+	-	+	-	-	+	-	-	+	-	-	Perennial
	Coode & Cullen													
Crassulaceae	*Sedum album L.*	Çoban kavurgası	+	-	+	+	+	+	-	-	+	-	+	Perennial
Euphorbia	*Euphorbia macroclada* Boiss.	neblul	+	-	+	+	-	+	-	-	+	-	-	Perennial

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Fabaceae	*Coronilla scorpioides* (L.) D.J.Koch	akrep burçağı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Fabaceae	*Sophora alopecuroides* L.	acımeyan	+	+	+	-	-	+	-	-	+	-	-	Perennial
Fabaceae	*Trifolium repens* L. var. repens	ak üçgül	+	-	+	-	-	+	-	-	-	-	+	Perennial
Geraniaceae	***Geranium subacutum* (Boiss.) Aedo.**	hoş ıtır	+	-	+	-	+	+	-	-	+	-	-	Perennial
Geraniaceae	*Geranium tuberosum* L.	çakmuz	+	-	+	-	+	+	-	-	+	-	-	Perennial
Hypericaceae	*Hypericum lydium* Boiss.	Caye sancıyan	+	-	+	-	-	+	-	-	+	-	-	Perennial
Hypericaceae	*Hypericum scabrum* L.	Kara hasançayı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Hypericaceae	*Hypericum perforatum* L. subsp. veronense (Schrank) H.Linn.	sarı kantaron	+	-	+	-	-	+	-	-	+	-	-	Perennial
Iridaceae	*Iris persica* L.	buzala	+	-	+	+	+	+	-	-	+	-	-	Rhizomatous
Lamiaceae	*Melissa officinalis* L. subsp. officinalis	oğulotu	+	+	+	-	-	+	-	-	-	-	-	Perennial
Lamiaceae	*Satureja hortensis* L.	çibriska	+	+	+	-	-	+	-	-	-	+	-	Perennial
Lamiaceae	**Stachys cretica L. subsp. anatolica Rech. f.	yağlıkara	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Prunella vulgaris* L.	gelincikle meotu	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	***Marrubium parviflorum* Fisch. & C.A. Mey. subsp. oligodon (Boiss.) Seybold**	küllü bozotu	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Mentha longifolia* (L.) L. subsp. typhoides (Briq.) Harley	dere nanesi	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	***Salvia absconditiflora* (Montbret & Aucher ex Benth.) Greuter & Burdet**	kara şalba	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Salvia candidissima* Vahl subsp. candidissima	galabor	+	+	+	-	-	+	-	-	-	-	+	Perennial
Lamiaceae	*Salvia frigida* Boiss.	sağır şalba	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Salvia microstegia* Boiss. & Balansa	yağlambaç	+	+	+	+	+	+	-	-	-	-	+	Perennial
Lamiaceae	*Salvia syriaca* L.	çevlikotu	+	+	+	-	-	+	-	-	-	-	+	Perennial

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Lamiaceae	*Scutellaria orientalis* L.	sarı kaside	+	-	+	-	-	+	-	-	+	-	+	Perennial
Lamiaceae	****Scutellaria orientalis* L. subsp. alpina (Boiss.) O. Schwarz var. glandulosissima O. Schwarz	dağ kasidesi	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	**** Scutellaria orientalis* L. subsp. bicolour (Hocsht.) J.R. Edm.	alaca kaside	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Scutellaria orientalis* L. subsp. cretacea (Boiss. & Hausskn) J.R. Edm.	kulaklı kaside	+	-	-	+	+	+	-	-	+	-	+	Perennial
Lamiaceae	****Scutellaria orientalis* L. subsp. macrostegia (Hausskn ex Bornm.) J.R. Edm	takkeli kaside	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Scutellaria orientalis* L. subsp. pectinata (Montbret & Aucher ex Benth.) J.R. Edm.	taraklı kaside	+	-	+	-	-	+	-	-	+	-	+	Perennial
Lamiaceae	*Scutellaria orientalis* L. subsp. pinnatifida J.R. Edm.	kırbaç sırımı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Scutellaria orientalis* L. subsp. santolinoides (Hausskn ex Bornm.) J.R. Edm.	fırat kasidesi	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Scutellaria orientalis* L. subsp. sintenisii (Hausskn ex Bornm.) J.R. Edm.	eğin kasidesi	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Scutellaria orientalis* L. subsp. virens (Boiss. & Kotschy) J.R. Edm.	yeşil kaside	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Scutellaria salviifolia* Benth.	has kaside	+	-	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Stachys cretica L.*	deliçay	+	+	-	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Stachys cretica L. subsp. mersinaea (Boiss.) Rech. f.	boncuk şalba	+	-	-	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Teucrium polium* L. subsp. polium	acıyavşan	+	+	+	-	-	+	-	-	-	-	+	Perennial
Lamiaceae	*Thymus kotchyanus* Boiss. & Hohen. subsp. Kotchyanus	kekik	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	****Thymus pallasicus* Hayek & Velen.	boz kekik	+	+	+	-	-	+	-	-	+	-	-	Perennial
Lamiaceae	*Thymus sipyleus* Boiss.	sipil kekiği	+	+	+	-	-	+	-	-	-	-	+	Perennial
Liliaceae	*Fritillaria imperialis* L.	Ağlayan gelin	+	+	+	-	-	+	-	+	+	-	-	Bulbous

Table 2 (continued)

Plant Name			Plant Characteristics											
			Flower characteristics			Leaf characteristics								
Family	Latin name	Local name	Colour	Scent	Blooming period	Colour	Colour change	Texture	Fruit characteristics	Solitary use	Use in flower parterres	Use as a live fence	Use as site covering	Plant type
Papaveraceae	*Corydalis solida* (L.) Clairv. subsp. solida	Rumeli kazgagası	+	-	+	-	-	+	-	-	+	-	-	Bulbous
Papaveraceae	*Papaver rhoeas* L.	gelincik	+	-	+	-	-	+	-	-	+	-	-	Annual
Plumbaginaceae	*Plumbago europaea* L.	karakına	+	-	+	-	-	+	-	-	+	-	-	Annual
Polygonaceae	*Rumex patientia* L.	efelek	+	-	+	-	-	+	-	-	+	-	-	Perennial
Polygonaceae	*Rumex tuberosus* L. subsp. horizontalis (K. Koch) Rech.f.	köme turşusu	+	-	+	-	-	+	-	-	+	-	-	Perennial
Primulaceae	*Anagallis arvensis* L. subsp. Arvensis	farekulağı	+	-	+	-	-	+	-	-	+	-	-	Perennial
Rosaceae	*Alchemilla pseudocartalinica* Juz.	kartal pençesi	+	-	+	-	-	+	-	-	+	-	-	Perennial
Rosaceae	*Fragaria vesca* L.	dağ çileği	+	-	+	-	-	+	+	-	+	-	-	Perennial
Rosaceae	*Potentilla recta* L.	su parmak otu	+	+	+	-	-	+		-	-	-	+	Perennial
Rosaceae	*Potentilla reptans* L.	reşatınotu	+	+	+	-	-	+		-	-	-	+	Perennial
Rosaceae	*Sanguisorba minor* L.	Çayır düğmesi	+	-	+	-	-	+	-	-	+	-	-	Annual
Rosaceae	*Sanguisorba minor L.* subsp. lasiocarpa (Boiss. & Hausskn) Nordborg	kara göndürme	+	-	+	-	-	+	-	-	+	-	-	
Rosaceae	*Sanguisorba minor L.* subsp. minor	Çayır düğmesi	+	-	+	-	-	+	-	-	+	-	-	
Santalaceae	*Viscum album* L. subsp. Album	ökseotu	+	-	+	-	+	+	-	-		-	-	

L. subsp. pectinata (Montbret & Aucher ex Benth.) J.R. Edm., *Scutellaria orientalis* L. subsp. santolinoides (Hausskn ex Bornm.) J.R. Edm., *Scutellaria orientalis* L. subsp. sintenisii (Hausskn ex Bornm.) J.R. Edm., *Scutellaria salviifolia* Benth., Stachys cretica L. subsp. anatolica Rech. f., *Thymus pallasicus* (Hayek & Velen.) and *Verbascum asperuloides* Hub.-Mor.

All 157 species were flowering plants. Therefore, certain sub-parameters of these species (flower characteristics: colour, pleasant scent and blooming period;

leaf characteristics: colour, seasonal colour change and texture) were analysed. There were 124 plant species with a blooming period of 3 months or longer. Seventy-nine percent of the species had flowering period characteristics that would make them useful in planting designs.

The parameters that received the lowest scores in the assessment were the fruit characteristic and usage as a live fence. These two characteristics account for 2% of the plant species.

Based on all the parameters, 8 species were found to have maximum positive properties: *Bellis perennis* L., *Helcyrsum plicatum* DC. subsp. plicatum, *Myosotis sylvatica* Hoffm subsp. rivularis Vestergr, *Sedum album* L., *Scutelleria oriantos* L., *Scutelleria oriantalis* L. subsp pectiana, *Fritillaria imperialis* L. and *Fragarra vesca* L.

It was determined that of the studied plant species, 103 had leaf properties that would make them useful for planting designs. In other words, the leaf characteristics of 66% of the species generated the desired effect. Flower parterres represented a prominent use of these species. Only 56 species could not be used in flower parterres. However, 24 of those 56 species could be used for site cover. There were 2 remarkable species in terms of fruit characteristics: *Capsicum annuum* L. and *Fragaria vesa* L.

The results showed that 5% of the 157 species had 5 beneficial characteristics, 46% had 4 beneficial characteristics, 27% had 3 beneficial characteristics, 18% had 2 beneficial characteristics and 4% had 1 beneficial characteristic.

Conclusion

In this paper, the cultural heritage assets of Malatya City as well as the local plant species growing naturally within the city limits and maintaining continuity from the past to the present as the living heritage of the city were investigated, and the potential application of these species in today's city landscape was scrutinized. The data obtained in this study reveals that the flora of Malatya is rich in medicinal and aromatic species.

The studied local species have not been used in completed or ongoing landscape architectural projects in Malatya City; instead, exotic plants with foreign origins were commonly used. The use of exotic species leads to many problems. For example, they may not generate the expected visual or functional composition or provide continuity in landscape designs because of the high level of care they need, their high purchase and irrigation costs and their poor adaptation to soil and climatic conditions. Furthermore, the increased use of exotic species leads to the disruption of the existing floral equilibrium. Using local species to restore the landscape or as a substitute for exotic ornamental plantings can help reversing the trend of species loss. Because they are adapted to the local region, they tend to resist damage from freezing, drought, common diseases and herbivores if planted in the same region (Dorner 2002). According to a report of National Wildlife Federation, "Native plants have formed symbiotic relationships with native wildlife over thousands of years, and therefore offer the most sustainable habitat". The same report states that exotic plants and artificially created plant forms do not support wildlife as well as native plants (National Wildlife Federation n.d). Thanks to the benefits they provide, natural plant species that are critical in ensuring the balance of flora and fauna are key elements for ecological restoration.

The results of this study indicate that based on their visual characteristics, the majority of the medicinal and aromatic plants have potential applications in planting designs; however, only a few of these species were cultivated and produced. It is critical to cultivate these species and include them in landscape architectural designs to improve their recognition, to prevent the extinction of these species and to generate more sustainable and healthier city landscapes. The effective use of these plants in planting designs and their cultivation and production are crucial. It is envisaged that popularizing the use of medicinal and aromatic plants in landscape designs would lead to an increase in the production and economic activities in the region, hence contributing to local progress.

Apart from their aesthetic and functional properties, aromatic plants are known to pose biological risks (Fusco et al. 2015). Biological risks mostly arise due to inappropriate use of plant drying and storage methods. Ainiza et al. (2015) state that toxigenic moulds that contain *Aspergillus flavus* and *Aspergillus parasiticus* show an increased activity when aromatic plants are not stored under proper temperature and humidity conditions. On the other hand, some types of species of aromatic plants are known to cause allergic reactions. Martinez et al. (2016) state that particularly certain types of spices lead to allergic asthma. Therefore,

it is essential to determine whether the plants to be used in urban public landscapes carry allergic reaction risks or not. On that account, it is recommended to use instructive and cautionary elements in planting areas. “Edible gardens” created for growing food can be included in public spaces provided that they are controlled in terms of food safety. It is also expected that these areas will contribute to urban ecology as alternative green spaces.

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References

Acıbuca, V., & Budak, B. D. (2018). Place and importance of medicinal and aromatic plants in the world and Turkey. *Çukurova Journal of Agricultural Food Science, 33*(1), 37–44.

Ainiza, W. W., Jinap, S., & Sanny, M. (2015). Simultaneous determination of aflatoxins and ochratoxin A in single and mixed spices. *Food Control, 50*, 913–918.

Akan, H., & Bakır, Y. (2015). Investigation of the ethnobotanical aspects the town Kâhta and village of Narince. *BEU Journal of Science, 4*(2), 219–248.

Arslan, M. (2010). Usage facilities of medical and aromatic herbs in landscape architecture, 4th Ornamental Plants Congress Proceedings Book, Alata Garden Cultivations Research Institution, Erdemli/Mersin, 265-270.

Arslan, M., Kalaylıoğlu, Z., & Erdi, E. (2018). Use of medicinal and aromatic plants in therapeutic gardens. *Indian Journal of Pharmaceutical Education and Research, 52*(4), 151–154.

Atik, A., Aslan, F., Yılmaz, B., & Ateş, O. (2013). Modelling purchasing demand of urban people for ornamental plants using logistic regression analysis: sample of Malatya City. *Journal of Animal and Veterinary Advances, 12*(16), 1317–1324 ISSN:1680-5593.

Calvet-Mir, L., Gomez-Baggethun, E., & Reyes-Garcia, V. (2012). Beyond food production: ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, Northeastern Spain. *Ecological Economies, 74*, 153–160. https://doi.org/10.1016/j.ecolecon.2011.12.011.

Cannabis, V.I. (Marijuana- Hemp) in Ancient Egypt. (2017). Resource document: http://researchgate.net/profile/Venice_Attia/publication/321420351_Cannabis_marijuana_hemp_in_Ancient_Egypt/links/5a212c49aca272ab5a623bef/Cannabis-marijuana-hemp-in-Ancient-Egypt. Accessed: 10 August 2019.

Dawa, S., Gurmer, P., Dolma, T., Angdus, T., Stobgais, T., Tharpa, T. (2018). Status of medicinal and aromatic plants in the State of Jammu and Kashmir, India, *International Journal of Current Microbiology and Applied Sciences* ISSN: 2319-7706 7(11).

Demirkan, G. Ç. (2019). Evaluation of healing gardens and design criteria. *Turkish Journal of Agriculture - Food Science and Technology, 7*(1), 148–151.

Dorner, J. (2002). An introduction to using native plants in restoration project, Report for Plant Conservation Alliance Bureau of Land Management, US Department of Interior, U.S. Environmental Protection Agency, Resource document. https://www.fs.fed.us/wildflowers/Native_Plant_Materials/documents/intronatplant.pdf Accessed: 27 June 2020.

Dönmez, Ş. (2016). Uses of some medicinal and aromatic plants in the landscape architecture grown in the Lake District, *International Journal of Advanced Research (IJAR),* https://doi.org/10.21474/IJAR01/1182

Fusco, V., Den Besten, H. M., Logrieco, A. F., Rodriguez, F. P., Skandamis, P. N., Stessl, B., & Teixeira, P. (2015). Food safety aspects on ethnic foods: toxicological and microbial risks. *Current Opinion in Food Science, 6*, 24–32.

Güler, S. (2004). Ethnobotanical characteristics of some medicinal and aromatic plants naturally distributed around Erzurum. In*Eastern Anatolia Forestry Research Institute, Technically Report No:5*. Erzurum: Turkey.

Güner, A., Aslan, S., Ekim, T., Vural, M., & Babaç, M. T. (2012). *Türkiye bitkileri listesi (damarlı bitkiler), Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği*. İstanbul: *Yayını*.

Inoue, M., & Craker, L. (2014). Medicinal and aromatic plants-uses and functions. In: Dixon G, Aldous D, (Ed.). *Horticulture: Plants for People and Places, 2*, 645–669. https://doi.org/10.1007/978-94-017-8581 Dordrecht: Springer.

Inoue, M., Hayashi, S., & Craker, L. (2019). Role of medicinal and aromatic plants: past, present, and future. In S. Perveen, & A. Al-Taweel (Eds.), *Pharmacognosy - Medicinal Plants*. London: IntechOpen Limited.

Drug Enforcement Administration, 2018, Museum. Cannabis, Coca, & Poppy: Nature’s addictive plants. Resource document: deamuseum.org/ccp/opium/history.html. Accessed 02 November 2020.

Jamshidi-Kia, F., Lorigooini, Z., & Amini-Khoei, H. (2018). Medicinal plants: past history and future perspective. *Journal of Herbmed Pharmacology, 7*(1), 1–7. https://doi.org/10.15171/jhp.2018.01.

Kala, C.P. (2010). Ethnobotanical and ecological approaches for conservation of medicinal and aromatic plants, *Acta horticulturae*, https://doi.org/10.17660/ActaHortic.2010.860.1.

Karakuş, S. (2016). *Flora of Malatya City, Graduate School of Natural and Applied Sciences, Department of Biology*. Ph.D: Inönü University, Malatya, Turkey.

Kevseroğlu K., Uzun, A., Çalışkan, V. (2014). Medicinal and aromatic plants identified in central and eastern Black Sea region natural flora. 2nd Medicinal and Aromatic Plants Symposium, Symposium Proceedings Book, 108-117, Yalova/Turkey.

Kilic, O., & Bagci, E. (2013). An ethnobotanical survey of some medicinal plants in Keban (Elazığ-Turkey). *Journal of Medicinal Plant Research, 7*(23), 1675–1684.

Kokkınou, I., Ntoulas, N., Nektarios, P., & Varela, D. (2016). Response of native aromatic and medicinal plant species to

water stress on adaptive green roof systems. *HortScience, 51*(5), 608–614.

Kujawska, M., Zamudio, F., Montti, L., & Carrillo, V. P. (2018). Effects of landscape structure on medicinal plant richness in home gardens: evidence for the environmental scarcity compensation hypothesis. *Economic Botany, 72*(2), 150–165.

Leszczynski, A.N. (1997). Planting the landscape a professional approach to garden design. John Wiley and Sons. Inc. pp. 205, New York.

Lindberg, M. H., & Bertelsen, G. (1995). Spices as antioxidants. *Trends Food Science Technologie, 6*(8), 271–277. https://doi.org/10.1016/S0924-2244(00)89112-8.

Martinez, M. B., Moreno-Borque, R., Sanchez-Lopez, P., & Gajate-Fernandez, P. (2016). Spice allergy: asthma in the food industry. *Journal of Allergy and Clinical Immunology, 137*(2).

Ministry of Economy of Turkish Republic, Sector Report, (2017), Resource document. https://ticaret.gov.tr/data/5b8700a513b8761450e18d81/Kuru_Kayisi.pdf Accessed: 10 August 2019.

National Wildlife Federation, Report, (n.d.), Resource document: https://www.nwf.org/Our-Work/Wildlife-Conservation, Accessed: 28 June 2020.

Phillipson, J. D. (2001). Phytochemistry and medicinal plants. *Phytochemistry, 56*(3), 237–243.

Sarı, D., & Karaşah, B. (2018). A research on preferences of planting design elements, principles and approaches in landscape design applications. *Yıldız Technical University Faculty of Architecture E-Journal (MEGARON), 13*(3), 470–479. https://doi.org/10.5505/MEGARON.2018.29981.

Sezen, I., Demircan, N., & Karaoğlan, E. (2018). Biodiversity and urban gardens: medicinal and aromatic plants that can be used in Erzurum (Turkey) Urban Gardens. *Journal of Architecture Sciences and Applications (JASA), 3*(2), 81–88.

Sunkar, M., Hatun, Ü., & Toprak, A. (2013). *The impact of climate characteristics on fruit production in and around Malatya Basin, 3rd International Geography Symposium-GEOMED Symposium Proceedings*. isbn:978-605-62253-8-3.

Uzun, A., & Uzun, S.P. (2014). Methods and principles to be used in ethnobotanical studies, KSU, *Report of Faculty of Forestry,* Kahramanmaraş Sütçü İmam University, Kahramanmaraş, Turkey. Resource document. http://om.ksu.edu.tr/depo/belgeler/Etnobotanik%20%C3%87al%C4%B1%C5%9Fmas%C4%B1%20-%202_1703231320492425.pdf. Accessed:15 December 2019.

Warner S.B. (1994). The periodic rediscoveries of restorative gardens: 1100 to the present in The Healing Dimensions of People-Plant Relations: Proceedings of a Research Symposium; (Ed.), Mark Francis, Pat Lindsey, Jay Stone Lindsey, University of California at Davis, 6-8.

Tetik, F., Civelek, S., & Cakilcioglu, U. (2013). Traditional uses of some medicinal plants in Malatya (Turkey). *Journal of Ethnopharmacology, 146*(1), 331–346.

Uprety, Y., & Asselin, H. (2012). Traditional use of medicinal plants in the boreal forest of Canada: review and perspectives. *Journal of Ethnobiology and Ethnomedicine, 8*(1), 7.

Zargari, A. (1992). Medicinal plants. Tehran University Press, 889.