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Aesthetic Evaluation of Autumn Landscape of Hyrcanian Native Trees Species for Use in Urban Landscape (A Case Study in Sari City Area of Iran)

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Abstract

Recent decades have witnessed the growing use of non-native plants in Iran while their use is very challenging and high-cost for the country. This raised a new approach in recent decades towards the use of native plants. Native species are precious because they possess the main ecological factors and they are already compatible with the region. Accordingly, this research was conducted to evaluate the species of woody plants that can be used in green space planning. The study focused on 55 tree species from 20 plant families in the research area. After evaluating the parameters that govern the aesthetic beauty of the studied plants in autumn, 27 tree species of Hyrcanian area were placed in the group of beautiful plants in terms of aesthetic criteria in autumn, 14 species were placed in the group of very beautiful trees, and 14 species were placed in the group of trees with average beauty. The final conclusion was that some species of Hyrcanian native trees can be used to beautify the urban landscape, especially in autumn, so it is recommended to do compatibility studies on the use of these species in urban landscape, especially in parks.

Keywords: Aesthetics, Fall landscape, Green space, Hyrcanian plant, Native trees.

INTRODUCTION

As a result of increased population in urban areas and its adverse impacts on the environment, people continue to live away from nature and among dense concrete structures of cities. One of the important requirements for the correct and sustainable development is to admit that human society and environment are not independent; rather, they complete each other. In fact, protection and restoration of natural resources makes the basis of sustainable development (Özturk and Bilgili, 2015). Urbanite humans grow plants near their homes to keep contact with the nature and have a part of living nature on their side (Bagheri, 2013). So, it is necessary to notice that designing landscapes for a city or a neighborhood is not a casual activity. As we contemplate and then design for lifeless body of city's constructions, we need to think, plan and then design for the living things too. How plants are used and designed in a landscape is closely related to the architecture and improves its quality (Leghaei, 2004).

Native plant species are very important in a landscape (Korkut, 1993; Yilmaz *et al*., 2003). In other words, native plants are vital ingredients for landscape architects in terms of conservation, restoration, development, and management of a landscape (Bayraktar, 1980). Among all types of plants used in landscaping, trees are more important due to their size, form, and life span. Trees can also have useful effects in improving the quality of urban aesthetics, such as creating a sense of beauty, determining external lines and borders, creating range and shadow, reducing stress, and improving the sense of security (Arslan *et al*., 1996; Leszczynski, 1999; Aslanboğa, 2002; Moore, 2002).

According to the principles of color psychology, social and cultural infrastructure, indigenous knowledge, and some other features, landscape designers use different colors in landscape designing. Thus, the plant pigments that color the leaves, flowers and fruits of plants have a high aesthetic value from architects' point of view (Kaufman and Lohr, 2004). The beauty of man-made landscapes depends on appropriate application of the colors within the layout. Generally, red, orange and yellow are warm colors which are used in the design of gardens and landscapes to provide a happy environment and diversity in different seasons of the year. On the other hand, green and blue are classified as cool colors used to show garden and landscape larger (Rouhani, 2015). The flourish and parade of colors is impressive, especially in spring and autumn (Khoshkhoui, 2015). In cold and temperate regions, autumn is one of the best seasons of the year when the leaf color change is very amazing and spectacular. In some parts of the temperate regions of the world, deciduous forests are very profitable because of their tourism importance (Homayoun and Mahdikhani, 2016). The color of about 15 percent of tree species in temperate zones changes in autumn, but this ratio may be even higher depending on the species occurring in every forest (Archetti *et al*., 2013). So, the change of leaf color in autumn can be considered as their visual potential in landscape.

Fig. 1. Change of leaf color in *Parrotia persica* (DC.) C. A. Mey (a) and *Acer cappadocicum* Gleditsch (b) in autumn - native tree species of Hyrcanian forest (Source: Authors).

Generally, with 8000 plant species and five different vegetative areas, Iran is one of the richest areas of plant growth in the world. Hyrcanian vegetative area is among summer broad-leaved forest and is similar to broad-leaved forests of Europe (Shahsavari, 1998). Due to the dominance of deciduous species together with evergreen species, forests of northern Iran have a great visual power to excite human sense and manifest the beautiful colors of autumn mixed with the magnificent evergreen trees and scenic view of naked trees in winter. These natural features of Hyrcanian forests and the need to upgrade the landscape and increase the diversity in urban landscape can be strong reasons for the visual assessment of the native tree species.

MATERIALS AND METHODS

The material of the study consisted of sub-Hyrcanian native tree species collected from the nine vegetative areas and the paths to these areas (Fig. 2) in the city of Sari according to the administrative divisions of Iran's map in 2010 to consider the changes of contributing factors of the study based on the differences in the vegetation regions such as dense forests, springs, scattered forests, rivers and relatively dry ecosystems. All considered areas of this research are located in geographic district of Sari (Table 1). The geographical position of Sari is between the longitudes of 52° 56′ and 53° 59′ east and latitudes of 35° 58′and 36° 47′ north with the average annual rainfall of 642 mm, average temperature of 5.18°C and relative humidity of 82-64% (Yaghoubi *et al*., 2014).

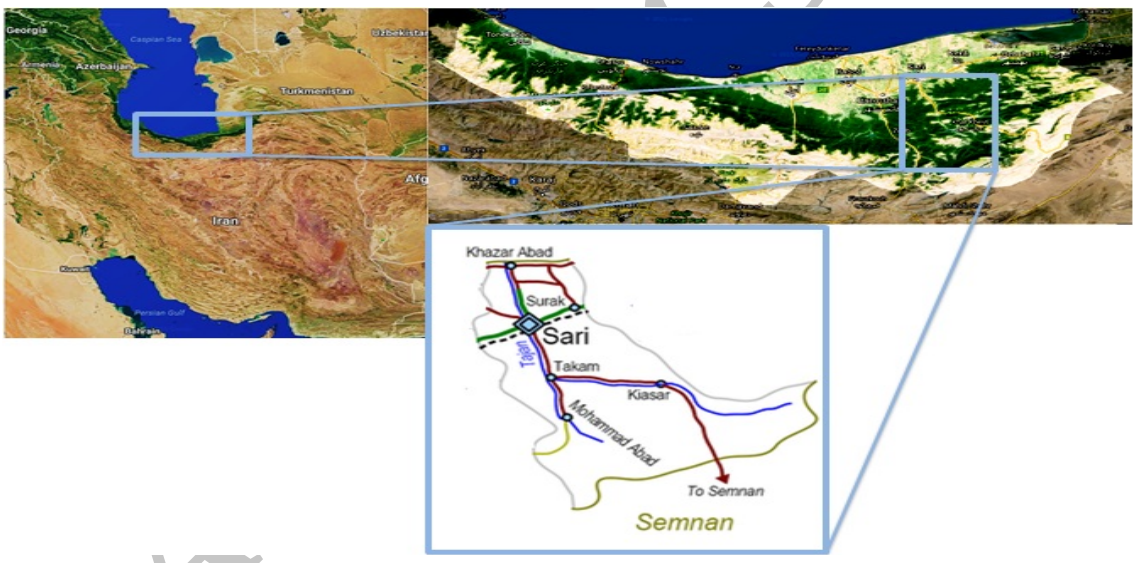

Fig. 2. Map of the study area (city of Sari) (Google Earth).

The field study was conducted in the fall of 2015. In this phase, besides observing trees in their original habitat, Herbarium specimens and photos were taken of each tree species and checklist of evaluation indicators was completed in every season. In order to record the data accurately, we took four pictures from every tree in every field observation that included:

1. An overall picture of tree canopy's form; the aim of this kind of photography is to study the difference in canopy type and its form diversity across different trees.

2. Picture of crown; this type of photography is to capture the crown area with the aim of recording the presence or absence of basal shoot.

3. Picture of trunk; the picture of all trees were taken from fixed height of 1 meter from the ground. These pictures were taken to record visual and aesthetic features of the trees including the bark of tree (Rhytidome), color, roughness or smoothness of the surface, and presence or absence of spines on surface.

4. Picture of branches: these pictures were taken to record the aesthetic features, form, shape and color of organs located on branch such as leaves and fruits.

Indicators used in this study included beauty of landscape trees, branching pattern, and leaves' color in autumn and visual attraction of fruits in autumn. These parameters were considered as quality benchmark and a herbarium specimen was prepared for every observed species. Visits took place in diverse habitats to examine trees' natural growing forms.

In the next step, botanical tree species were identified with the help of reference books, such as Flora Iranica (Rechinger, 1963-2007), Flora of Iran (Asadi *et al*., 1989-2011) and Flora of Trees and shrubs of Iran (Mozaffarian, 2005).

Then, to complete the checklist of aesthetic features regarding the fact that beauty is a quality and depends on perception, and by using numerous resources, multiple studies, and help of scoring method (Amerin *et al*., 1965; Yu *et al*., 2003), the recorded indicators were scored from 1 as the lowest aesthetic value to 10 as the highest aesthetic value.

Since the criterion of beauty depends on taste, opinions of specialists and experts who were familiar to native species were also used for scoring. Then, the results of these scores were evaluated by the SPSS version 19 software package using cluster analysis.

Table 1. Features of the locations reviewed.

No.	*Data collection pathways*
1	**Dasht-e Naz Wildlife refuge:** At a height of 6 meters above sea level. Pristine areas are in coastal plain forest of Sari.
2	**Afratakht Forest:** At a height of 83 meters above sea level. This forest is located to the west of Sari-Ghaemshahr at the end of Afratakht village.
3	**Lajim Forest:** At a height of 641-1155 meters above sea level. Forest area is located in the central district of Sari. Due to the limited rural development forest in this area remains pristine. In this area some endangered species like Ulmus glabra can be found.
4	**Forest lands of Roudbarkola:** At a height of 226 meters above sea level. Some branches of Zalemroud river pass through the village. The purpose of this survey was in the registration of available information of species, their effect on riverside beauty and their compatibility with riverside lands.
5	**Alandan Forest:** At a height of 1023 meters above sea level. This forest is located in Kiasar district. This area was selected to study the vegetation around lake ecosystem and increase in height from sea level and change in vegetation from lower types to middle types.
6	**Sangedeh:** At a height of 1409 meters above sea level. These forests are among upper forest of Hyrcanian area in Dodangeh, the southern part of the Sari. Due to the slope of the ground, and Impassable mountains are covered with trees, shrubs and bushes, this area has diverse vegetation.
7	**The forest leading to Kharkhoun's Spring:** At a height of 810 meters above sea level. Forest lands of this area are located in Kiasar district. This path was selected to study the vegetation and ecosystem of groundwater's outflows.
8	**Vargine va Spring:** At a height of 835 meters above sea level. This spring is located in Khosh Roudbar village, Dodangeh district. It is located in the woods and is very rich in terms of vegetation.
9	**Badab-e Surt Spring:** At a height of 1721 meters above sea level. It is located in the ruined village of Surt, Chahardangeh. The aim of this selection was to study vegetation area in South East of Sari which is poorer than previously reviewed areas in terms of humidity, type of soil, precipitation.

RESULTS AND DISCUSSION

After conducting field surveys, finally, 55 Hyrcanian native tree species from 20 plant families were collected and recognized within the city of Sari in sub-Hyrcanian forests vegetative area.

Table 2. The introduction of flora of native trees in Sari area along with some influential criteria for using them in urban landscape.

No.	Scientific name	Spiny	Suckers	Texture	Crown form	No.	Scientific name	Spiny	Suckers	Texture	Crown form
1	*Acer campestre* L.	0	1	2	Round to oval	29	*Juniperus excelsa* M.Bieb.	0	0	3	Pyramidal
2	*Acer cappadocicum* Gleditsch	0	1	2	Round to oval	30	*Laurocerasus officinalis* Roemer	0	0	1	Round, wide or horizontal
3	*Acer hyrcanum* Fisch. & C.A.Mey.	0	1	2	Round to oval	31	*Malus orientalis* Uglitzk	0	0	2	Pyramidal
4	*Acer monspessulanum* L.	0	1	3	Round	32	*Melia azedarach*	0	0	2	Round
5	*Acer platanoides* L.	0	1	1	Round to oval	33	*Mespilus germanica* L.	1	1	1	Wide round-up
6	*Acer velutinum* Boiss.	0	1	1	Round to oval	34	*Morus alba* L.	0	0	1	Ovate to broad, rounded
7	*Albizia julibrissin* Durazz	0	0	2	Horizontal	35	*Parrotia persica* (DC.) C. A. Mey	0	1	1	Round, pyramidal to oval
8	*Alnus glutinosa* (L.) Gaertn.	0	1	1	Ovate to pyramidal	36	*Populus alba* L.	0	1	2	Round to oval
9	*Alnus subcordata* C.A.Mey.	0	1	1	Conical	37	*Prunus divaricata* Ledeb	1	1	3	Pyramidal to oval
10	*Betula pendula* Roth	0	1	2	Ovate	38	*Prunus spinosa*	1	1	3	vase
11	*Buxus hyrcana* Pojark	0	1	3	vase	39	*Pterocarya fraxinifolia* (Poir.) Spach	0	1	1	Round to oval
12	*Carpinus betulus* L.	0	0	2	Ovate	40	*Punica granatum* L.	1	1	3	Wide round-up
13	*Carpinus orientalis* Mill.	0	0	2	Conical	41	*Pyrus boissieriana* Buhse	1	1	3	Ovate to cylindrical
14	*Celtis australis* L.	0	0	2	Round	42	*Quercus castaneifolia* C. A. Mey.	0	0	1	Wide and round
15	*Cercis siliquastrum* L.	0	1	1	Round to vase	43	*Quercus macranthera* Fisch. & C. A. Mey. .	0	0	1	Round
16	*Cornus australis* C.A.Mey	0	0	2	Round to vase	44	*Quercus petraea* (Mattuschka) Lieblein	0	0	1	Round
17	*Crataegus atrosanguinea* A. Pojark	1	1	2	vase	45	*Robinia pseudoacacia*	1	1	3	Oval
18	*Crataegus melanocarpa*	1	1	2	vase	46	*Rosa canina* L. S. Str.	1	1	3	vase
19	*Crataegus pontica*	1	1	2	vase	47	*Salix alba* L.	0	1	2	Extended to the semi-insane
20	*Crataegus pseudomelanocarpa*	1	1	2	vase	48	*Salix caprea*	0	1	2	Round
21	*Crataegus songarica* C. Koch	1	1	2	vase	49	*Salix excelsa* J.F.Gmel	0	1	2	Ovate to wide
22	*Cupressus sempervirens* L. Var.horizontalis (Mill) Gord.	0	1	3	Pyramidal	50	*Sorbus torminalis* (L.) Crantz.	0	0	1	Ovate to pot
23	*Diospyros lotus* L.	0	1	1	Ovate	51	*Taxus bacata*	0	0	3	Pyramidal to cylindrical
24	*Fagus orientalis* Lipsky.	0	0	1	Ovate	52	*Tilia platyphyllos* Scop.	0	0	2	Rounded to pyramidal to columnar
25	*Ficus carica* L. Ph DML Ir-Tur. Medit.	0	1	1	Ovate	53	*Ulmus glabra* Hudson	0	1	1	Round to oval
26	*Fraxinus excelsior* L.	0	0	2	Round	54	*Ulmus minor* Mill.	0	1	2	Ovate to vase
27	*Gleditsia caspica* Desf.	1	0	2	Ovate to wide	55	*Zelkova carpinifolia* (Pall.) Dipp	0	1	3	vase
28	*Juglans regia* iaciniata jacques.	0	0	1	Round						

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1 & 2. Having thorn and suckers: Plants with thorns got the score of 0 and plants without thorns got 1.
3. Texture: It is plant's visual roughness or smoothness. In the above table rough texture code is 1, medium texture code is 2 and soft texture code is 3.
4. The form of crown: In fact, the form of a plant is determined based on its perimeter's lines of side view. Aggregation of pieces which builds the tree's mass is called crown form. This volume occupies a three-dimensional space (Scarfone, 2012)

In the next stage, data matrix was prepared in the MS-Excel spreadsheet in the format of rows and columns for different aesthetic and appearance characteristics and with the help of cluster analysis, and groups' integration was performed by standardized data. Squared Euclidean Distance was used as similarity criterion for grouping. Next, the results were plotted as a tree diagram (Fig. 3).

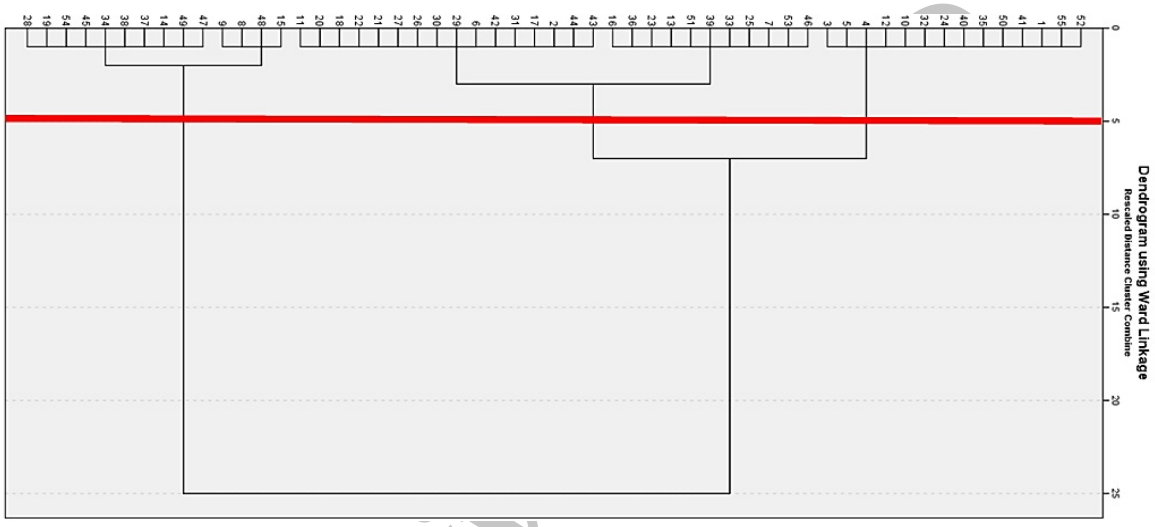

Fig. 3. Dendrogram derived from cluster analysis of parameters which affect the beauty of Hyrcanian native trees in autumn.

Dendrogram of features which are related to the beauty of the trees in autumn includes the beauty of the trunk, leaves, fruit and branch pattern as drawn. A study was carried out on 55 tree species using statistical cluster analysis in order to group the data by Ward's method. Regarding cluster diagrams in scale conversion distance of 5 units (shown by the red line), trees were divided into three distinct groups in terms of their aesthetic features in autumn. The results indicate that, in terms of aesthetic criteria in autumn, most (27 species) species of Hyrcanian native trees were classified as beautiful plants, 14 species as very beautiful trees, and 14 species as trees with average beauty (Table 3).

Table 3. The classification resulted from cluster analysis based on the scientific name of native tree species.

No.	First group (very beautiful)	Second group(beautiful)	Third group (average beauty)
1	*Acer campestre* L.	*Acer cappadocicum* Gleditsch	*Alnus glutinosa* (L.) Gaertn.
2	*Acer hyrcanum* Fisch. & C.A.Mey.	*Acer velutinum* Boiss.	*Alnus subcordata* C.A.Mey.
3	*Acer monspessulanum* L.	*Albizia julibrissin* Durazz	*Celtis australis* L.
4	*Acer platanoides* L.	*Buxus hyrcana* Pojark	*Cercis siliquastrum* L.
5	*Betula pendula* Roth	*Carpinus orientalis* Mill.	*Crataegus pontica*
6	*Carpinus betulus* L.	*Cornus australis* C.A.Mey	*Juglans regia iaciniata* jacques.
7	*Fagus orientalis* Lipsky.	*Crataegus atrosanguina*	*Morus alba* L.
8	*Melia azedarach* L.	*Crataegus melanocarpa*	*Prunus divaricata* Ledeb
9	*Parrotia persica* (DC.) C. A. Mey	*Crataegus pseudomelanocarpa*	*Prunus spinosa*
10	*Punica granatum* L.	*Crataegus songarica* C. Koch	*Robinia pseudoacacia* L.
11	*Pyrus boissieriana* Buhse	*Cupressus sempervirens* L. Var.*horizontalis* (Mill) Gord.	*Salix alba* L.
12	*Sorbus torminalis* (L.) Crantz.	*Diospyros lotus* L.	*Salix caprea*
13	*Tilia platyphyllos* Scop.	*Ficus carica* L.	*Salix excelsa* J.F.Gmel
14	*Zelkova carpinifolia* (Pall.) Dipp	*Fraxinus excelsior* L.	*Ulmus minor* Mill.
15		*Gleditsia caspica* Desf.	
16		*Juniperus excelsa* M.Bieb.	
17		*Laurocerasus officinalis* Roemer	
18		*Malus orientalis* Uglitzk	
19		*Mespilus germanica* L.	
20		*Populus alba* L.	
21		*Pterocarya fraxinifolia* (Poir.) Spach	
22		*Quercus castaneifolia* C. A. Mey.	
23		*Quercus macranthera* Fisch. & C. A. Mey. .	
24		*Quercus petraea* (Mattuschka) Lieblein	
25		*Rosa canina* L. S. Str.	
26		*Taxus bacata* L.	
27		*Ulmus glabra* Hudson	

It is worth noting about these important points that Hyrcanian vegetative area with special climate and weather conditions is a very valuable and important settlement for plant and animal species in Iran. Using native plants do not have the problems raised from using exotic plants like invasion to other species, disease outbreaks, costs of planting, control and conservation (Irani Behbahani and Shafie, 2008). Giving priority to native species for the use in urban landscape, all local aesthetics and functional needs of urban areas can be fulfilled. Not only for cities' beautify but also in operational methods such as biological compensation in an affected region or modernization of urban landscapes and forests, native plants are preferred over other non-native species. As self-growing native tree species can grow with little indirect irrigation and monitoring, they can create dynamic ecosystems that would be convenient for different groups of plants and animals (Shahsavari and Rezatorab, 2012).

Few studies have been done on native species, especially trees, to evaluate the effectiveness of their use in landscapes. Among researches which have been done, environmental planning and protection of geotourism in Gheshm island's park can be mentioned. After reviewing various aspects of landscape, researchers eventually identified that restoring habitats of native plants and trees of the region is an essential and required solutions to relief and beautify the tourist sights and landscapes (Farokhi Zadeh *et al*., 2012). In another study, visual quality assessment of Ferdowsi park's landscape has been done according to formal aesthetic using matrix method and numerical scoring. The results of this study are presented in the form of four full protection strategies: 1) Protection, 2) Revival, 3) Improvement, and 4) Renovation. In another study, a detailed review

was conducted on different species of native and non-native Hyrcanian plants which were compatible with temperate climate of Hyrcanian area and have aesthetic value, and then appropriate species were suggested for use in landscape (Aminzadeh and Kaveh, 2006).

In the first group, trees like *Parrotia persica* (DC.) C. A. Mey, *Acer platanoides* and *Acer* were classified. In all species of this group, change of the leaves' color in autumn and cold weather caused the manifestation of beautiful warm colors such as red, brick red, and purple, orange, yellow, and cornelian. The trees of this group have a high aesthetic value in terms of autumn landscape, like "*Betula pendula* Roth", "*Fagus orientalis* Lipsky", "*Zelkova carpinifolia* (Pall.) Dipp". Beside the beauty of leaves, their branching pattern and trunk's color is also beautiful, like the white trunk of "*Betula pendula* Roth" and "*Populus alba* L." and copper trunk of "*Zelkova carpinifolia*". So, this feature can be used to create a beautiful autumn landscape in winter and autumn, to be utilized in gardens and parks designing, creation of green belts and urban forest, or even national forests according to space demands and available possibilities and limitations.

Most of the trees of this group, like *Parrotia persica* (DC.) C. A. Mey, have a short period of fall. Their color-change happens over two months (from early October to early December); therefore, unlike trees such as sycamore, these trees do not need to be cleaned and purged several times in a long period during the year. Despite the loss of dried fruits in autumn due to the quick decomposing of the fruit tissue, *Acer* species like *Acer monspessulanum* will not produce lots of dirt in landscape. It is recommended that cleaning operation should be done besides removing leaves from landscape.

In some trees of this group, like *Zelkova carpinifolia* (Pall) Dipp and *Betula pendula* Roth, defoliation and fruit downfall happen almost simultaneously in late autumn (November), and due to their exiguity compared to other species of *Acer* spp. and berry fruits it causes less problems in terms of cleanup. While most common trees like sycamore and spruce have longer fall period and start their defoliation gradually from early summer making their continuous cleanup and maintenance expensive. Yellow leaves of *Platanus orientalis* trees make the face of streets, parks and areas where this tree is used as the main plant of landscape very unpleasant and undesirable (Khoshgoftarmanesh *et al*., 2013). Moreover, the incidence of early autumn caused interference of seasons and opacity and inertia in human. In some trees in this group such as Melia azedarach L. with pretty umbellate crown and fast-growing nature (Karimiyan, *et al*., 2015), incidence of early autumn and bright yellow leaves is an announcement of fall. Also, standing of yellow fruits on the tree with cluster shape besides the beautiful and regular branching pattern makes a scenic beauty.

The results of this study were harmonious with the study of Firoozeh *et al*. (2008) which introduced *Parrotia persica* (DC.) C. A. Mey as very beautiful species in autumn and recommended it to be used in parks and gardens with cold weather and colorful autumn. *Parrotia persica* (DC.) C. A. Mey has a high visual quality, so, for its visual value in autumn and winter it can be a good choice for designing. The change in trees' color to warm colors in autumn and its contrast with cold weather can be desirable for observers, and the use of *Parrotia persica* (DC.) C. A. Mey leads to diversity of environment, so the results of research are consistent with the results of this study. Since *Parrotia persica* (DC.) C. A. Mey is a tree with deep root growth and its surface roots is not smooth (Khakpoor Moghaddam *et al*., 2008), so it is recommended for areas where there is no restriction for root growth, such as streets, green belts, rural landscapes and intercity routes in northern cities to create windbreaks and prevent erosion on slopes (Habibi Bibalani and Majnounian, 2005). Due to its high resistance against pests, diseases, drought, wind, pollution and environmental tensions, *Parrotia persica* (DC.) C. A. Mey is a resistant tree and appropriate for the use in urban landscape (Karimi and Yaghoubi, 2016).

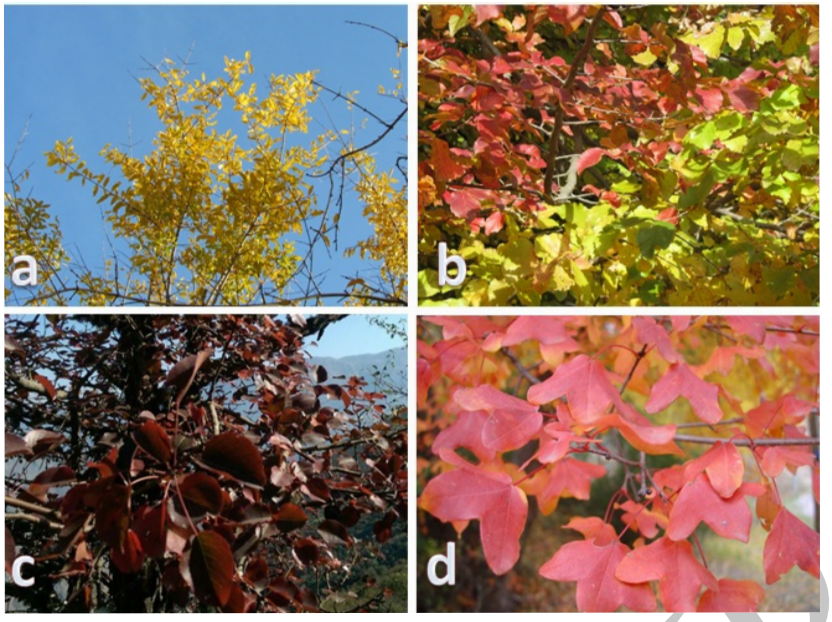

Fig.4. Some outstanding species of first group are (a) *Punica granatum* L., (b) *Parrotia persica* (DC.) C. A. Mey., (c) *Pyrus boissieriana* Buhse, and (d) *Acer monspessulanum* L.

In the second group are trees that provide beautiful landscape in autumn, and compared with the first group, they have earned lower score. For example in *Rosa canina L*. S. Str. color change in hip fruit in autumn beatifies it and in terms of leaves' beauty, this plant's score is not high. Other tree plants in this group such as *Albizia julibrissin* Durazz, despite the lack of beautiful color change in leaves due to the durability of legume fruits are considered because of their elegant form of umbellate branching pattern. Oak species have leaves' color change in autumn but the attractiveness of their color change is not as much as first group's trees.

Due to its scenic beauty in autum, especially leaf color change to yellow and its medium texture of leaves, using *Acer cappadocicum* Gleditsch in street's landscape is very adventagous, but the cultivation of this tree with an average height of 21 meter under the electrical wires with the height of 9 to 12 meters from the ground is not safe. Pruning of its headbranches leads to a disfigured crown. However, Platanus with even greater heights in comparison with *Acer cappadocicum* Gleditsch in streets where trees have been planted out of the electric power lines privacy making beautiful landscapes with the creation of architectural principles such as rhythm and line which guide human eyes to follow the way. Therefore, in urban landscape designing, *Acer cappadocicum* Gleditsch is recommended for places where there is no limitation in terms of height and crown width.

Also "*Laurocerasus officinalis* Roemer" maintains its beauty until late autumn because of the durability of its leaves and fruits as evergreen tree. Therefore, this species is recommended to be used in places where other diciduous and evergreen trees are used because of its beauty in autumn due to leaf durability and as intensifier plant or as green hedge due to its capibility of being pruned.

In the third group are trees which often make moderate-to-low beauty in autumn. In most trees of this group, leaf color changes into brown in autumn without high visual quality for viewers. Also, they do not produce attractive fruits in autumn. For example, different species of "*Salix* spp.", in comparison with the trees of first group like *Crataegus* spp., Diospyros lotus L. and Taxus bacata L., have a lower level of beauty in terms of color change and fruit beauty. However, *Alnus* spp. species have low score in beauty of leaf color change, trunk and branching pattern, but in autumn and after falling of leaves, male and female inflorescences which will flourish in the next

spring can create moderate beauty on tree's body. It is worth noting that some species of this group such as Alder, *Salix* and *Juglans*, are applicable at the edge of the parks along the river due to their resistance against certain conditions like high humidity of soil. The results of this study are in agreement with Valizadegan *et al*. (2014) that introduced trees resistant to heavy soils, such as alder, salix and etc as hydrophilic species and emphasized on attention to these resistant species.

In this research, 55 species of native trees of Sari were studied in terms of aesthetics value and functionality. Because they are indigenous, this species are able to grow in the soil and climatic conditions of northern part of Iran and areas with a similar climate and weather like many European countries. According to our results, some of these trees have the capability to be used in an urban landscape design. However, unfortunately little attention has been paid to the high potential of this species. So, because of this gap and absence of native species in landscape, the use of these species is a proposed solution. Beside saving maintenance costs, native species make sustainable landscape with a lower risk of failure. However, the use of non-native species with a high risk of failure in the annual landscape leads to high costs for municipalities. Unsuccessful and invasive non-native species impose large costs to government yearly to restore landscape. In this paper, regarding the high potential of native species of Hyrcanian area in creating charming landscape in autumn, preventing lethargy in human with the advent of warm colors in cold season and increasing the diversity of trees used in urban landscape, suitable species are presented in separate tables. Regarding the fact that the introduction of this species in this study was based on aesthetic criteria and conditions of trees' natural environment, it is, therefore, recommended that these species should be used in urban landscapes after assessment of their compatibility, resistance and efficient methods of mass production.

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