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Original Article

Comparison of the Studied Morphological, Yield and Essential oil Traits of *Rosa damascena* in Kermanshah Province

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Abstract

Rosa damascena Mill from the Rosaceae family plays an important role in the perfume and rose making industries in the Iran and the World. The aim of this study that was performed at Islamabad-e-Gharb Research Station in Kermanshah province was selection of adaptive and elite genotypes. The research was conducted in the form of a complete randomized block design with 3 replications for 5 years (2012-2016).The results showed that the average dry weight of petals in different Accsessions include: Fars 1, West Azerbaijan 1, Lorestan 1 and Kermanshah 9 genotypes was highest and in contrast, in Isfahan 5, Isfahan 7 and Kermanshah 10 genotypes, was lowest. Compare the average of the studied traits of different accessions such as average dry weight of flowers, wet weight of flowers, dry weight of petals, wet weight of petals, average small and large diameter, average plant height and average number of flowers showed varies in different genotypes. Statistical analysis of the inter Accsessions of two factors of year and genotype also showed that except two chemical compounds of essential oil (y-elemene and a-cadinene); other compounds had a significant difference (statistical level of 1% and 5%).

Keywords: Essential oil, Kermanshah, Petals, Yield, *Rosa damascena*

Introduction

Rosa damascena Mill. Has been popular since ancient times due to its various properties and is considered a mystical flower. Iranians are the first to realize the oral and therapeutic properties of rose from the ancient past. *Rosa Damascena* is exported to European countries [1]. At present, Iran is one of the largest producers of *Rosa damascena* in the world. Persian Gulf countries and to a lesser extent, European countries are also major buyers of Iranian roses.

Kermanshah province is suitable for planting and developing *Rosa damascena*. *Rosa damascena* essential oil in Kermanshah province has succeeded in obtaining the approval of international standards and currently there are two processing units, production and packaging of herbal essences and rose water making in this province [2].

Essential oil is a volatile aromatic compound produced by plants and stored in their various organs [3]. These essential oils have a distinct odor and often evaporate at room temperature. These essential oils are most commonly found in the plants of the mint, rose, umbrella, cypress, and pine plants. There are cases for plant stability and in response to stress, attack and pathogens [4]. *Rosa*. Essential oil is located in the upper part of the petals and inside the cells with a prominent appearance, which is extracted by distilling rose water in the form of an oily substance [1,5]. This essential oil has two solid parts (stearopten; crystalline and odorless) and liquid (oleoptean; has a strong and fragrant aroma and a slightly sweet taste) [6]. The liquid part has different compounds, the most important of which are geraniol with formula C10H18O in the amount of 45 to 75% and

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citronellol with formula $C_{12}H_2O$ in the amount of 20 to 40% .These two substances are the main aroma of *Rosa damascena* essential oil [6, 7 and 8]. The amount and composition of essential oils depends on the method of extract methods [9, 10 and 11], aaccessions [7,12,13], and the location of the plants [5,8].

In the steam distillation method, less essential oil remains [7,10,12]. Essential oils and fragrances are both oily in nature. The amount of essential oil in rose petals is about 0.03% (7). However, due to the lack of artificial and natural alternatives, it is one of the most expensive essential oils in the global market. The amount and composition of essential oils of rose petals is affected by various factors such as age, harvest time and fermentation time.

The role of Rosa flowers and products in the economy of rural households is very important and has many applications in various pharmaceutical, cosmetic and health industries. This plant adapts to different ecological conditions and produces flowers. Numerous studies have demonstrated the impact of ecological conditions on the quantity and quality of essential oils [7,8,14]. Since the economic value of the essential oil of this plant is determined by the type and amount of compounds in it, in order to use this plant optimally and economically, it is necessary to study the flower yield, quantity and quality of essential oil in different ecological conditions, and the most suitable genotypes select for each area. The objectives of this study were as follows:

- Identification of suitable genotypes of *Rosa damascena* for cultivation in climatic conditions of Kermanshah province.
- Comparison of the chemical composition of essential oils of each of the planted genotypes in order to select the best genotypes in this field.

Material and Methods

The research method is field operations, statistical data and laboratory analysis and the measured data are statistically analyzed including analysis of variance, mean comparison by Duncan method, principal component analysis, cluster analysis and correlation analysis of traits by using SPSS software (version 18).

10 genotypes of the top genotypes of *Rosa damascena* based on the results obtained from the comparison of the top genotypes of the country introduced by the Forest and Rangeland Research Institute, and five native genotypes of Kermanshah province selected, and their rooted seedlings were prepared at Islamabad-Gharb Research Station. Seedlings planted in the form of a complete random block design with three replications. In each repeat, three bases of each genotype were planted in holes with 1 m diameter and depth and 3 m distance (3×3 m). The planting bed was prepared with a mixture of farm soil and animal manure. Drip irrigation was performed. After cultivation in the first year, statistics were conducted in the second, third and fourth years.

The Area of Study

The study area is located at Islamabad Gharb Research Station, 65 km south of Kermanshah. It is 1346 meters above sea level and has a semi-arid Mediterranean climate.

According to meteorological statistics, the average annual rainfall of this station is 461 mm. The average annual temperature is +13 degrees Celsius. The evaporation rate is 1808 mm and the number of hours of sunshine is 2430 hours per year.

Table 1 Different Accsessions of *Rosa damascena* Mill. Planted in Islamabad Gharb station

Accsessions name	Accsessions number	Accsessions name	Accsessions number
Isfahan 5	37	West Azerbaijan 1	2
Isfahan 7	39	Isfahan 9	4
Isfahan 8	40	Fars 1	16
Kermanshah 3	42	Kermanshah 1	21
Kermanshah 8	47	Khorasan 2	23
Kermanshah 9	48	Lorestan 1	26
Kermanshah 10	49	Arak 1	28
Yazd 1	31	-	-

The climate of this station is Mediterranean semi-arid.(Fig. 1). Also, based on the soil decomposition results of the mentioned station, which was done up to a depth of 125 cm, the amounts of sand, silt and clay are 10.8, 0.56 and 33.2%, respectively, and represent the total silicate texture of the loam. The organic carbon content of the soil surface is about 1.5 percent.

The texture of the surface soil is heavy and the texture of the soil below is very heavy. The surface structure of the mass soil and the structure of the lower layers of the cube are large and strong. The high proportion of lime at a depth of 50 cm is observed, which puts these soils under the group of calcareous soils. The amount of organic carbon, phosphorus and potassium can be used and the acidity of the soil is normal.

Studied Traits

The studied traits include flower yield, number of flowers in each rootstock, yield and essential oil yield, and finally the compounds in the Essential Oil. The essential oil in the petals of the plant was extracted by distillation with water [10,15,16]. Chemical components of essential oil were identified by using gas chromatograph (GC) and chromatograph connected to a mass spectrometer (GCM) [17], using Kovats index (17). +

Results and Discussion

Important morphometric characteristics of the tested genotypes:

The results of comparing the mean of the most important morphometric specifications of *Rosa damascena* genotypes are listed in Table 2. These characteristics included the average number of flowers, plant height, large diameter, small diameter, wet petal weight, dry petal weight, wet flower weight, dry flower weight. The status of the top three genotypes and the three genotypes with the least amount of these characteristics is as follows:

1- The average of the number of flowers for Isfahan 5, Arak 1 and Kermanshah 1 genotypes had the highest, respectively, and in contrast to West Azerbaijan 1, Lorestan 1 and Kermanshah 10 genotypes, they had the lowest.

2- The average of plant height was higher in genotypes of Isfahan 9, Arak 1 and Fars 1 and in contrast in genotypes of Isfahan 7, West Azerbaijan 1 and Kermanshah 10 were the lowest;

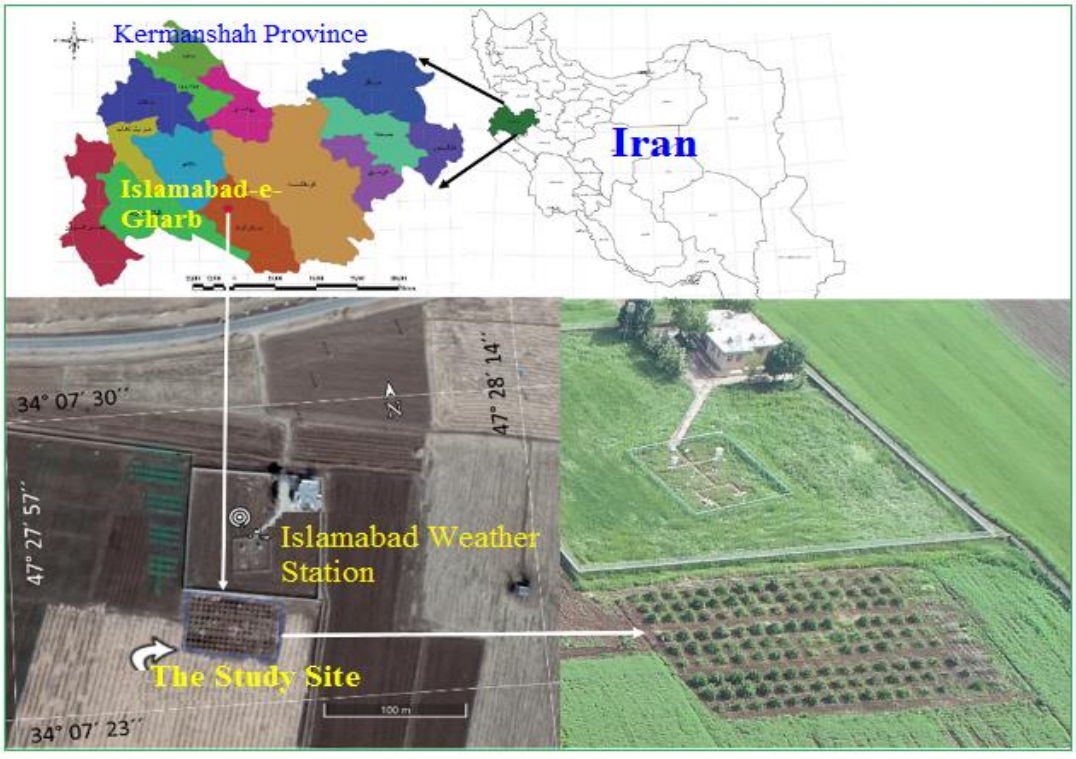

Fig. 1 Geographical location of the project site in Islamabad- Gharb Research Station in Kermanshah province

Table 2 Comparison of the average of the studied traits of different *Rosa damascena* genotype in Kermanshah province

Accsessions (Genotype) code	Name	The average number of flowers	Average plant height	Medium large diameter	Medium small diameter	Medium weight of petals	Medium dry weight of petals	Average wet flower weight	Average dry flower weight
2	West Azerbaijan 1	562.00	91.3	125.0	105.0	2.19	0.305	2.23	0.36
4	Isfahan 9	917.00	129.5	159.2	149.2	1.60	0.225	1.77	0.26
16	Fars 1	1781.33	119.0	172.5	160.2	2.03	0.259	2.41	0.36
21	Kermanshah 1	1038.22	102.2	147.6	124.9	1.63	0.235	1.83	0.28
23	Khorasan 2	1250.56	107.5	155.0	130.8	1.83	0.262	2.31	0.37
26	Lorestan 1	563.67	111.5	192.1	175.8	1.49	0.278	1.86	0.31
28	Arak 1	1783.89	121.5	192.5	176.7	1.69	0.236	1.85	0.29
31	Yazd 1	1410.33	104.1	159.2	131.3	1.72	0.228	1.61	0.29
37	Isfahan 5	1859.78	107.8	189.7	172.5	1.56	0.193	1.83	0.30
39	Isfahan 7	767.11	87.2	117.0	96.3	1.54	0.213	1.75	0.28
40	Isfahan 8	1564.67	110.0	173.3	132.7	1.59	0.226	1.80	0.30
42	Kermanshah 3	1243.89	114.7	161.7	139.2	1.90	0.249	1.91	0.30
47	Kermanshah 8	1037.53	98.5	120.0	110.0	1.57	0.234	1.83	0.30
48	Kermanshah 9	1504.89	94.3	143.3	122.0	1.72	0.250	1.94	0.31
49	Kermanshah 10	877.25	81.0	126.9	115.2	1.57	0.230	1.95	0.31

3- The average of large diameter in Arak 1, Lorestan 1 and Isfahan 5 genotypes was higher and in contrast in Kermanshah 8, West Azarbaijan 1 and Kermanshah 9 genotypes was the lowest;

4- The average of small diameter in Arak 1, Lorestan 1 and Isfahan 5 genotypes was higher and in contrast it was lower than in Isfahan 7, West Azerbaijan 1 and Kermanshah 8 genotypes;

5- The average weight of petals was higher in genotypes of West Azerbaijan 1, Fars 1 and Kermanshah 3 and in contrast in genotypes of Lorestan 1, Isfahan 5 and Kermanshah 8 were the lowest;

6- The average dry weight of petals in Fars 1, West Azerbaijan 1, Lorestan 1 and Kermanshah 9 genotypes was higher and in contrast in Isfahan 5, Isfahan 7 and Kermanshah 10 genotypes, the lowest was obtained;

7- The average weight of petals in Fars 1, Khorasan 2 and West Azerbaijan 1 genotypes was higher and in Yazd 1, Isfahan 7 and Isfahan 9 genotypes the lowest.

8- The average of dry weight of flowers in Khorasan 2, Fars 1 and West Azerbaijan 1 Genotypes, more and in contrast, in Isfahan 9, Kermanshah 1 and Isfahan 7 genotypes, the lowest was obtained.

Accordingly, the factor of the year had a significant effect only on the number of flowers (statistical level of 1%) and did not have a significant effect on the other seven-morphometric traits examined. Perhaps the reason for this trend is environmental changes such as temperature and precipitation [8 and 19].

In addition, the results of the effects of genotype on eight morphometric traits had significant effects at the statistical level of 1%. In other words, genotypes differ significantly in number of flowers, height, diameter, flower weight, and petal weight [8, 12 and 18]. However, statistical analysis for Accsessions between year and genotype did not show significant changes. In other words, with the continuation of the crop year, the morphometric effect of the tested Accsessions did not occur due to the inter Accsessions of the year and the genotype [16 and 19].

Conclusion

The results of this study showed that:
- Dry weight of flowers and number of flowers play the most important role among the eight-morphometric traits of genotypes in essential oil production. Accordingly, the genotypes of Isfahan 5, Arak 1 and Fars 1 have the highest number of flowers, while Lorestan 1, West Azerbaijan 1 and Kermanshah 10 have the lowest number of flowers.
- In terms of dry weight, West Azerbaijan 1, Lorestan 1 and Fars 1 have the first rank. Therefore, Fars 1 is the best genotype in terms of flower number and petal weight, and the other two (West Azerbaijan 1 and Lorestan 1) although they have fewer flowers, but the dry weight of their petals is higher.

This study showed that the amount of essential oil in the studied genotypes was significantly different and the genotypes have sufficient diversity for the evaluated characteristics. Based on the results of this study, a wide variety of genotypes studied for morphometric properties and essential oil compounds were obtained.
The results of similar research in different parts of Iran showed the difference in the amount of essential oil components and diversity of genotypes in this field, which in turn is derived from climatic conditions, topography, soil conditions, genotype type, planting method, and flowering time of plants.

Suggestions

Due to the increasing use of *Rosa damascena* products on the one hand and the diversity of its genotypes on the other hand, the economic importance of this valuable species is more than before and its economic importance is especially in the conditions of drought and climate change. In this regard, the following suggestions are provided:
1- Research on the reproduction and expansion of those genotypes, that produce some chemical compounds (out of 21 identified compounds), that are effective in increasing the value and quality of perfume.
2- Research on appropriate irrigation methods by reducing the amount of water consumed and increasing water productivity and the most appropriate irrigation method in this field;
3- Using biotechnological methods to introduce cultivars with superior essential oil or resistant to drought conditions in order to maintain its economic efficiency.
4- It seems, that in some mountainous and remote parts of Kurdistan, Kermanshah, West Azerbaijan, Khorasan, Kohgiluyeh, Boyer-Ahmad, Chaharmahal and Bakhtiari provinces, there may be some types of *Rosa damascena* that are suitable in terms of Adaptation to different climatic conditions has unique characteristics, that require will study them.

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