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Comparison Scent Compound Emitted from Flowers of Damask Rose and Persian Musk Rose

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Abstract

Rose emits a great group of scent that is functional in their communication with their instantaneous environment. In this study, the chemical compositions of floral scent from Damask and Musk roses flowers were isolated at full bloom stage by using headspace extraction. The main floral headspace components in Damask rose were Phenylethyl alcohol (2-phenylethanol), β-citronellol, α-Pinene and Geranyl acetate however the main components in Musk rose were Phenylethyl alcohol, 1-Nonadecene, Heneicosane and n-Nonadecane. In the both of species, the relative percentage of Phenyl ethyl alcohol was main scent compound. β-citronellol, α-Pinene and Geranyl acetate were highest and a major component in the Damask rose however these components (except α-Pinene) were not detected in Musk rose. The results of this study indicated that a number of factors, including particular rose species and the genetic triggers for releasing fragrance, determine the amount of fragrance.

Keywords: *Rosa sp.*; Floral scent; Genotypes; Headspace

Introduction

The genus *Rosa* has involved about 200 species, only a few species among hundreds in the genus *Rosa* are scented, which involve *Rosa damascena* Mill., *R. gallica* Linn., *R. centifolia* Linn., *R. moschata* Herrm., *R. bourboniana* Desportes., *R. chinensis* Jacq., and *R. alba* Linn. *Rosa* has sixteen wild species in Iran of which *R. moschata* with the common names of Persian Musk rose, Nastrane Shiraz and Rose Anbar is distributed in many local regions of the Iran [1-8]. In addition, the Damask rose (*R. damascena*) is the most important species used to produce rose water, attar of rose, and essential oils in the perfume industry [6,9]. In Iranian traditional medicine, water rose of Damask rose and Persian Musk rose have been used to sedative, strengthen heart muscles, stomach, liver, spleen, nerves and intelligence [4,6]. This study aimed to evaluate and compare the floral scent headspace compounds and their content in Persian Musk rose vs. Damask rose as well as to provide useful information regarding the elucidation of biosynthetic pathways.

Materials and Methods

Plant materials

Flowers of Damask rose and Persian Musk rose were harvested from plants grown in Eram Botanical Garden (Shiraz – 57° 32' E, 29° 37' N, Altitude 1486 m).

The headspace volatiles extraction

The headspace proceeded on the Combi PAL System that was provided with headspace auto-sampler, heater and agitator. The vial was heated to 45°C and retained for 20 min while being agitated; the temperature of the sampling needle and transmission line was 85°C.

Volatile oil analysis procedure

GC analysis was done using an Agilent gas chromatograph series 7890-A with a flame ionization detector (FID). GC-MS analysis was completed by using Agilent gas chromatograph, equipped with fused silica capillary HP-5MS column (30 m × 0.25 mm i.d.; film thickness 0.25 m) and coupled with 5975-C mass spectrometer. The constituents of the VOCs were identified by calculation of their retention indices under temperature-programmed conditions for n-alkanes (C8-C25) and the volatile oil on a HP-5 column under the same chromatographic conditions.

Results and Discussion

The chemical compositions of the volatile oils isolated from two species of *Rosa* including *R. damascena* and *R. moschata* var. *nastarana* flowers by using headspace extraction are presented in Table 1. The applied headspace GC-MS metabolite profiling resulted in the identification of a total of 31 and 21 compounds in Damask rose and Persian Musk rose respectively. The relative percentage of Phenylethyl alcohol was as main compound in the both of rose species. The relative percentage of Phenylethyl alcohol was significantly increased to peak (54.15 ± 1.34%) at the full bloom stage of Persian Musk rose, but the highest quantity of this compound was 36.6 ± 2.05% in Damask rose. These results were in agreement with previous studies, who found a similar evolution of phenyl ethyl alcohol in the flower of *R. hybrid* and other genotypes of *R. damascena* [1,2,5,6,9,10]. In the same way, Phenyl ethyl alcohol (2-Phenylethanol) is a prominent scent compound released from flowers of Damask rose and some hybrid roses such as *Rosa* 'Hoh-Jun' and *Rosa* 'Yves Piaget' [1,4,5]. In the wild roses, from which *R. hybrida* is resulting, floral scent are notice to be chemical signals between the plant and insects, the second including both pollinators and predators [9]. In previously study, it was show that the petal aroma such as Phenyl ethyl alcohols, which are known insect attractants for seed formation and dispersers [2,6].

The percentages of β-citronellol (35.53 ± 1.82%) were observed as second major component of Damask rose volatile oils by headspace methods; however this compound was not detected in Persian Musk rose. α-Pinene was the representative monoterpene hydrocarbons detected in the floral volatile and accumulated in Damask rose (14.15 ± 1.02%),

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Compound	RI[a]	% GC peak area	
		Damask Rose	Musk Rose
Hexanol	861	0.05 ± 0	-
α-Pinene	931	14.153 ± 1.028	0.563 ± 0.155
Benzaldehyde	957	0.146 ± 0.081	-
Sabinene	970	0.34 ± 0.155	-
β-Pinene	974	0.916 ± 0.71	0.036 ± 0.062
β- Myrcene	988	0.833 ± 0.434	-
α-Terpinene	1014	0.113 ± 0.07	-
p-Cymene	1022	-	0.06 ± 0.104
Limonene	1025	0.19 ± 0.113	0.123 ± 0.131
Benzyl Alcohol	1029	0.186 ± 0.075	-
Benzene acetaldehyde	1041	-	0.103 ± 0.091
γ-terpinene	1055	0.223 ± 0.152	0.106 ± 0.184
α-Terpinolene	1086	0.06 ± 0	-
Linalool	1097	0.09 ± 0.014	-
Phenyl ethyl Alcohol	1110	36.6 ± 2.052	54.152 ± 1.34
trans-Rose oxide	1124	0.2 ± 0.096	-
Terpinene-4-ol	1174	0.07 ± 0	-
β-Citronellol	1225	35.53 ± 1.821	-
Neral	1238	0.615 ± 0.304	-
Geranyl acetate	1251	4.906 ± 0.833	-
2-Phenyl ethyl acetate	1254	-	0.377 ± 0.342
Geranial	1267	0.345 ± 0.403	-
Eugenol	1354	-	1.151 ± 0.088
n-Tetradecane	1401	0.29 ± 0	-
Methyl eugenol	1404	0.185 ± 0.077	-
dihydro-β-Ionone	1435	-	0.181 ± 0.314
E-(β)-Farnesene	1459	0.64 ± 0	-
(E)-β-Ionone	1482	-	1.431 ± 0.252
2-Phenyl propyl butanoate	1484	-	0.105 ± 0.182
Geranyl propanoate	1496	0.64 ± 0	-
n-Pentadecane	1496		0.14 ± 0.242
α-Selinene	1498	1.58 ± 0.675	-
1-Methylethyl ester	1670	0.18 ± 0	-
1-Heptadecene	1672	-	1.261 ± 0.152
n-Heptadecane	1695	0.646 ± 0.61	1.711 ± 0.067
1-Nonadecene	1865	-	15.576 ± 1.708
Hexadecen-1-ol	1866	0.18 ± 0	-
n-Nonadecane	1891	2.35 ± 0.385	8.147 ± 0.143
n-Octadecanol	2072	-	0.491 ± 0.45
Heneicosane	2098	0.21 ± 0	8.175 ± 0.801
1-Tricosene	2285	-	1.972 ± 0.416
n-Tricosane	2297	-	1.196 ± 0.071
Hexacosane	2554	0.21 ± 0	-
Total		97.057 ± 0.347	99.556 ± 0.561

[a]RI: Retention indices determined on HP-5MS capillary column

Table 1: Chemical compositions of floral scent of two Roses.

however a trace amount (0.56 ± 0.15%) of this compound was found in Persian Musk rose. Acetate esters such as geranyl acetate are important contributors to the aroma of different rose flowers. The highest geranyl acetate (4.9 ± 0.83%) was detected in Damask rose. No quantity of this compound was detected in Persian Musk rose. During flower opening, the level of emission of acetate esters (geranyl acetate) reached to maximal levels at full bloom stage, and decreased in the last stages [6].

Conclusion

In general, the present investigation showed that the flowers of Damask rose differed in fragrance characteristics compared to Persian Musk rose. In addition, it was shown that in both of rose species, petal aromas are dominated by Phenyl ethyl alcohols, which are known insect attractants for seed formation and dispersers. In conclusion, the genetic factors affect volatile oil composition in rose. Consequently, there was high variation in floral scent levels in the different rose genotypes suggesting a key role of the genotype in the biosynthesis of secondary metabolites.

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