Chemistry of Natural Compounds, Vol. 47, No. 5, November, 2011 [Russian original No. 5, September–October, 2011]

ESSENTIAL OIL COMPOSITION OF FRESH AND DRIED FLOWERS OF *Rosa moschata* FROM IRAN

M. Honarvar,[1] K. Javidnia,[2*] and M. Khosh-Khui[3]

UDC 547.913

The genus *Rosa* (Rosaceae) is commercially important for its essential oil in fragrance industries and also for its rose water which is used traditionally in food as flavoring agent in Iran. The genus *Rosa* includes 200 species and 18000 cultivars [1]. There are mainly four species of roses for essential oil production, which are *Rosa damascena* Mill., *Rosa gallica* L., *Rosa moschata* Herrm., and *Rosa centifolia* L. [2].

A lot of investigations were carried out on rose essential oil [3–10]. Because of the low oil content and the lack of natural and synthetic substitutes, rose oil is one of the most expensive essential oils in the global markets [7]. The research effort on rose oil nowadays is targeted on the changing composition of rose oils obtained by different methods of sample preparation, variations in the geographical origin, and new developments in techniques for general odor constituent analysis [11]. For instance, Musk rose (*Rosa moschata* J. Herrm. var. *nastarana* Christ in Boiss) has not been recorded clearly in history, but the presumption is that it is a parent of Damask rose [12]. Iran is the origin of Musk rose, and Fars and Kerman provinces are the geographical dissemination points of this plant. Its Persian name is "Nastarana" [13].Water rose of "Nastarana" has been used to strengthen heart muscles, stomach, liver, spleen, nerves, and gums and to increase intelligence in folk medicine [14]. There is no report on the essential oil composition of Musk rose (var. *nastarana*) in the world. Therefore, in this research, the essential oil composition of fresh and dried samples was studied by GC and GC-MS techniques and the effects of the drying process and planting site on the oil of flowers from two important regions of cultivation in Iran was carried out.

Comparison of the Yields of the Musk Rose Oils. A highly significant difference was observed in the oil content between fresh and dried oil samples. The yield (w/w) of the oils in fresh samples was 0.36%, which decreased noticeably to 0.14% in dried ones. No significant difference was seen in the yield of the oils of two regions. The color of the oils was pale yellow.

Compositions of the Essential Oil of Fresh and Dried Flowers of Musk Rose Cultivated in Meimand and Shiraz. The compositions of the essential oil of fresh and dried flowers of Musk rose from Meimand and Shiraz are presented in Table 2. Twenty-three and 22 components were found in fresh and dried samples, which represented 94.5% and 91.7% of total oil, respectively. In Shiraz, the oil was found to contain 22 components in fresh flowers and 23 components in dried flowers, compromising 94.7% and 93.4% of the oil, respectively. The main compounds in all samples were eugenol (21.1–38.6%), heneicosane (20.5–26.5%), tricosane (5.1–8.5%), and nonadecene (5.0–6.6%). The presence of Eugenol (phenyl propanoid) is the most typical feature of these oils, showing a higher percentage in the oil of fresh flowers in both regions. However, the drying process probably decreased the relative amount of this compound. Eugenol was also the main compound of the oil of *R. damascene*, R. *brunonii*, and *Rosa davurica* [3, 5].

Monoterpene hydrocarbons were not detected in these oils. Citronellol, geraniol, and nerol, which were the main and important compounds in the oils of *R. damascena*, were not detected in Musk rose oil. β-Phenylethyl alcohol, which gives the characteristic odor to rose oils and is a common compound in *R. damascena* and *R. centifolia* [15], were not detected in these oils, but its acetate form (β-phenyl ethyl acetate) was present as minor compound only in fresh flowers oils. So, the drying process might cause some changes in the odor of the oil. The sesquiterpenes showed a low percent in all of the oils (2.3–3.3%).

1) Department of Horticultural Science, Islamic Azad University-Estahban Branch, Estahban, Iran; 2) Medicinal and Natural Products Chemistry Research Centre, Shiraz University of Medical Sciences, Shiraz, Iran, fax: (98711) 233 22 25, e-mail: javidniak@sums.ac.ir; kjavidnia@gmail.com; 3) Department of Horticultural Science, Shiraz University, Shiraz, Iran.
Published in Khimiya Prirodnykh Soedinenii, No. 5, pp. 724–725, September–October, 2011. Original article submitted April 13, 2010.

TABLE 1. Comparative Chemical Constituents (%) of the Essential Oils of Fresh and Dried Flowers of Musk Rose in Meimand and Shiraz, Iran

Compound	RI	Meimand[a]		Shiraz[b]	
		Fresh flower	Dried flower	Fresh flower	Dried flower
Linalool	1102	0.7 ± 0.3	1.2 ± 0.4	0.7 ± 0.4	1.1 ± 0.3
β-Phenylethyl acetate	1256	0.8 ± 1.0	–	0.4 ± 0.2	–
Eugenol	1361	38.6 ± 11.9	21.1 ± 6.1	36.9 ± 8.6	23.6 ± 5.5
Methyl eugenol	1406	–	–	–	0.1 ± 0.0
β-Caryophyllene	1418	0.9 ± 0.9	0.5 ± 0.4	0.4 ± 0.2	0.3 ± 0.2
Aromadendrene	1440	0.5 ± 0.3	–	0.3 ± 0.1	–
cis-α-Ambrinol	1443	0.1 ± 0.0	–	0.1 ± 0.1	–
Geranyl acetone	1455	0.3 ± 0.2	–	0.1 ± 0.1	0.3 ± 0.1
(*E*)-β-Ionone	1490	1.3 ± 0.6	2.2 ± 0.8	1.7 ± 1.3	2.0 ± 1.1
Bicyclogermacrene	1498	0.2 ± 0.3	–	–	–
β-Sesquiphellandrene	1520	0.3 ± 0.1	–	–	–
Tetradecanal	1612	–	0.5 ± 0.2	–	–
8-Heptadecene	1676	0.2 ± 0.2	0.4 ± 0.1	0.7 ± 0.3	0.4 ± 0.1
Acrylic acid derivative[c]	1695	3.8 ± 1.6	5.1 ± 1.5	3.8 ± 2.2	5.0 ± 2.0
Heptadecane	1700	1.1 ± 0.4	1.5 ± 0.4	1.3 ± 0.5	1.5 ± 0.7
Pentadecanal	1715	–	1.3 ± 0.2	–	1.2 ± 0.3
Tetradecanoic acid	1780	–	–	–	0.3 ± 0.0
Hexadecanal	1815	0.5 ± 0.2	1.4 ± 0.2	–	1.2 ± 0.1
Nonadecene	1874	7.7 ± 2.2	6.8 ± 1.5	10.4 ± 4.3	7.0 ± 2.1
Pentadecanoic acid	1876	–	0.1 ± 0.0	–	0.1 ± 0.0
Nonadecane	1900	5.0 ± 1.2	5.5 ± 0.6	5.8 ± 1.2	6.6 ± 0.7
Hexadecanoic acid	1978	–	0.8 ± 1.1	0.7 ± 0.2	2.1 ± 1.3
Eicosane	2000	0.4 ± 0.3	1.4 ± 0.7	0.2 ± 0.2	1.2 ± 0.1
Heneicos-10-ene	2071	3.1 ± 0.8	2.3 ± 0.7	3.1 ± 1.0	1.9 ± 0.4
Heneicosane	2100	21.6 ± 7.4	26.5 ± 4.4	20.5 ± 4.3	25.8 ± 2.7
Phytol	2128	0.2 ± 0.2	–	0.1 ± 0.1	–
Octadecanoic acid	2176	0.4 ± 0.2	0.7 ± 0.3	0.4 ± 0.3	0.5 ± 0.2
Docosane	2200	1.3 ± 0.4	2.3 ± 0.4	1.1 ± 0.7	2.3 ± 0.3
Tricosane	2300	5.4 ± 2.1	8.5 ± 1.6	5.1 ± 3.0	8.5 ± 2.0
Pentacosane	2500	–	0.8 ± 0.8	0.9 ± 1.0	0.6 ± 0.6
Hexacosane	2600	–	0.9 ± 0.7	–	–
Total, %		94.5	91.7	94.7	93.4
Yield, % ± SD		0.36 ± 0.05	0.16 ± 0.005	0.36 ± 0.07	0.12 ± 0.006

[a]Meimand – 52° 45′ E, 28° 52′ N, Altitude 1545 m; [b]Shiraz – 57° 32′ E, 29° 37′ N, Altitude 1486 m.
Means of 3 replicates ± SD. [c]Correct structure not identified.

The stearoptene content was in all samples. It was hingher in dried samples (60.9–61.2%) than in fresh ones (46.7–50.2%) due to its nonvolatile character, and it contained mainly heneicosane, nonadecene, and nonadecane. These compounds were found in some Rose oil at a level 10–15% and were also present in the oil of *R. damascena*, which gives a fixative property to it. In our samples, because of the high level of these compounds, the oils were waxy and solidified in the refrigerator.

Characteristics of Planting Site. Flowers were collected from two important regions of cultivation (Meimand and Shiraz) in Iran. Topographical and climatic characteristics and the soil of planting sites are presented in Table 1.

Plant Materials and Isolation Procedure. The flowers were collected from rose gardens during their flowering period. A specimen (Collector Number: PC 87-23) has been deposited in the Herbarium of the Faculty of Sciences, Shiraz University. The collected flowers were divided into fresh and dry parts. One part was air dried at ambient temperature in the shade. Both parts were steam distilled using a Clevenger type apparatus for 3 h. In all replicates (n = 3), extracting of oil was carried out under uniform conditions. They were dissolved in *n*-hexane (Merck) and dried over anhydrous sodium sulfate, and the yield of the oils was measured as percentage (w/w). They were stored at 4–6°C until analysis by GC and GC-MS.

GC and GC-MS Analysis. The analysis method for GC and GC-MS was according to previous studies [16]. The compounds were identified by comparison of their retention indices (RRI, HP-5) with those reported in the literature and by comparison of their mass spectra with the Wiley and Mass finder 3 libraries or with the published mass spectra [17].

Data Analysis. The means and standard deviations of the relative percentage of components from three replications of fresh and dried flowers were calculated using the Excel software.

ACKNOWLEDGMENT

The authors are grateful to Prof. Miri, head of Medicinal and Natural Products, Chemistry Research Centre, Shiraz university of Medical Sciences, for support during this study.

REFERENCES

1. S. Gudin, *Rose. In Genetics and Breeding*, Wiley, 2000.
2. A. O. Tucker and M. J. Maciarello, *Dev. Food Sci.*, **18**, 99 (1988).
3. V. K. Kaul, R. K. Gujral, and B. Singh, *Flav. Fragr. J.*, **14**, 9 (1999).
4. A. J. Al-Rehaily, T. A. Al-Howiriny, and H. R. Bizzo, *J. Essent. Oil Res*., **15**, 344 (2003).
5. K. G. D. Babu, B. Singh, V. P. Joshi, and V. Singh, *Flav. Fragr. J.*, **17**, 136 (2002).
6. M. Z. Ozeland and A. A. Clifford, *Flav. Fragr. J.*, **19**, 354 (2004).
7. H. Baydarand and N. G. Baydar, *Ind. Crops Prod*., **21**, 251 (2005).
8. A. Joichi, K. Yomogida, K. Awano, and Y. Ueda, *Flav. Fragr. J.*, **20**, 152 (2005).
9. P. J. Dunphy, *Phytochemistry*, **67**, 1110 (2006).
10. A. Almasirad, Y. Amanzadeh, A. Taheri, and M. Iranshahi, *J. Essent. Oil Res*., **19**, 110 (2007).
11. L. Jirovetz, G. Buchbauer, A. Stoyanova, A. Balinova, G. J. Zhang, and X. H. Ma, *Flav. Fragr. J*., **20**, 7 (2005).
12. H. Iwata, T. Kato, and S. Ohno, *Gene*, **259**, 53 (2000).
13. V. Mozaffarian, *Tree and Shrubs of Iran*, Farhang Moaser Press, Tehran, 2004.
14. A. Zargari, *Medicinal Plants*, Tehran University Publications, Tehran, 1996.
15. L. Jirovetz, G. Buchbauer, and S. Manochehr, *J. Essent. Oil-Bear. Plants*, **5**, 111 (2002).
16. K. Javidnia, R. Miri, M. Kamalinejad, H. Sarkarzadeh, and A. Jamalian, *Flav. Fragr. J.*, **19**, 213 (2004).
17. R. P. Adams, *Identification of Essential oil Components by Gas Chromatography-Quadropole Mass Spectroscopy*, Allured Publishing Corporation, IL, 2001.