

## Constituents of flowers essential oils of *Smirnovia iranica* Sabeti from Iran

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### ABSTRACT

**Background and aims:** *Smirnovia iranica* Sabeti is one of the valuable and adapted shrub native species to the sandy fields of Central Iran and of Fabaceae family that in terms of the production of forage and soil conservation and creating a beautiful landscape and medicinal value is critically important. No study has been conducted on this plant essence in Iran, so far.

**Methods:** In the habitat of the plant, located in Kashan sandy areas, during flowering in the third week of April in each site, flowers were collected and after extraction of essential oils using simultaneous method of distillation and extraction using organic solvents, a chromatography device connected to a mass spectrometer (GC/MS) was used in order to identify the combinations of essential oils.

**Results:** The essence yields were 0.02% and the color of essential oils was yellowish. The important and main combinations of essential oils were Hexadecanoic acid, Tetradecanoic acid and 6,10,14-Trimethyl-2-pentadecanone which consisted more than 10 percent of the composition.

**Conclusion:** It can be concluded that *Smirnovia iranica* sabeti is a versatile plant found in sandy fields of Iran with medicinal, anti-virus, anti-cancer and anti-bacterial properties.

**Keywords:** Essential oil, Flower, Hexadecanoic acid, Tetradecanoic acid.

### INTRODUCTION

Due to adaptation with extremely difficult environmental conditions such as low humidity, high temperature, salt concentration of the soil, organic material shortages, fluctuating temperatures during day and night, strong winds and water and wind erosion, medicinal herbs of desert areas are very important and species containing valuable genes, therefore, they

are considered as genetically valuable resources and plant communities existing in these areas are of particular communities that are surprisingly adapted to the low resources available and the constraints of their environment.

*Smirnovia iranica* is one of the valuable, beautiful and durable shrub species which has spread among sand dunes in

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Dashte Kavir deserts and floodways, around Kashan and Khorasan. This plant is suitable in terms of forage production and due to its high protein content; it has a very good quality and a high economic value.<sup>1,2</sup> In terms of flowing sand stabilization and protecting the soil, the special root system is one of the other distinctive features of *Smirnovia iranica*. Beautiful vision during the flowering, long activity period and short dormancy have made the *Smirnovia iranica* as one of the best plant species in combating desertification and creating green spaces around cities located in the desert, so that the sand can be prevented from entering into residences and agricultural areas.

Sabeti has suggested that the vast differences between the native species of Iran and the *Smirnovia turkestanica* species are leaves with three ovate leaflets, round navel of the seed and the oval shape of its fruits.<sup>3</sup>

Sairafianpour et al. carried out a research titled as Isoflavonoids separated from *Smirnovia iranica* as a new antiprotozoal agent. The results of phytochemical tests of this plant introduced two new isoflavonoids named as 8-pernil macronolol and smirankin that in addition to Glir Aspirin H were present in this plant.<sup>4</sup>

The present study was arranged and carried out to determine the quality and quantity of flower essential oil of this valuable plant in sandy fields of Kashan. It is noteworthy to mention that no research has been carried out in this field in Iran, so far and hence, this evaluation is quite unique.

## METHODS

First, using library studies, the habitats of the concerned species were identified. Then, considering various factors such as the availability of habitat, natural habitat conditions, the existence of different sites

with the appropriate distances from each other as well as the appropriate and the harvestable presence of the plant through field visits from various habitats in the Isfahan province in April 2012, the species was found in the harvestable quantity only in Rig Boland sand dunes strip located in the North and the East of Kashan.

Geographical characteristics of the selected sites of *Smirnovia iranica* sabeti were: Altitude: 1186m, latitude: N  $36.91051^{\circ}$ , and longitude: E  $51.68334^{\circ}$ .

Sampling from the studied plant flowers during the flowering in April 2012 was carried out randomly in each site in accordance with the presence and abundance of species along a 100-meter transect of the concerned plant bases. After harvesting, the samples were transferred to the laboratory and were exposed to the open air to dry. In this research, the extraction of essence oil was carried out using simultaneous distillation-extraction method with organic solvent SDE (simultaneous distillation-extraction). The device worked on this basis that the plant essences were extracted based on distillation by steam and then the simultaneous extraction of essences was carried out by organic solvent from the droplets produced by the condensation of steam.

In this regard, an amount of 40 g of flowers samples per site was transferred to a 2 liter distillation balloon and distilled water was added so that the total plant sample and distilled water could occupy 2.3 of the balloon volume. Pentane was used as the solvent to collect the essence and this process continued for 2 hours.

Immediately after making essential oils, the organic solvent containing the essence was dehydrated using sodium sulfate and after the evaporation of the solvent, the essence oil samples were kept in the freezer until transferring and injecting into the GC-MS device.

The weight of collected essential oil was accurately calculated (with Analytical Scales) and using the dry weight, the essential oil extraction yield was calculated. The obtained essence samples were analyzed using GC-MS instrument containing HP-5MS column (length 30 m, internal diameter 0.25 mm, thickness of static layer 0.25  $\mu$ m) and helium gas with 99.9999% purity. In addition, the carrier gas flow rate and ionization energy in mass spectrometer were chosen as 1 ml/min and 70 eV, respectively. To identify the ingredients comprising the essential oil of the plant, the following steps were taken: According to the suggestions offered by GC-MS instrument library, each of them was analyzed separately. Then, the obtained MS spectra were compared with the spectra of reference books, including the book by Adams. Finally, with regard to the retention time of each peak, Kovats retention index (RI) of each of them was calculated through

the equation of calculating the Kovats coefficient and was compared with the Kovats index of references to similar conditions.

## RESULTS

The essence yields was 0.02% and the color of essential oils was yellowish. The flower oil composition of *S. iranica* is summarized in Table 1. essential oil color was yellow. 15 compounds were identified in the essential oil of this plant.

The major components from flower oil in this study were Hexadecanoic acid (17.57%), Tetradecanoic acid (16.13%), and 2-Pentadecanone, 6,10,14-trimethyl- (14.66%). The three components of the essential oil, is another indicator of this species chemotype. Other compounds above 3% were Pentacosane (5.83%), Hexadecanoic acid, methyl ester (4.04%), and Dodecanoic acid (3.42%).

**Table 1:** Flower oil composition of *Smirnovia iranica* Sabeti

RI	Compound	Area %
10.17	Limonene	1.78
28.37	Hexadecane	2.34
29.46	$\beta$ -Ionone	1.36
33.02	Dodecanoic acid	3.42
37.47	Heptadecane	0.67
38.17	Ethanol, 2-(dodecyloxy)-	1.20
40.52	Tetradecanoic acid	16.13
40.98	Octadecane	0.99
42.62	2-Pentadecanone, 6,10,14-trimethyl-	14.66
44.98	5,9,13-Pentadecatrien-2-one, 6,10,14-trimethyl-, (E,E)-	1.11
45.20	Hexadecanoic acid, methyl ester	4.40
46.94	Hexadecanoic acid	17.57
52.61	(Z,Z,Z)-9,12,15-Octadecatrien-1-ol,	1.64
56.21	Tricosane	1
61.49	Pentacosane	5.83

## DISCUSSION

Tetradecanoic acid (acid Myristic), Hexadecanoic acid (palmitic acid) and Dodecanoic acid (lauric acid) are saturated as fatty acids. Myristic acid is used as sunscreen, softener, moisturizer and cleanser. Palmitic acid: is a fatty acid, solid and waxy with a melting point of 64 °C which is found as palmitin in solid fats, palm oil, and natural fats, including milk fat. This acid has lubricant, binder and defoamer properties. Lauric acid appears as a white crystalline that eliminates the bacteria; the bacterial infections caused by intestinal parasites and infections of a variety of diseases ranging from AIDS to common colds. In fact, the human body converts Lauric acid into a material called monolaurin which is an antibacterial and antiviral agent, especially for viruses with a lipid envelope such as HIV and influenza.

## CONCLUSION

It can be concluded that *Smirnovia iranica* sabeti is a versatile plant found in sandy fields of Iran with medicinal, anti-virus, anti-cancer and anti-bacterial properties.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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