Journal of Herbal Drug
journal homepage: www.jhd.iaushk.ac.ir

Chemical composition of the leaf essential oil of *Smirnovia iranica* Sabeti from Iran

Mansureh Ghavam*

College of Natural Resources and Earth Sciences, University of Kashan , Isfahan, Iran;
***Email:** mghavam@kashanu.ac.ir*

ARTICLE INFO

Type: *Short Original Research*
Topic: *Medicinal Plants*
Received *January 5th 2014*
Accepted *April 5th 2014*

Key words:
- ✓ Smirnovia iranica *sabeti*
- ✓ *Essential oil*
- ✓ *Leaf*

ABSTRACT

Background & Aim: *Smirnova iranica* Sabeti is one of the valuable and adapted shrub species native 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.

Experimental: In the habitat of the plant, located in Kashan sandy areas, during flowering in the third week of April, leaves 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 & Discussion: The essence yield was 0.04% and the color of essential oils was yellowish. The important and main combinations of essential oils were β-Ionone, dodecanoic acid, tetradecanoic acid, Phytol and (Z, Z, Z) -9,12,15-Octadecatrien-1-ol which consisted more than 6 percent of the composition.

Industrial and practical recommendations: Hence, it can be concluded that *Smirnova iranica* sabeti is a versatile plant found in sandy fields of Iran with medicinal, anti-virus, anti-cancer and anti-bacterial properties and is rich in vitamin A precursor.

1. 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 among very important and species containing valuable genes and 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 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, and (Joneidi Jafari, 2005). 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 desert, so that the sand can be prevented from entering into residences and agricultural areas.

Sabeti (1976) has suggested that the vast differences between the native species of Iran and the *Smirnovia turkestana* species are leaves with three ovate leaflets, round navel of the seed and oval shape of its fruits.

Sairafianpour *et al*. (2004) carried out a research titled as Isoflavonoids seprated from *Smirnovia iranica* as a new antiprotozoal agent. The results of phytochemistrical tests of this plant introduced two new isoflavonoids named as 8-pernil macronolatol and smirankin that in addition to Glir Aspirin H were present in this plant.

The present study was arranged and carried out to determine the quality and quantity of leaf 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.

2. Materials and Methods

2.1. Plant Material

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 appropriate distances from each other as well as the appropriate and harvestable presence of the plant through field visits from various habitats in the Isfahan province in April 2012, the species was found in harvestable quantity only in Rig Boland sand dunes strip located in the North and the East of Kashan. Geographical characteristics of the selected site are listed in Table 1.

Table1. Geographical characteristics of the selected site of *smirnovia iranica* sabeti

altitude (meters)	latitude,	longitude,
1186	34° 0.683 ´ N	51° 36.910 ´ E

Sampling from the studied plant leaves 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 (simaltarions distillation-extraction).

Table 2. Chemical ingredients comprising the essential oil of the leaf of the *Smirnova iranica* sabeti.

RI	Compound	area %
3.87	(Z)-2-Penten-1-ol	o.38
4.08	2-Butenal, 3-methyl-	0.61
4.28	Hexanal	o.38
5.27	2-Hexenal, (E)-	o.79
7.34	α-Pinene	0.25
8.19	Benzaldehyde	0.43
10.49	Limonene	0.75
11.10	Benzeneacetaldehyde	0.68
12.09	(Z,E)-3,5-octadien-2-one	0.89
13.41	Nonanal	0.86
17.68	Decanal	0.53
21.72	Theaspirane B	0.58
22.52	2-Methoxy-4-vinylphenol	2.34
25.47	Decanoic acid	2.42
26.15	2-Undecanone, 6,10-dimethyl-	0.41
27.42	Nonanoic acid, 9-oxo-, methyl ester	0.66
28.27	5,9-Undecadien-2-one, 6,10-dimethyl-, (E)-	2.02
29.68	β-Ionone	10.95
31.08	4-Hexen-3-one, 5-methyl-	3.46
31.85	2(4H)-Benzofuranone, 5,6,7,7a-tetrahydro-4,4,7a-trimethyl-	2.57
33.03	Dodecanoic acid	7.49
33.80	Hexadecane	0.62
37.49	Heptadecane	0.68
40.75	Tetradecanoic acid	9.90
41.00	Octadecane	0.32
46.93	2-Pentadecanone, 6,10,14-trimethyl-	3.37
43.44	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	1.27
45.02	Farnesylacetone B	1.1
45.23	Hexadecanoic acid, methyl ester	1.12
46.46	Dibutyl phthalate	0.65
46.93	Eicosamethyl-cyclodecasiloxane	4.47
47.53	Hexadecanoic acid	4.31
50.61	9,12,15-Octadecatrienoic acid, methyl ester	0,73
51.19	Phytol	6.44
52.61	(Z,Z,Z)-9,12,15-Octadecatrien-1-ol	5.6
58.47	Vitamin E acetate	3.16
61.48	Pentacosane	1.12

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 leaves 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 injection 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.

2.2 Gas Chromatography – Mass Spectrometry

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 μm) 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:

A) According to the suggestions offered by GC-MS instrument library, each of them was analyzed separately.

B) The obtained MS spectra were compared with the spectra of reference books, including the book by Adams (Adams, 2001).

C) 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 in references for similar conditions.

3. Results and discussion

The leaf oil composition of *S. iranica* is summarized in Table 2. Essential oil color was yellow. 37 compounds were identified in the essential oil of this plant.

The major components from leaf oil in this study were β-Ionone (10.59%) ،dodecanoic acid (7.49%) , tetradecanoic acid (9.90%) , phytol (6.44%) and (Z,Z,Z)-9,12,15-Octadecatrien-1-ol (5.6%).The five components of the essential oil, is another indicator of this species chemotype. Other compounds above 3% were 4-Hexen-3-one, 5-methyl- (3.46%), 2-Pentadecanone, 6,10,14-trimethyl- (3.47%), Eicosamethyl-cyclodecasiloxane (4.47%), Hexadecanoic acid (4.31%) and Vitamin E acetate (3.16%).

Tetradecanoic acid (acid Myristic), Hexadecanoic acid (palmitic acid) and Dodecanoic acid (lauric acid) are saturated 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. Aliphatic alcohols lower the cholesterol levels and help to prevent platelet aggregation. Phytol which is an alcohol of this type, has antioxidant and anti-cancer benefits. β-Ionone reduces the activity of HMG-CoA reductase of the liver. β-Ionone is a vitamin A precursor.

Hence, it can be concluded that Smirnova iranica is a versatile plant found in sandy fields of Iran with medicinal, anti-virus, anti-cancer and anti-bacterial properties and is rich in vitamin A precursor.

4. Conclusion

Hence, it can be concluded that *Smirnova iranica* sabeti is a versatile plant found in sandy fields of Iran with medicinal, anti-virus, anti-cancer and anti-bacterial properties and is rich in vitamin A precursor.

5. References

Joneidi Jafari, H. 2005. *Ecological and functional characterization of bovine tail Smirnovia iranica Kashan sand dunes*. Range Management, Master

Thesis, Department of Natural Resources, Tehran University.In Persian

Ghazian Tafrishi, K. and Azizi, M. 2006. Review of the production and properties of plant secondary metabolites, Professional Builder Magazine zeytoon., 170: 38-43. In Persian

Omidbygi, R. 1995. *Approaches to processing plants*. The first volume. Publications about the day, Tehran, 283 pages .In Persian.

Sabeti, H. (1976). *Actaecological*, No. 25, Vol 1. National University of Iran . In Persian

Sairafianpour, M., Kayser, O., Christensen, J., Asfa, M., Witt, M., Staerk, D., Jaroszewsk, J.W. 2004. Isoflavonoids isolated from Smirnowia iranica as new antiprotozoal agents. *Iranian Journal of Pharamaceutical Research*., 3(2): 18. Zhong, JunZhong. Jun MAXian LI1. Yang LU2. Cheng Wange., Qi Tai zehrngo. 2003. A New Cycloartane rom Sphaerophysa salsula. *Chinese Chemical Letters*., 14(6): 594 – 596,.