International Journal of Agriculture Innovations and Research
Volume 2, Issue 2, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 06/07/2013 | Accepted on : 14/10/2013 | Published : 31/10/2013

Study of Essential Oil on Populations of *Stachys Inflata* Benth of Khan-Gormaz Protected Area from Iran

A. Yavari
Department of Biology, Payame Noor University,
19395-4697 Tehran, Islamic Republic of Iran
Email: yavari.afagh@gmail.com

S. M. Shahgolzari
Department of Biology, Payame Noor University,
19395-4697 Tehran, Islamic Republic of Iran
Email: mehdi.shahgolzari@gmail.com

***Abstract* – To examine the chemical variability in aerial parts of wild populations of *Stachys inflata* collected from Khan –Gormaz protected area, in west Iran. The essential oils of *S. inflata* from four populations were obtained by hydro-distillation and analysed by GCMS. The results revealed that distinct differences in the content of compounds depending on region of sample collection. The rate of essential oil changed in the populations, with an average of 3.8%. Caryophyllene oxide (0-22.49%), Dibutylphthalate (0.47-34.66%), Spathulenol (20.15-41.64%), trans-caryophyllene (2.15-24.81) were characterized as main components of the essential oil, while their rates were changed according to the populations. So, we propose two population groups with intriguing patterns in their geographic distribution. Variations in essential oil rates and compositions may be due to on genetic, ecological or individual variability.**

***Keywords* – Essential Oil, *Stachys Inflata* GCMS, Population.**

I. Introduction

The remarkable number of the world's ecological regions, including variety of habitats in Iran, supports a large number of unique species of fauna and flora. According to the first national report of department of environment to convention on biological diversity (CBD), about 8.5 million hectares of the surface area of Iran is protected as different kinds of conservational categories [1]. Khan-Gormaz protected area is situated on southern highlands of Hamadan Province. Aimed at protecting Armenian sheep and wild goat, this region was designated protected area in 2001. It is an about 9000 ha. About 60 medicinal species were determined in this area. Some of most important species area as follows: *Thymus kotschyamus*, *Ziziphora clinopodioides*, *Stachys inflata*, *S. lavandulifolia* [2]. *Stachys inflata* Benth. is a native plant widely distributed in Iran [3], being popularly named "Poulk" or "Ghol-e-Argavan". Aerial parts from sterile stems of *S. inflata* have been used as a folk medicine and the people in the north of Iran believed it to cure infective, asthmatic, rheumatic and other inflammatory diseases. Hydroalcoholic extract of the aerial parts of *S. inflata* shows potent anti-inflammatory activity in rat [4, 5]. According to exiting references and information, individuals of this species are present in many stations with different ecological conditions. We are becoming increasingly aware that an individual cannot be considered out of the context of its environment. With regard to the wide distribution of *S. inflata* in the Iran we wanted to know if there is Essential oil diversity between individuals of this species in study area.

II. Materials and Methods

Khan-Gormaz Protected Area with9000 hectares surface area is situated between 34°35′ and 34°40′ northern latitudes and 48°10′ and 48°15′ eastern longitudes, with an altitude ranging from 1580 to 2853 m on southern highlands of Hamadan Province. Plant materials of different populations of *S. inflata* were collected. Totally, 4 populations selected for investigation in the study area. A voucher specimen has been deposited in the Herbarium of Biology Department, Payame Noor University,Touyserkan, Hamedan, Iran. The aerial parts of the plant were air-dried. The oil was obtained by hydrodistillation using a Clevenger-type apparatus for 3 hours. GC/MS analyses was performed with a TRACE MS apparatus equipped with a HP-5MS capillary column (60 m ´ 0.25 mm; coating thickness 0.25 µm) and a TRACE MS mass selective detector. The oven temperature was programmed from 60–250°C at 5°C/min. Carrier gas, helium, was adjusted to a flow of 1.1 mL/min. The MS operating parameters were: ionization voltage, 70 eV; ion source temperature, 200°C. The populations were compared for rate and components of essential oil by community analysis package III and *PC-ORD* software. Cluster analysis (with ward method) and ordination (with PCA method) was applied for classifications of the populations for the main components of essential oil.

III. Results

Table 1: Essential oil composition (%) of four populations of *S. inflates.*

Components	RI	P3	P4	P1	P2	Average
6,10,14-trimethyl-2-pentadecanone	1848	1.34	5.21	0.51	0.54	1.9
ar-Curcumine	1492	0.08	0	0.14	1.3	0.38
bicyclogermacrene	1517	0.05	4.98	2.83	-	1.965
Caryophyllene oxide	1608	5.84	18.27	22.5	-	11.65
Dibutylphthalate	1969	34.66	4.51	0.47	15.1	13.69
E-Citral(Geranial)	1272	-	-	-	3.95	0.9875
E-Nerolidol	1569	0.08	0.09	0.73	0.18	0.27
Germacrene D	1501	0.27	12.61	1.09	0.56	3.6325
isobutyl phthalate	1874	24.68	0.6	0.15	8.45	8.47
isospathulenol	1658	0.82	1.83	0.12	-	0.6925
limonene	1035	0.24	0	5.09	1.15	1.62
n-tetradecane	1401	0.03	1.18	0.07	-	0.32
pristane	1709	1.91	1.2	0.45	-	0.89
spathulenol	1600	20.15	21.15	24.9	41.6	26.96
trans-caryophyllene	1441	2.15	6.73	24.8	4.15	9.46
trans-α-bergamotene	1447	0.07	0.43	0.35	-	0.2125
Viridiflorol	1617	1.03	2.98	0.13	-	1.035
Z-citral (Neral)	1244	-	-	-	2.86	0.715
α-Cadinol	1674	0.69	0	0.14	1.6	0.6075
α-copaene	1392	0.07	1.61	1.74	0.23	0.9125
α-pinene	940	0.01	0.04	0.12	-	0.0425
β-bourbonene	1403	0.02	1.92	0.15	0.07	0.54
δ-Cadinene	1538	0.4	2.08	1.86	0.74	1.27
Total	-	94.59	87.42	88.3	82.5	3.8358
Average essential oil	-	4.113	3.801	3.84	3.59	-

International Journal of Agriculture Innovations and Research
Volume 2, Issue 2, ISSN (Online) 2319-1473

The averages of components of the essential oils are given in Table 1. The major components of the oil were Caryophyllene oxide (0-22.49%), Dibutylphthalate (0.47-34.66%), Spathulenol (20.15-41.64%), trans-caryophyllene (2.15-24.81) (Fig. 1). Averages of rates were of each population is show in figure 2. Total essential oil compositions of *S.inflata* for the populations were identified in the figure 3. The dendrograms represents graphically the relationships among the populations and the groups, based on their essential oil composition. Two groups were formed by the Linkage cluster and PCA ordination analysis (Fig. 4, 5).

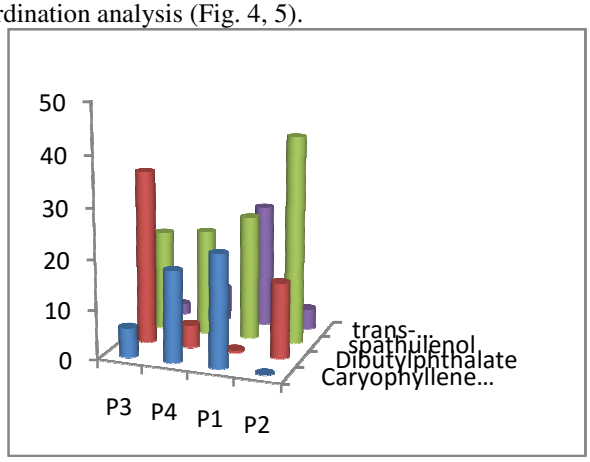

Fig.1. The major components of the oil from *S. inflata* for the populations

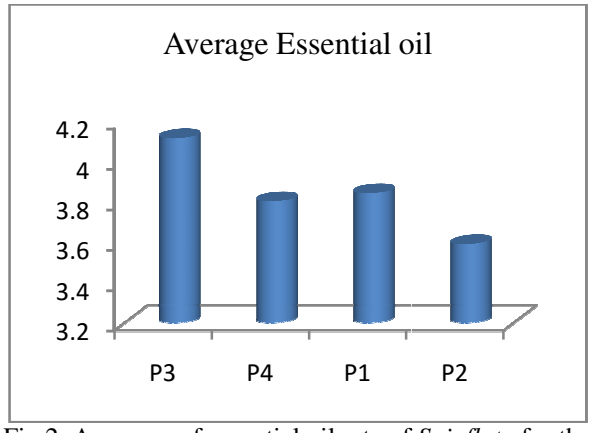

Fig.2. Averages of essential oil rate of *S. inflata* for the populations (%).

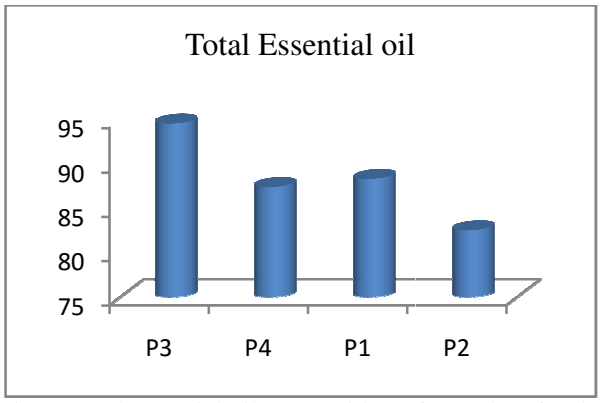

Fig.3. Total essential oil composition of *S. inflata* for the populations (%).

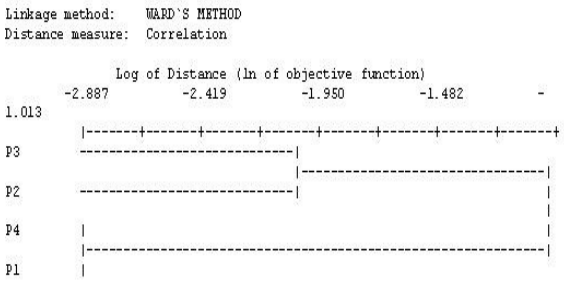

Fig.4. A dendrogram of four populations of *S. inflata* using cluster analysis.

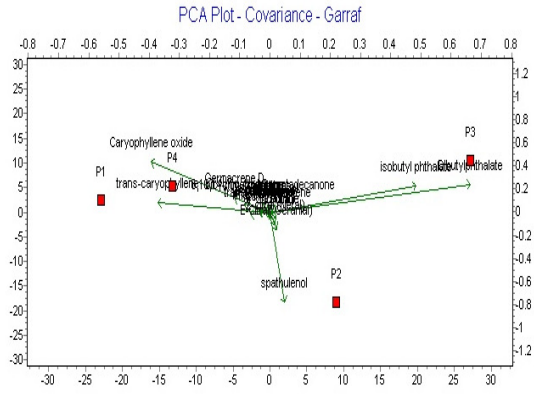

Fig.5. A ordination of four populations and components oil of *S. inflata* using PCA analysis.

IV. Discussion

Chemical polymorphisms have been reported for many medicinal plants. According to previous studies, various components of essential oil on *S. inflata* have been reported [6, 7, 8, and 9]. This shows that the volatile oil composition of *S. inflata*, in Iran is extremely variable. The differences in the quantity or quality of the oils composition of the present and previous studies may be because of the chemotypes, phenological stage, drying conditions, mode of distillation and geographic and climatic factors. In conclusion, *S. inflata* with different chemical compositions have been reported. It is known that many factors influence the chemical constitution of *S. inflata* oils. We propose 2 population groups with intriguing patterns in their geographic distribution. First Group is P1 and P4 and second group is P2 and P3 (Fig. 4). These groups are distinguished by different levels of classes of natural products. The first group exhibited high Caryophyllene oxide and spathulenol contents. The second group displayed high Dibutylphthalate and spathulenol contents. These differences emphasized the large variations among population and within population of the species. Present results show that *S. inflata* from chemical points of view, have high variation in the study area. Variations in essential oil rates and compositions may be due to on genetic, ecological or individual variability. So far has shown that when individuals of a species are found in a variety of species habitat, It is possible that some of these habitat types intraspecific (chemotype, ecotype, etc.) to be present [10].

In this regard, widespread presence of this species in different habitats, it can at least show Phytochemical variation in different populations of this species is in different areas.

REFERENCES

[1] Anonymous, 2000. The First National Report to Convention on Biological Diversity (CBD). Department of Environment, Iran.

[2] Yavari, A and S. M, Shahgolzari. 2010. Floristic Study of Khan-Gormaz Protected Area in Hamadan Province, Iran. International Journal of Agriculture & Biology, ISSN Print: 1560–8530; ISSN Online: 1814–9596

[3] Rechinger Kh, 1982. Flora Iranica. No. 150, Labiatae. Akademische Druck-u. Verlagsanstalt, Graz. 354-396.

[4] Javidnia, K., F. Mojab and S. A. Mojahedi, 2004. Chemical Constituents of the Essential Oil of Stachys lavandulifolia Vahl from Iran. Iranian Journal of Pharmaceutical Research 3: 61-63.

[5] Nadaf, M., H. khalil abad., L. Monfaredi and N. Neyestani, 2011. Chemical Composition of the Essential Oil of stachys lavandulifolia (after flowering) Growing wild in Darkesh Protected Area (North Khorassan Province Iran). Asian Journal of Plant Science and Research, 1 (1): 1-4.

[6] Sajjadi, S. E., M. Somae, 2004. Chemical Composition of the Essential Oil of Stachys inflata Benth. from Iran.Chemistry of Natural Compounds, Vol 40, Issue 4, pp 378-380.

[7] Morteza-Semnani K., M. Akbarzadeh, S. Changizi, 2006. Essential oils composition of Stachys byzantina, S. inflata, S. lavandulifolia and S. laxa from Iran. Flavour Fragr. J., 21: 300–303.

[8] Omidbaigi, R., M. A. Omidbaigi, M. R. Bastana, 2006. The essential oil content and composition of Benth fron Iran. Jeobp 9 (1), pp 60-64.

[9] Yavari, A and S.M. Shahgolzari, 2013. Chemical composition of the essential oil of Stachys inflata Benth. from Iran. Asian Journal of Plant Science and Research, 3(2):62-65.

[10] Atri, M., M. Asgari Nematian and M. Shahgolzari, 2007. Determination and discrimination of intraspecific diversity of Astragalus gossypinus by Eco-phytosociological method from West of Iran. Pakistan J. Biol. Sci., 10: 1947–1955.