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# GC/MS Analysis of Essential Oils of *Cymbopogon schoenanthus* and *Origanum majorana* L. Grown in Eastern Algeria

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The chemical compositions of the essential oils obtained from the aerial parts (leaves) of *Cymbogopogn schoenanthus* and *Origanum majorana* L, grown in Eastern Algeria (35°24'15" N and 8°7'27" E), by hydrodistillation was carried out using gas chromatography-mass spectrometry (GC-MS) analysis. The components obtained were identified. The most important compound detected in leaves of *Cymbopogon proxima* L was 4-isopropyl-1-methyl-2-cyclohexen-1-ol (*cis*) (15 %) and most important compound detected in leaves of *Origanum majorana* L was *p*-menth-1-en-4-ol, (R) (21 %).

**Keywords: Essential oil, *Cymbogopogn schoenanthus*, *Origanum majorana* L, GC/MS, Hydrodistillation.**

## INTRODUCTION

The world is rich with natural and unique medicinal plants. Medicinal plants are now getting more attention than ever because they have potential of myriad benefits to society or indeed to all mankind, especially in the line of medicine and pharmacological. The medicinal value of these plants lies in bioactive phytochemical constituents that produce definite physiological action on the human body[1]. Some of the most important bioactive phytochemical constituents are alkaloids, essential oils, flavonoids, tannins, terpenoid, saponins, phenolic compounds and many more[2]. These natural compounds formed the foundations of modern prescription drugs as we know today[3]. Phytochemical is a natural bioactive compound found in plants, such as vegetables, fruits, medicinal plants, flowers, leaves and roots that work with nutrients and fibers to act as an defense system against disease or more accurately, to protect against disease. Phytochemicals are divided into two groups, which are primary and secondary constituents; according to their functions in plant metabolism. Primary constituents comprise common sugars, amino acids, proteins and chlorophyll while secondary constituents consists of alkaloids, terpenoids and phenolic compounds and many more such as lavonoids tannins, *etc.*[4].

The genus *Origanum* belonging to the *Lamiaceae* family, has 38 species that are widespread in the Euro-Siberian and Irano-Siberian regions. However, most of the species, about 75 % are concentrates in the Mediterranean periphery, especially in the East Mediterranean regions[5-14]. The term oregano comes from two Greek words "oros" and "genos" is-a` say "radiance of the mountains". *Cymbopogon schoenanthus* L Spreng, is an aromatic herb. Fresh young leaves are consumed in salads and are used to prepare traditional meat recipes. Due to its pleasant aroma and taste it is used to prepare an aromatic "tea" that is much appreciated and largely consumed in the north of Africa[15]. Besides its use in culinary, *C. schoenanthus* is also used in folk medicine. Its medicinal properties are known from the antiquity, being already described by "Pliny the Eldey" in his book Naturalis Historia[16]. Le Floc'h[17] reports its use for the treatment of rheumatism and fever. This author describes also its use as a diuretic, insecticide and a poultice to cure dromedary wounds. In the South of Tunisia, this plant is also used for the treatment of rheumatism and to diminish fever. The plant is particularly appreciated for its medicinal action in North Africa and it is also used for the anorexia. In the Djanet area (Algeria), it is well known for bringing back the appetite. The infusions are taken as a diuretic, it cures intestinal troubles and, in the form of decoction, it acts against food poisoning and helps also in the digestion. Some of the diseases like rheumatism and fever, that this plant is used against, can be attributed to the formation of free radicals in the biological system[18].

The purpose of this study was evaluate the essential oils of 2 medicinal plants (*Cymbogopogn schoenanthus* and *Origanum majorana* L) grown in East Algeria (Tebessa region).

## EXPERIMENTAL

Samples of the aerial part leaves of (*Cymbogopogn schoenanthus* and *Origanum majorana* L) were collected from Tebessa region, Eastern Algeria (35°24'15" N and 8°7'27" E). Plant material were gathered at the flowering stage in March 2014, cut in to little pieces and weighed before the extraction of volatile compounds. Voucher specimens are deposited in VPRS Laboratory, University of Ouargla, under the code Number CP1 and OM1 Respectively, the Fig. 1a and 1b shown respectively, the picture of *Origanum majorana* L and *Cymbogopogn schoenanthus*.


Fig. 1. Picture of plants (a): *Origanum majorana* L; (b) *Cymbogopogn schoenanthus*

**General procedure:** Conventional hydrodistillation was carried out with a Clevenger-type apparatus and using samples of at least 100 g of dried leaves of each plant. The essential oil of *Cymbogopogn schoenanthus* was obtained after 3 h of distillation and the yield was 0.40 %. The essential oil of *Origanum majorana L* was obtained after 4 h of distillation the yield was 0.60 %. Oils were collected in the vials, dehydrated with anhydrous sodium sulfate and kept under refrigeration until being analyzed.

**Detection method:** The essential oils were analyzed by Trace gas chromatograph and a Trace Q mass spectrometer. These two latter were managed by the dedicated Excalibur software (all from Thermo Fisher, Rodano MI, Italy) using a fused-silica capillary column with an apolar stationary phase HP5MSTM (30 m × 0.25 mm × 0.25 µm film thickness). GC-MS spectra were obtained using the following conditions: carrier gas Helium; flow rate 1.0 mL $min^{-1}$; split 1:20; injection volume 0.1 µL; injection temperature 250 °C; oven temperature progress from 60 to 280 °C at 2 °C $min^{-1}$; the ionization mode used was electronic impact at 70 eV. The identification of analytes was carried out by comparing the peak relative retention times and mass spectra.

## RESULTS AND DISCUSSION

Fig. 2, represent the chromatogram GC/MS of essential oil from *Cymbopogon schoenanthus* in scan mode, while the Fig. 3 represent the chromatogram GC/MS of essential oil from *Origanum majorana* L in scan mode.

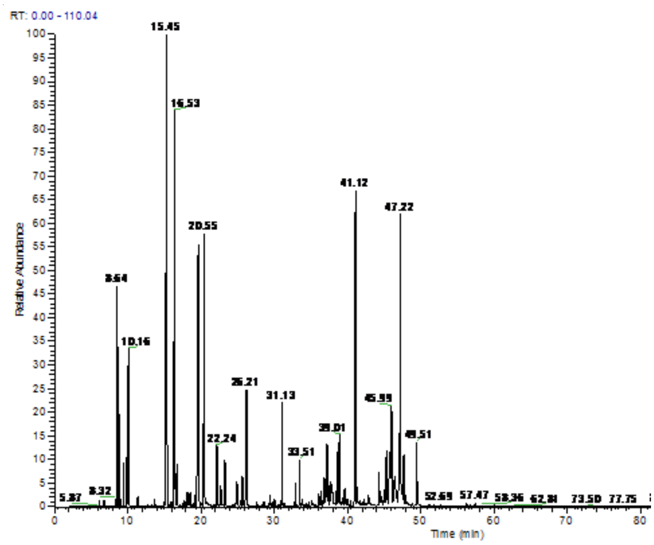


Fig. 2. GC/MS chromatogram of essential oil from *Cymbopogon schoenanthus*

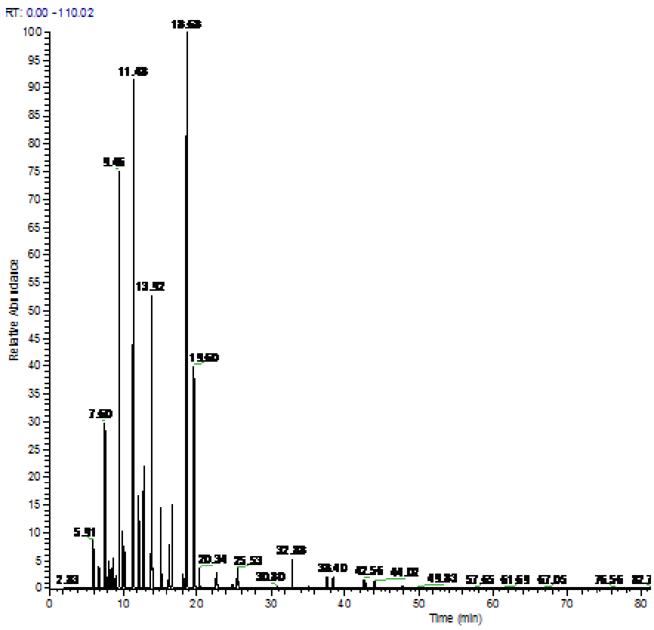


Fig. 3. GC/MS chromatogram of essential oil from *Origanum majorana* L.

The Table-1, regroup the most abundant compounds of essential oil composition, twenty one compounds were identified as majorities compounds. The compounds identified were included in four families: monoterpenes hydrocarbons; oxygenated monoterpenes; sesquiterpenes hydrocarbons and oxygenated sesquiterpenes. Oxygenated monoterpenes was the most abundant family, which represent 49 % (Fig. 4) and 4-isopropyl-1-methyl-2-cyclohexen-1-ol (*cis*) was the most abundant compound when represent 15 % of the total compounds identified.

For the essential oil composition obtained from *Origanum majorana* L, the monoterpenes hydrocarbons and oxygenated monoterpenes were the majorities family, they represent 90 % of the total, while the sesquiterpenes hydrocarbons and oxygenated sesquiterpenes families represent together 10 % (Fig. 5). Among the essential oil composition, *p*-menth-1-en-4-ol, (R) was the most abundant compounds with 21 % of the total essential oil compounds identified.

The composition of essential oil compounds of the areal parts from two plants does not include many very volatile compounds; this fact will be in relation with oven temperature program of gas chromatography. Since that, the temperature program started at 60 °C and at this temperature does not promote the very volatile compounds in the chromatogram. Other analyse will be focused of identification of very volatile compounds from two plants in the future using head space/solid phase microextraction (HS/SPME).

TABLE-1
SEMI-QUANTITATIVE COMPOSITION OF ESSENTIAL OIL FROM *Cymbopogon schoenanthus*

| No. | Retention time (min) | Compounds | % |
|---|---|---|---|
| 1 | 8.63 | 2-Carene | 7 |
| 2 | 9.00 | α-Phellandrene | 3 |
| 3 | 9.44 | *p*-Mentha-1,4(8)-diene | 1 |
| 4 | 9.89 | *p*-Cymene | 2 |
| 5 | 10.02 | d-Limonene | 5 |
| 6 | 10.16 | β-Phellandrene | 5 |
| 7 | 15.40 | 4-Isopropyl-1-methyl-2-cyclohexen-1-ol (*cis*) | 15 |
| 8 | 16.49 | 4-Isopropyl-1-methyl-2-cyclohexen-1-ol (*trans*) | 13 |
| 9 | 16.76 | Camphor{1R,4R} | 1 |
| 10 | 19.65 | *p*-Menth-1-en-3-ol, *cis* | 8 |
| 11 | 20.51 | *p*-Menth-1-en-3-ol, *trans* | 9 |
| 12 | 22.23 | *p*-Menth-4(8)-en-3-one | 2 |
| 13 | 23.30 | *p*-Menth-1-en-3-one | 1 |
| 14 | 25.69 | Carvacrol | 1 |
| 15 | 31.11 | Cyclohexene, 2,4-diisopropenyl-1-methyl-1-vinyl-(1S, 2R, 4R) | 3 |
| 16 | 32.86 | 6-Chamigrene | 1 |
| 17 | 37.22 | Isolongifolan-8-ol | 2 |
| 18 | 38.73 | γ-Cadinene | 2 |
| 19 | 41.09 | Cyclohexanemethanol, 4-ethylene-α,α, 4-trimethyl-3-(1-methylethenyl)-, [1R(1α,3α, 4β)]- | 10 |
| 20 | 47.18 | 2-Naphtalenemethanol, decahydro-α,α, 4a-trimethyl-8-methylene-, [2R(2α,4aα, 8aβ)]- | 9 |
| 21 | 57.47 | 1,7,7-Trimethylbicyclo(2,2,1)-hept-2-yl 3-methylenecyclopentacarboxylate | < 1 |

TABLE-2
SEMI-QUANTITATIVE COMPOSITION OF ESSENTIAL OIL FROM *Origanum majorana* L.

| No. | Retention time (min) | Compounds | % |
|---|---|---|---|
| 1 | 7.59 | β-Phellandrene | 6 |
| 2 | 9.45 | α-Terpinene | 15 |
| 3 | 11.67 | τ-Terpinene | 19 |
| 4 | 12.16 | 4-Isopropogenyl-1-methylcyclohexanol | 3 |
| 5 | 12.80 | *p*-Mentha-1,4(8)-diene | 5 |
| 6 | 13.90 | Terpineol (*cis*) | 11 |
| 7 | 15.16 | 4-Isopropyl-1 methyl-2-cyclohexen-1-ol | 1 |
| 8 | 16.76 | Camphor{1R,4R} | 3 |
| 9 | 18.64 | *p*-Menth-1-en-4-ol, (R) | 21 |
| 10 | 19.58 | *p*-Menth-1-en-8-ol, (S) | 8 |
| 11 | 20.32 | *p*-Menth-1-en-3-ol *trans* | 1 |
| 12 | 22.49 | Acetic acid linalool ester | 1 |
| 13 | 24.78 | Bornyl acetate | < 1 |
| 14 | 25.69 | *p*-Menth-1-en-4-ol acetate | 1 |
| 15 | 32.88 | Caryophyllene | 1 |
| 16 | 37.57 | *o*-Menth-8-ene, 4-isopropylidene-1-vinyl | < 1 |
| 17 | 38.39 | 1,5-Heptadiene, 6-methyl-2-(4-methyl-3-cyclohexen-1-yl)-, (S) | < 1 |
| 18 | 42.56 | Spathulenol | < 1 |
| 19 | 44.01 | Carotol | < 1 |
| 20 | 47.79 | Ar-Tumenone | < 1 |

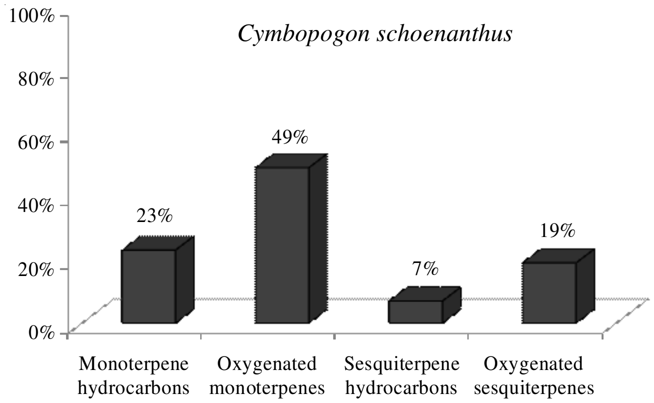


Fig. 4. Composition of essential oil by family from *Cymbopogon schoenanthus*

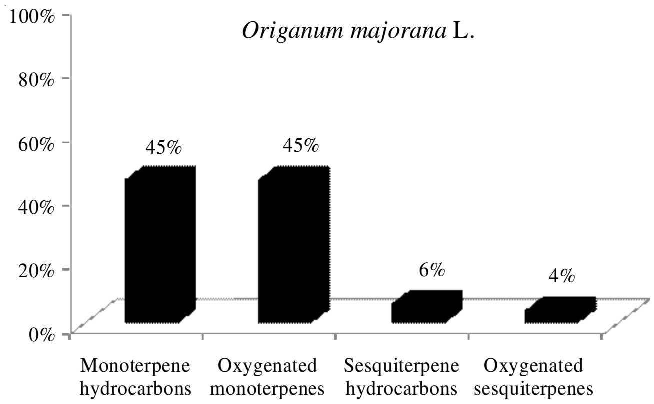


Fig. 5. Composition of essential oil by family from *Origanum majorana* L

The reported data literature for the content of the main components of *Origanum majorana* essential oils shows different main components according to the origin of the plant. Essential oil of *Origanum majorana* was rich in cymyl compounds (carvacrol 77 %) of *Origanum majorana* from Argentina[19], 1,8-cineole (33.5-50.9 %) from Italy[20,21], Linalool (15.5-37.8 %) from Finland[22], terpinen-4-ol (20.0–55.1 %) from Austria[23] and Egypt[24] and γ-terpinene (0.5-14.1 %) from Germany[25] and Hungary[26] and *p*-cymene (0.0-11.3 %) from Poland[27], Reunion island[28] and Tunisia[29]. In our study, the essential oil of *Origanum majorana* L was rich in *p*-menth-1-en-4-ol, (R).

The previous study of essential oil of *Cymbopogon schoenanthus* from Togo, indicate that the oil was rich in piperitone (68 %) and 2-carene (21 %)[30], while the essential oil from *Cymbopogon schoenanthus* in this study was rich in 4-Isopropyl-1-methyl-2-cyclohexen-1-ol (*cis*) (15 %).

## Conclusion

The study of the essential oil of the aerial parts of *Cymbopogon schoenanthus* and *Origanum majorana* L. allowed to identify the most abundant compounds of essential oil composition.

Twenty one and twenty compounds were identified as majorities compounds of essential oil respectively from *Cymbopogon schoenanthus* and *Origanum majorana* L.

4-Isopropyl-1-methyl-2-cyclohexen-1-ol (*cis*) was the most abundant compound when represent 15 % of the total compounds identified of oil essential from *Cymbopogon schoenanthus*. While *p*-menth-1-en-4-ol, (R) was the most abundant compounds with 21 % of the total essential oil compounds identified of oil essential from *Origanum majorana* L.

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