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# Comparison of volatile constituent of *Cymbopogon olivieri* (Boiss.)Bor in field and nature (wild) conditions in Iran

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## Abstract

The constituents of essential oil of *Cymbopogon olivieri* (Boiss.)Bor were studied in 3 different conditions including growing in field in two phonological stages (before flowering and after flowering) and in nature (wild). The identified compounds of essential oil were different in 3 sites (wild 29, field before flowering 22 and field after flowering 14 compounds). The major same components of three sites were Piperitone (35.62- 50.1%), α-Terpinene (8.3- 20.12%), Elemol (5.41- 11.32%), Carene (7.12- 9.56%) and β - Eudesmol (2.96-5.29%). The results of PCA test showed that the amount of Piperitone has the most variation in studied conditions.

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## Introduction

*Cymbopogon* genus belonging to Poaceae family which distributed and cultivated in tropical and sub tropical area in the world especially in southeast of Asia Nair (1982). Up to now 56 species and 120 varieties of this genus were identified Mohammadi *et al.*, (2011). *Cymbopogon olivieri* (Boiss.)Bor is a perennial grass widely distributed in south of Iran Moghimi (2005), Ghahraman (1995), Rechinger (1982). This species by having the essence of lemon fragrance was used in pharmaceuticals, cosmetics health and food industries Mohammadi *et al.*, (2011), Weiss (1997). In Iran in traditional medicine *Cymbopogon olivieri* (Boiss.)Bor used as an antiseptic and for treatment of stomachache and influenza Amin (2005), Zargari (1991). Also essential oil of this species showed interesting activity against larvaes of *Anophel stephensi* (Hadjiakhoondi *et al.,* (2003) and has a remarkable antimicrobial activity Sonboli *et al.,* (2006). As far as are our literature survey could ascertain the volatile constituent of *Cymbopogon olivieri* (Boiss.)Bor has already been analyzed in wild condition and piperitone, elemol, α-terpinene, α-eudesmol, β-eudesmol were the major constituents Sonboli *et al.,* (2006), Hadjiakhoondi *et al.,* (2003), Norouzi-Arasi *et al.,* ( 2002). But to date we know of no published report concerning the volatile constituent of *Cymbopogon olivieri* (Boiss.)Bor in field condition. Since volatile compounds of this species have many uses in pharmaceuticals, cosmetics health and food industries the present work was undertaken to study and comparison the chemical composition of the essential oil of *Cymbopogon olivieri* (Boiss.)Bor grown in field and wild condition in additional we studying the phonological effects on chemical composition of essential oil of *Cymbopogon olivieri* in field condition.

## Material and methods

The aerial parts of *Cymbopogon olivieri* (Boiss.)Bor were collected from nature habitat (wild condition) in Khouzestan province- Iran at full flowering stage. The samples field were sown in March and then harvested in two phonological stages including before flowering and after flowering. Plant materials were dried at ambient temperature and shade condition. Voucher specimen is identified and deposited at the herbarium of Islamic Azad University, Shahrerey branch. The essential oil of air-dried samples (100g) of each site was isolated by hydro distillation for 3 h, using a Clevenger-type apparatus. The distillated oils were dried over anhydrous sodium sulfate and stored in tightly closed dark vials at 4$^{oc}$ until analyzing time.

*GC analysis*

GC analysis was performed by using a thermoquest gas chromatography Shimadzu 9A, with a Flame Ionization Detector (FID) and carried out using fused silica capillary DB-5 column (60m*0.25mm i.d., film thickness 0.25 *m).The operating conditions were as follows: Injector and detector temperatures were 250$^{oc}$and 300$^{oc}$, respectively. Nitrogen was used as carrier gas at a flow rate of 1 mL min$^{-1}$, oven temperature programmed 60$^{oc}$-250$^{oc}$ at the rate of 5$^{oc}$ min$^{-1}$ and finally held isothermally for 10 min.

*GC-MS analysis*

GC-MS analysis was performed by using a thermoquest-finigan gas chromatograph Varian 3400, equipped with above mentioned column and coupled to trace Mass quadrupled detector. Helium was used as carrier gas with ionization voltage of 70 ev. Ion source and interface temperature were 200 $^{oc}$ and 250$^{oc}$, respectively. Mass range was form m/z 43-456. Gas chromatographic conditions were as given for GC.

*Identification of compounds*

The chemical compounds of essential oil were identified by calculation of their retention indices under temperature-programmed conditions for *n-alkanes* and the oil on DB-5 column under the same chromatographic conditions. Identification of individual compounds was made by comparison of their Mass spectra with those of the internal reference Mass spectra library or with authentic compounds and confirmed by comparison of their

retention indices with authentic compounds in literature. For quantitative purpose, relative area percentages obtained by GC/FID were used without the use of correction factors. For studying the variation of same major components and determination which compounds have the most variability between different condition the PCA (Principal Component Analysis) test was used.

**Table 1.** Identified chemical compounds on essential oil of Cymbopogon olivieri (Boiss.)Bor in wild and field (before and after flowering) conditions.

| No | Compounds | RRI | % (relative percent of identified compounds) | | |
|---|---|---|---|---|---|
| | | | Wild | Field(B.F) | Field(A.F) |
| 1 | Tricyclene | 932 | 0.89 | - | - |
| 2 | α-Pinene | 936 | 1.56 | 1.93 | 2.51 |
| 3 | Camphene | 946 | 2.83 | 0.83 | 0.52 |
| 4 | β-Pinene | 983 | 0.68 | 2.14 | 3.27 |
| 5 | α-Terpinene | 1011 | 8.3 | 15.85 | 20.12 |
| 6 | Para Cymene | 1023 | 0.52 | 0.73 | - |
| 7 | Limonene | 1034 | 1.8 | 0.6 | - |
| 8 | Carene | 1041 | 7.33 | 9.56 | 7.12 |
| 9 | 1,8-Cineole | 1043 | 0.56 | 1.65 | 0.89 |
| 10 | α-Terpinolene | 1074 | 0.24 | 0.31 | - |
| 11 | α-Thujene | 1095 | 0.86 | 0.6 | 0.35 |
| 12 | Myrcene | 1131 | 0.93 | 0.58 | - |
| 13 | Camphor | 1137 | - | 1.52 | 0.98 |
| 14 | α-Terpineol | 1169 | 1.9 | 2.89 | 2.58 |
| 15 | Borneol | 1182 | 0.8 | - | - |
| 16 | Piperitone | 1263 | 50.1 | 35.62 | 41.09 |
| 17 | Bornyl acetate | 1271 | 0.12 | 1.05 | - |
| 18 | Neryl acetate | 1382 | 0.89 | 0.68 | - |
| 19 | β-Elemene | 1398 | 1.32 | 1.42 | - |
| 20 | Germacrene-D | 1479 | 0.75 | - | - |
| 21 | β - Selinene | 1493 | 1.89 | 1.19 | 0.89 |
| 22 | Valencene | 1505 | 0.38 | 1.48 | 0.95 |
| 23 | Elemol | 1563 | 5.41 | 10.42 | 11.32 |
| 24 | Spathulenol | 1582 | 0.28 | - | - |
| 25 | Guaiol | 1599 | 0.89 | - | - |
| 26 | γ- Eudesmol | 1613 | 1.2 | - | - |
| 27 | β - Eudesmol | 1638 | 2.96 | 4.36 | 5.29 |
| 28 | α-Cadinol | 1672 | 0.73 | - | - |
| 29 | Farencyl acetate | 1733 | 0.32 | 0.82 | - |
| 30 | *(E, Z)*- Farensol | 1742 | 0.29 | - | - |
| | Total | | 96.73 | 96.23 | 97.88 |

**Table 2.** Results of Eigen values in main vectors for essential oil compounds in PCA Test.

| AXIS | Eigen value | % of Variance | Cum. % of Var. |
|---|---|---|---|
| 1 | 2946.132 | 97.583 | 97.583 |
| 2 | 68.885 | 2.417 | 100.000 |

**Table 3.**Coordinates (scores) of compounds in PCA.

| compound | Axis (Component) | |
|---|---|---|
| | 1 | 2 |
| Piperitone | -47.3480 | 1.5032 |
| α-Terpinene | 2.7533 | -6.7238 |
| Elemol | 11.9092 | -1.1249 |
| Carene | 13.1241 | 3.2688 |
| β - Eudesmol | 19.5614 | 3.0766 |

**Results and discussion**

The average yield of essential oil in 3 conditions were 1.5% to 2% (v/w), (wild condition=0.2%, Field condition, before flowering=1.5% and Field condition, after flowering =1.5%). The identified compounds of essential oil were different in these 3 sites (wild 29, before flowering 22 and after flowering 14 compounds) that shown in Table 1. Based on identified compounds we recognized over 96% of total oil of *Cymbopogon olivieri* (Boiss.)Bor in 3 conditions (wild condition 96.73%, Field condition, before flowering 96.23 % and Field condition, after flowering 97.88 %). The major same components of three sites were Piperitone (35.62-50.1%), α-Terpinene (8.3- 20.12%), Elemol (5.41-11.32%), Carene (7.12- 9.56%) and β - Eudesmol (2.96-5.29%). The identified compounds in wild condition is more than field conditions (before and after flowering) since environmental stresses especially water stress cause to increase the amount of essential oil of plants Farzaneh *et al.* (2010) it refers to existence of many different environmental stresses in nature (wild) condition. Based on table 1 Iran. Vol. 13.Research Institute of Forest and Rangelands.

the amount of compounds were different in 3 sites and it could be refer to environmental factors in studied sites Tajali *et al.* (2007). The results of PCA test showed that the first and second vectors interpreted all the characteristics variation of compounds among 3 conditions (Tables 2, 3) and based on these results the amount of Piperitone has the most variation and Elemol, Carene, β-Eudesmol and α-Terpinene almost have the same variation in 3 conditions and could ordered in one group (Figure 1). However the major compounds of essential oil of *Cymbopogon olivieri* (Boiss.)Bor in all 3 sites such as Piperitone, α-Terpinene, Elemol, Carene, and β - Eudesmol and having a good antimicrobial activity (Sonboli etal., 2006) show the essential oil of this plant could be used in aromatherapy and pharmacy.

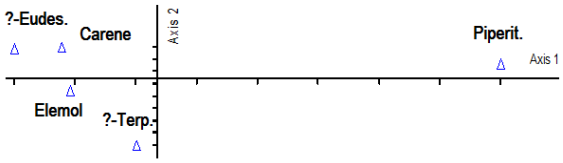


**Fig. 1.** Ordination compounds based on variation.

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