CHEMICAL CONSTITUENTS AND EFFICACY OF *CYMBOPOGON OLIVIERI* (BOISS.) BAR ESSENTIAL OIL AGAINST MALARIA VECTOR, *ANOPHELES STEPENSI*

[*]ABBAS HADJIAKHOONDI, [**]HASSAN VATANDOOST, [*]AMIRHOSSEIN JAMSHIDI AND [*]EBRAHIM BAGHERJ AMIRI

[*]Department of Pharmacognosy, Faculty of Pharmacy & Institute of Medical Plants Research, [**]Department of Medical Entomology, School of Public Health & Institute of Health Research, Tehran University of Medical Sciences

ABSTRACT

Hydrodistillation of aerial parts of *Cymbopogon olivieri* (Boiss.) Bar (Andropogonae) yielded 1.7% v/w of the essential oil. By GC and GC/MS twenty-two components, representing 94.80% of the total oil composition were identified. The major constituents were ? -3 carene (22.46%), piperitone (44.90%) and a-eudesmol (13.33%). The essential oil of *Cymbopogon olivieri* (Boiss.) Bar showed interesting activity against larvaes of *Anophel stephensi* (LD50=321 ,902 p.p.m.).

Key words: *Cymbopogon olivieri*, Andropogonae, essential oil, ? -3 carene, piperitone, a-eudesmol, *Anophel stephensi*

INTRODUCTION:

Cymbopogon olivieri (Boiss.) Bar (Andropogonae) is a plant growing in south east of Iran. The Andropogonae is the subtype of Graminae. This plant family grows under divers conditions of climate and many species of this family are consumed as aliments (1-4). A few investigation have been accomplished about the *Cymbopogon* species. The main constituents of this species are alkaloids, saponin and essential oil *(5)*. The essential oil of several species of *Cymbopogon* have been studied and the important components which were identified are; citral in *C. pendalus* and *C. flenuosus* (6), citronellol, citronellal and geraniol in *C. nardus and C. winterianus* (7) and geranial, geraniol and citronellol in *C. martini* (8). The essential oil of *C. olivieri* which grows in India has also analyzed, 3-pinene, myrcene, pulgone and piperitone were the major constituents (9), and this essential oil showed interesting anti-fungi activity. Previously by our laboratories, constituents and effects of the essential oils of aromatic plants grown in Iran against the larvae of the vectors of Malaria and Schistosoma were reported (10-12). In continuation of these systematic studies, results of the chemical investigations and anti-vectors effects of essential oil of *Cymbopogon olivieri* are reported in this manuscript.

MATERIALS AND METHODS:

Plant materials: *Cymbopogon olivieri* (Boiss.) Bar was collected in June 2001 from Jirauft, located in the south east of Iran. The plant was identified by Dr. Fakhr Tabatabaie (Faculty of Agriculture, University of Tehran). Voucher specimens were deposited at the Faculty of Agriculture, University of Tehran, Iran with the herbarium number of 7850.

Isolation of the essential oil: The air dried aerial parts of *C. olivieri* were pulverized and hydrodistilled for 3 h. using Clevenger type apparatus. *C. olivieri* yielded 1.7% v/w of the essential oil.

GC Analysis: The analysis was carried out by gas chromatography (Shimadzu 9A, Data processor, Chromatopac c-R3A, Column: DB-1, 60m, 0.25 mm, I.D. micron film thickness). The carrier gas was Helium.

GC/MS Analysis: GC/MS analysis was carried out by the use of Finnigan-Mat, Model Incos-50 apparatus. The mass spectra corresponding to GC peaks were scanned at 70 eV. The column temperature for GC and GC/MS were from 50 °C to 280 °C at 4°C/min. Injection and ion source temperatures were 280 °C and 270 °C respectively. The oil components were identified by comparison of their retention indices and mass spectra data with those of authentic samples and published data (13 - 14).

Correspondance: Abbas Hadjiakhoondi, Department of Pharmacognosy, Faculty of Pharmacy , TehranUniversity of Medical Sciences, Tehran, 14155/6451, Iran. Email: abbhadji@sina.tums.ac.ir

Table 1 : Chemical composition of *Cymbopogon olivieri* (Boiss.) bar essential oil

Compound	R,Time	Kovatz I.	Percent
m- Cymen	6 . 42	427	1.55
? –3 - Carene	7.29	444	22.46
P- Cymene	7.79	471	0.56
Limonene	7.91	481	3.43
Cis- Ocimene	8.12	498	0.27
α - Terpineol	10.74	852	0.62
C10 H14 O	11.45	869	1.21
C10 H14 O	11.91	903	0.26
C10 H14 O	12.16	933	2.17
Nerol	13.23	949	0.10
Piperitone	13.97	1011	44.90
Neryl acetate	15.97	1303	0.10
β - Bourbonene	16.51	1339	0.16
β - Elemene	16.64	1375	0.29
Germacrene- D	18.54	1594	0.28
γ - Selinene	18.59	1602	0.46
β - Selinene	18.66	1608	0.12
Valencene	18.79	1624	0.67
7 – epi - α - selinene	19.30	1631	0.29
? – Cadinene	19.37	1700	0.12
Elemol	19.94	1759	2.42
C15 H26 O	21.18	1867	0.12
γ - Eudesmol	21.54	1951	0.57
β - Eudesmol	21.97	1993	1.68
α - Eudesmol	22.18	2000	13.33
Farnesol	22.31	2106	0.42

% Identification	94.80
% Total monoterpens	73.99
% Total sesquiterpens	20.81
% Terpens hydrocarbons	30.66
% Terpens oxygenated	64.14

Table2: Parameters of probit regression line of *Cymbopogon olivieri* against *An. stephensi*

A	b ± SE	LD50 ± 95%C.I	LD90 ± 95%C.I	X2 (df)	P
-6.6255	2.642 ± 0.293	233.76 321.90 429.93	684.2 983.6 1884.8	12.9	0.01

A = intercept, b± SE = slope ± standard error
LD5O±95%C.I.= lethal dose cause *50%* mortality, *95%* confidence interval
LD9O±95%C.I.= lethal dose cause 90% mortality, *95%* confidence interval
(df) = degree of freedom, p= p value

Biological study: According to WHO recommendation (15), different concentrations of the essential oil of *C. olivieri* in distillated water were prepared (dimethylsulfoxide was used as co-solvent). In Each 400 ml beaker 25 of 4th instar larvae of *Anopheles* were exposed to these concentrations at different replicates. LC_{5O} was determined by the use of regression line employed by Finney (16). In control only 1 ml of solvent were applied into the water. Mortality was counted after 24 hours recovery period. If mortality of control was 5-20%, then all other mortalities were corrected by Abbott's correction.

RESULTS AND DISCUSSION:

Cymbopogon olivieri yielded 1.7% of the essential oil. The constituents of this essential oil which were identified are shown in Table 1. Twenty two components representing 94,80% of the total oil were identified. Among monoterpens, ?-3 carene (22.46%) and piperitone (44.90%) were the major ones of sesquiterpens, *C. olivieri* is rich in a-eudesmol (13.33%). The C_{10} (monoterpens) 73.99% and oxygenated terpens ($C_xH_yO_z$) (64.14%) were abundant in *C. olivieri*, Three constituents of moleculare formula $C_{10}H_{14}O$ with total concentration 3.64% were identified.

In comparison with the previous study on the *C.olivieri* of India there is a notable difference between the constituents of the two species (9). While piperitone is the major constituent in both two oils, ß-pinene, myrcene and pulgone were other constituents major in essential oil of Indian plant. The acyclic monoterpens (geraniol and citral) were reported in other species of cymbopogon (6-8).

Results of bioassay against *An. stephensi* larvae are shown in Table 2. LD_{5O} value was 321.9 mg/l. According to the biological results, the essential oils extracted from *Cymbopogon olivieri* has moderate effects on malaria vectors. In another study it was found that essential oil of *Mentha spicata* L. in concentrationof 9±5 µg/ml was effective against the same species (17). Also in parallel study (Hadjiakhondi et al, submitted) components of *Tagetes minuta* were evaluated against late 3rd and early 4th instar larvae of *An.stephensi* and the minimum and maximum concentrations were 0.25 and 4 mg/l, respectively. LC_{50} of 1 mg/l was found with this plant extraction. In conclusion, results of our studies show that the essential oil and the extract of plants had the greatest biological effect on the larvae of *An.stephensi*.

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REFERENCES

1. Rechinger, K. H. (1982). Flora Iranica. NO. 70, Gramineae; Akademische Druck-u, Verlagsanstalt, Graz Austria; P 543.
2. Zargari, A. (1993). Medicinal Plants, Vol. 4; 5th Ed., Tehran University Publication Co., Tehran, P 73.
3. Ghahraman, A. (1994). Flora of Iran, Vol. 13, third Ed., Research Institute of Forests and Rangelands, Tehran, P *1532.*
4. Mobin, S. (1980). Vegetation of Iran, Vol. 1, Tehran University Publication Co., Tehran, P 264.
5. Carpenter, D. (2001). Herbal Medicine Handbook , First Ed., Springhouse, P 267-8.
6. Rajamani, T.S., Ramachandra, D. Range Gowda, D. (1965). Citronella in India Perfumery

Essent.oil Record. *56*, p 726-30.
7. Singh, K., Singh, D.V. (1998). Effect of rates and sources of nitrogen application on yield and nutrient uptake of citronell. Java. Fert. Res. 33 (3), p:187-91.
8. Setti, K. L., Maheshwari, M. L., Gupta, R.(1989). Genetic diversity and development of high oil yielding Palmarosa strains. Proc - Tnt. congr.Essent.oils, Fragrances flavours, p:89-96.
9. Rajendrudu,G., Rama Das, V. S.(1983). Interspecific differences in the constituents of essential oils of Cymbopogon. Proc. Indian Acad. sci., plant sci.92 (4), p 331-4.
10. Rustaiyan, A., Hadjiakhoondi, A., Khalighi-sigaroodi, F., Vatandoost, FL, (2000). Sensitivity evaluation of Anopheles larva to the total terpenoidal and alkaloidal extracts of Tanacetum fruticulosum, 1st international congress on traditional Medicine & Materia Medica, 6-9 Nov., Tehran, P 73.
11. Hadjiakhoondi, A., Aghel, N., Zamanizadeh-nadgar, N., Vatandoost , H. (2000) Chemical and biological study of mentha spicata L. essential oil., Daru 1,2, P 19-21.
12. Hadjiakhoondi, A., Aghel, N., Etemadi, R.(2002). Chemical and biological study of essential oil of Ferulago macrocarpa (Fenzi) Boiss, Hamdard Medicus, vol XLV, 2, P 35-38.
13. Eight peak index of mass spectra (1983). Vol. 1-3; Mass spectroscopy data centers. The Royal Society of Chemistry; Nottingham.
14. Adams, R.P. (1995) Identification of essential oil components by Gas chromatography / mass spectroscopy. Allured Publ. Corp., Carol Stream, IL.
15. Styear, S. (1998). International strategies for tropical disease treatment; No.3; World Health organization.
16. Finney, D.J. (1971). Probit analysis. 3rd ed. Cambridge University press,
17. Cambridge, P 227.
18. (17)-Hadjiakhondi, A., Aghel, N., Zamanizadeh-Nadghar, N. & Vatandoost, H. (2000). Chemical & biological study of *Mentha spicata* L essential oil from Iran. Daru, 8:19-21.