



ISSN: 2231-3354
 Received on: 15-02-2012
 Revised on: 26-02-2012
 Accepted on: 06-03-2012
 DOI: 10.7324/JAPS.2012.2415

Antibacterial Activity and Composition of Essential Oil of *Nepeta pungens* Benth. from Iran

Mohammad Hossein Farjam

Mohammad Hossein Farjam
 Department of Chemistry, Firoozabad
 Branch, Islamic Azad University,
 Firoozabad, Iran.

ABSTRACT

The oils obtained by hydrodistillation from fresh and dried aerial parts of *Nepeta pungens* Benth. at the flowering stage were analyzed by GC and GC-MS to investigate the variations of oil yields, oil components along with their percentages in fresh and dry stages. Forty-nine compounds (97.2%) were determined. The major compounds were geranyl acetate (17.0%), limonene (12.0%), eucalyptol (5.8%), (bornylacetate (5.3%), citronellal (4.9%), spathulanol (4.2%), sabinene (3.9%), β -ocimene (3.9%), β -sesquiphellandrene (2.8%), nerylacetate (2.5%), α -humulene (2.4%), α -pinene (2.3%), humuleneoxide (2.2%), norsolanadione (2.1%) and terpinen-4-ol (2.0%). The yield of the oil was 1.1 (v/w)%. The essential oil showed antibacterial activity for *Staphylococcus aureus*.

Keywords: *Nepeta pungens* Benth., essential oil, hydrodistillation, geranyl acetate.

INTRODUCTION

The genus *Nepeta* (Lamiaceae) comprises 280 species that are distributed over a large part of central and southern Europe, West, central, and Southern Asia. About half of the existing species are recorded in Iran. The genus *Nepeta* is represented in Turkey by 33 species and altogether 38 taxa, 17 of these being endemic in Turkey (Davis, 1982). *Nepeta* species are widely used in folk medicine because of the antispasmodic, diuretic, antiseptic, antitussive, antiasthmatic, ethnobotanical effect, diaphoretic, vulneary, antispasmodic, tonic, febrifuge (Ghannadi et al., 2003; Gkinis et al., 2003; Dorman et al., 2000; Zenasni et al., 2008). The feline attractant properties of several *Nepeta* species have been known for a long time. The compounds of essential oil of *Nepeta* are considered to be responsible for the feline attractant activity of *Nepeta* species (Dabiri et al., 2003; Hussain et al., 2009). As far as our literature survey, there are no reports on the chemical compositions of essential oil and antibacterial activity of the essential oil of *N. pungens* Benth. Thus, this study is the first report on this plant. The aims of this work are to identify the chemical compositions and a brief study of antibacterial activity of essential oil of *N. pungens* Benth. Obtained by using a Clevenger distillation apparatus. The chemical compositions of the essential oil were evaluated by using gas chromatography-mass spectrometry (GC-MS).

For Correspondence
 Email: mhfarjam@yahoo.com
 Tel: +98 7126229705
 Fax: +98 712 6224402

MATERIALS AND METHODS

Plant material

The aerial parts of *Nepeta pungens* Benth. was collected during August 2011 from Sepidan Mountain, Fars, Iran. The plant was identified at SUMSH Herbarium, Shiraz university of Medical Science, Iran, and a Voucher specimen is kept at SUMSH Herbarium (27628SUMSH).

Isolation procedure

The air dried leaf of specimens (70g) were extracted by hydro-distillation using Clevenger-type apparatus for 4 h. The oil was dried over anhydrous sodium sulfate. The corresponding oils were isolated in yield of 1.1% (v/w).

Identification of oil components

The essential oil was analyzed by gas chromatography mass-spectrometry (GC-MS). The GC-MS analysis was carried out on a Shimadzu GC-MS model QP5050. The capillary column was DB-5 (30×0.2 mm, film thickness 0.32µm). The initial temperature of column was 60°C (held 1 min) and then heated to 200°C with a 3°C/min rate and then heated to 250°C and kept constant for 2 min. The flow rate of Helium as carrier gas with (1.7mL/min). The analysis uses split ratio 1/28. The injector and detector temperatures were both at 280°C; volume injected 0.1 µl of the essential oil and ionization potential 70eV. The same condition of temperature programming used from alkenes mixture to calculate the retention index (RI).

Identification of components in the oil was based on the retention index (RI), Wiley computer library and literature survey (Adams, 1995). The relative percentage of the oil constituent was calculated.

Antibacterial activity

Antibacterial activity by disc diffusion method and determination of inhibition zones at different oil dilutions were done for *Staphylococcus aureus*.

RESULTS AND DISCUSSION

The compositions of essential oil and antibacterial activity of aerial parts of *Nepeta pungens* Benth. are shown in Table 1 and 2, respectively. Forty-nine constituents, representing 96.1 % of the total components in the oil, have been identified in the essential oil extracted from the aerial parts of this plant.

The essential oil with major compositions of geranyl acetate (17.0 %), limonene (12.0 %), eucalyptol (5.8%), bornyl acetate (5.3%), showed moderate anti-bacterial activity and inhibited the growth of the tested bacteria. Due to the high amount of geranyl acetate (17.0%), limonene (12.0%), eucalyptol (5.8%), and other terpenoids in the oil of *Nepeta pungens* Benth. it can be concluded that the herb essential oil of *Nepeta pungens* Benth. can be used as flavoring agents in food and also in the medicinal and perfume industries. These main components have been reported in

the literatures for *Nepeta* genus (Rustaiyan *et al.*, 1999a; Sefidkonet *et al.*, 2002). There is evidence indicating that *Nepeta pungens* Benth. has potential use in phytotherapy.

Table.1: Chemical composition of *Nepeta pungens* Benth. Essential oil.

No	Compound	RI	%
1	α -Thujene	927	0.2
2	α -Pinene	935	2.3
3	Camphene	950	1.1
4	β -Pinene	979	0.5
5	β -Myrcene	994	1.9
6	Octan-3-ol	1002	0.2
7	α -Terpinene	1021	0.3
8	Limonene	1038	12.0
9	Cyclooctyne	1045	0.2
10	β -Ocimene	1057	3.9
11	Sabinene	1069	4.0
12	Sabinene hydrate	1072	0.5
13	Terpinolene	1090	0.1
14	Linalool	1105	0.2
15	1-Pentylallyl acetate	1120	0.4
16	Thujone	1138	0.3
17	Camphor	1143	0.5
18	Citronellal	1163	4.9
19	Borneol	1170	1.4
20	Terpinen-4-ol	1182	2.0
21	α -Terpineol	1193	0.7
22	Chrysanthemal	1211	0.1
23	iso-Borneol	1225	0.1
24	Nerol	1235	0.2
25	D-Pulegone	1237	1.4
26	Citronellol	1244	0.4
27	Geraniol	1267	1.4
28	β -Farnesene	1272	0.2
30	Limonene oxide	1290	5.3
31	Eucalyptol	1314	2.0
32	Citronellyl acetate	1359	5.8
33	Neryl acetate	1361	0.7
34	Geranyl acetate	1372	2.5
35	Caryophyllene	1396	17.0
36	Bergamotene	1407	0.7
37	α -Humulene	1432	1.3
38	Hotrienyl acetate	1441	2.4
39	Nerolidol	1466	0.1
40	β -Bisabolene	1476	1.4
41	β -Sesquiphellandrene	1501	0.5
42	Norsolanadione	1518	2.8
43	Spathulanol	1537	2.1
44	iso-Caucalol	1546	4.2
45	Caryophyllene oxide	1568	1.1
46	Nepetalactol	1581	1.2
47	Humulene oxide	1586	1.1
48	β -Elemene	1591	2.2
49	Lancifol	1607	0.2
	Total		96.1

Table. 2: Antimicrobial activity of *Nepeta pungens* Benth. essential oil.

Microorganism	Inhibition zone [mm] ^a					Standard antibiotics	
	The ratio of oil dilutions (with methanol)					Ampicillin ^b	Tetracycline ^c
	1	1/2	1/4	1/8	1/16		
<i>Staphylococcus aureus</i>	19.5*	16	12.5*	9	7	13	20

^aincludes diameter of the disc (6mm) and the range size: (7-13) moderately active; >14) highly active. The results are average of two experiments

^btested at 10µg/disc

^ctested at 30µg/disc

*similar inhibitory type of activity of the oil to that of standard antibiotics.

ACKNOWLEDGEMENT

The author thank Firoozabad branch of Islamic Azad University Research Council for financial support.

REFERENCES

- Davis, P.H. Flora of Turkey and the East Aegean Islands, Edinburgh University press.(1982).
- Ghannadi A., Aghazari F., Mehrabani M., Mohaghzadeh A., Mehregan A. Quantity and Composition of the SDE prepared essential oil of *Nepeta macrosiphon* Boiss. Iranian J. Pharm.Sci. 2003; 2:103-105.
- Gkinis G, Tzakou Q., Iliopoulou D., Roussis, V. Z. Chemical composition and biological activity of *Nepeta parnassica* oil sand isolated *Nepeta lactans*. Naturforsch.2003; 58:681-686.
- Dorman H.J., Deans S.G Antibacterial activity of plant volatile oils. J. Appl Microbiol. 2000; 88:308-316.
- Zenasni L., Boudida H., Hancali A., Boudhane A., Amzal H., Idrissi A., Aouad R., Benjouad, Y. The essential oils and antimicrobial activity of four *Nepeta* species fromMorocco, J. Med Plants Res. 2008; 2: 111.
- Dabiri M., Sefidkon F. Chemical composition of *Nepetacrassifolia*Boiss. Flavour and Fragrance J. 2003; 18: 225-227.
- Hussain J., Jamila N., Gilani S.A., Abbas G., Ahmed S. Platelet gregation, antiglycation, cytotoxic, phytotoxic and antimicrobial activities of extracts of *Nepetajuncea*, Afr. J. Biotechnol. 2009; 8: 935-940.
- Adams, R.P. Identification of essential oil components by Gas chromatography- Mass spectrometry, Allured publishing, Illinois.(1995).
- Rustaiyan A., Monfared A., Masoudi Sh. Composition of the essential oil of *Nepetaastero- trichus*Rech. from Iran. J. Essent. Oil Res. 1999; 11: 229-230.
- Sefidkon, F., Dabiri, M., Alamshahi A. Analysis of the essential oil of *Nepetafissa* C.A. Mey. from Iran. FlavourFragr. J. 2002; 17: 89-90.