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Comparative aroma profile of *Mentha arvensis* L.corn Mint. from Uttarakhand Himalaya

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ABSTRACT

The chemical composition of the essential oil from Japanese mint (*Mentha arvensis* L.) collected from six places was analyzed by GC and GC-MS. The main constituents were menthol (60.22-77.46%) and menthone (9.22-5.25%), followed by iso menthone, DL-limonene, iso -menthyl acetate, ß-pinene and trans-caryophyllene. Results indicated that the compositions of the six oil were similar, whereas only quantitative differences in the concentration of some constituents was observed, on the basis of chromatographic profiling, quality of Uttrakhand produces well matched with other major mint producing geographical regimes.

Key Words: Essential oil Profiling, Menthol, GC and GC-MS.

INTRODUCTION

Mentha arvensis L. (Lamiaceae), commonly known as corn mint, menthol mint or Japanese mint was introduced into India in 1952 from Japan. Corn mint plants consist of shoots, having over ground main stems with big leaves and small flowers, stolons, with crawling succulent stems and underground rhizomes. Essential oils obtained from natural sources are important raw materials in the perfumes and flavour industry. The natural origin of some components leads due to great importance as premium materials in applications such as food grade flavours. Some compounds of *M. arvensis* L. were widely used as cooling compound in mint flavours, fruit flavours, oral care products, confections and beverages[1]. In Indian folk medicine numerous plant products are used in the regulation of human fertility. Amongst these, the leaves of *Mentha arvensis* L. (Lamiaceae), the common edible aromatic herb, has been described to possess various medicinal properties including an anti-fertility effect.[2,3]. *Mentha arvensis* L. is commercially cultivated in tropical and subtropical climates. The oil and a by-product, menthol and dementholized oil (DMO), respectively of this plant have the highest share in the global mint trades[4]. *Mentha arvensis* L. is cultivated in many parts of the world for the production of menthol from its essential oil which is used in pharmaceutical, perfumery and food industries. Besides China and United States of America, India is a major producer of mint with an annual production of about 5000 tonnes of essential oil. Present estimates indicate that the crop is cultivated in approximately 100000 hectares in India, with the estimated production of approximately 15000 tonnes of volatile oil during 1997. The bulk of this production comes from Badaun, Bareilly, Bilaspur, Moradabad, Rampur (tarai tract), Barabanki and Luckhnow (Indo-Gangetic plains) districts of the State of Uttar Pradesh (North India). The rest of the production originates in the state of Punjab and Himachal Pradesh (North-West India). Field experiments conducted under the semi-arid tropical climatic conditions of Andhra Pradesh State (South India) showed that the crop can be successfully grown in this climate also[5]. Large efforts of genetic improvement in menthol mint made via proper exploitation of the advantages of sexual and asexual (vegetative) means of propagation[6,7,8,9]. Therefore, with the establishment of superior cultivars, India is emerging as the largest producer (70%) of menthol mint oil in the world[4]. Volatile oil is extracted mainly from the shoots, the composition of which has been studied in detail[10]. Several GC-MS reports were given by workers on *M. arvensis* L[11,12,] But, there is not even a single comparative report available about the compositions of essential oils of *M. arvensis* L. from these locations of Uttarakhand.

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MATERIALS AND METHODS

Plant material

Fresh leaves of *Mentha arvensis* L. were collected from Khanpur (Haridwar),Khatima, Jaspur (U.S Nagar) ,Kalsi (Dehradun), Roorkee (Haridwar) and Vikasnagar (Dehradun) during the month of April, 2010. The specimens were kept in Centre Herbarium.

Oil distillation

The essential oil of the 500 gm sample was extracted by hydro-distillation for 6 h using Clevenger apparatus[14].The oil content (v/w %) was estimated. The oil obtained was dehydrated over anhydrous sodium sulphate and kept in cool place before analysis.

GC

The gas chromatograph (GC) analyses of the oil samples was carried out by using HP6890 gas chromatograph equipped with a FID detector and a HP-5 fused silica column (30m x 0.32 mm x 0.2µm film thickness). Nitrogen was used as a carrier gas during analysis. The injector and detector temperature were maintained at 210°C and 230°C respectively. The column oven temperature was programmed from 60°C to 220°C with an increase in rate of 3°C/min.The injection volume was 0.2µL neat.

GC-MS:

The GC-MS analysis of the oil was performed out on a Perkin Elmer mass spectrometer (Model Claurus 500) coupled to a Perkin Elmer Claurus 500 gas chromatograph with a 60m x 0.32 mm x0 .2µm film thickness column (RtX5). Helium was used as the carrier gas (flow rate 1ml/min). The oven temperature was programmed range from 60°C to 220°C at 3°C min^{-1}. Other conditions were the same as described under GC. The mass spectrum was taken with a mass range of 40-600 Daltons.

Identification of components

The identification of constituents was performed on the basis of retention index (RI), determined with reference to the homologous series of n-alkanes,C_9-C_{32}under experimental conditions, co-injection with standards (Aldrich and

Table-1 Essential oil of *Mentha arvensis* from Uttarakhand region

S.No	Compounds Name	RI	Khanpur Haridwar	Roorkee Haridwar	Jaspur U. S Nagar	Khatima U.S Nagar	Kalsi Dehradun	Vikasnagar Dehradun
1	α-Pinene	939	0.04	0.04	0.05	0.07	0.05	0.08
2	ß-Pinene	979	0.78	0.81	0.89	1.02	0.69	1.20
3	ß-Myrcene	991	0.25	0.27	0.36	0.30	0.08	0.26
4	3-Octanol	991	0.78	0.83	0.89	1.03	0.78	1.17
5	P-Cymene	1025	0.56	0.64	0.70	0.80	0.31	0.93
6	DL-Limonene	1029	2.25	2.54	3.18	4.55	2.46	3.36
7	Menthone	1153	6.17	6.39	6.62	9.22	5.32	6.47
8	Iso menthone	1163	5.36	5.44	5.33	5.54	5.25	5.45
9	Menthol	1172	77.46	77.07	74.71	70.84	60.22	70.28
10	Piperitone	1253	0.37	0.37	0.49	0.43	3.02	0.43
11	Iso-menthyl acetate	1305	1.83	1.84	2.47	1.80	3.61	5.44
12	Trans Caryophyllene	1419	0.17	0.12	0.14	0.10	0.14	0.11
13	γ- Cadinene	1514	0.50	0.48	0.81	0.44	0.25	0.44
14	δ- Cadinene	1523	0.12	0.10	0.18	0.07	0.14	0.09
	TOTAL		96.64	96.94	96.82	96.21	82.32	95.71

RI= Retention indices according to their elution order on HP-5 column.

Fluka),MS library search (NIST and WILEY),and by comparing with the MS literature data[15,16] . The relative amounts of the individual components were calculated based on the GC peak area (FID response) without correction factors.

RESULT AND DISCUSSION

The volatile oils from six locations of *M. arvensis* L. which are cultivated by Uttarakhand farmers were obtained by conventional hydro distillation, which give yellowish coloured oil. The extraction yield for all the samples was between 0.31- 0.38% . The components of the essential oil were identified by gas chromatography/mass spectroscopy (GC/MS).Total 82 to 96% of constituents were identified, menthol was found as the major component (60.22-77.46%). This was maximum in the sample collected from Khanpur (77.46%) and minimum in the sample collected from Kalsi (60.22%). Our results resemble previously reported data from India as well as all over the globe from various workers.[11, 12,13, 17, 18,19] . Present investigation only three components viz. menthone, isomenthone, and Limonene occurred in considerably higher concentration in oil.

Most Labiatae family member accumulates terpenes and a range of other components in the epidermal glands of leaves, stems and reproductive structures[19]. The quantitative composition of the essential oils of many aromatic plants is greatly influenced by the genotype and agronomic conditions, such as harvesting time, plant age and crop density[19]. The oil composition data generated in this investigation was analyzed in such a way that even variation at the minor component level was detected. In view of developing metabolomics to exploit such potentials, this data can be highly useful, not only for chemoprofiling but also in determining the variations that particular phenotypic (s) possess in the functional phenotypic constitution with expression. The time of harvest, in general has a close relation to yield and quality of oil and it varies from place to place and genotype to genotype. It is concluded that quality of farmers produce comparable with locations such Badaun, Bareilly, Bilaspur, Moradabad, Rampur (tarai tract), Barabanki and Luckhnow (Indo-Gangetic plains) districts of the State of Uttar Pradesh (North India). Study recommended that essential oil quality investigated locations well matched with National standards.

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