

Short Communication

Constituents of Leaf and Fruits Essential Oil of *Carum Roxburghianum* Benth

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Abstract

Essential oil from the leaves and fruits of *Carum roxburghianum* Benth. is analyzed by gas chromatography-mass spectrometry (GC-MS). The oil leaf is dominated by apiol (20.81%), 2(3H)-furanone,dihydro-5-pentyl- (17.21%), 1,3-benzodioxole, 4-methoxy-6-(2-propenyl)- (9.51%) and citronellol (6.62%). The fruit oil is rich in 2-cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- (40.03%), and other components that follow are apiol (18.71%), limonene (17.11%), myristicin (12.30%), dihydrocarvone (7.89%) and eugenol (1.68%). The compositions of both oils vary qualitatively and quantitatively.

Keywords: *Carum roxburghianum*; Essential oil; GC-MS analysis; Apiol, 2-cyclohexen-1-one; 2-methyl-5-(1- methylethenyl)-.

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1. Introduction

Carum roxburghianum Benth. (Syn. *Trachyspermum roxburghianum* (DC.) Craib.; *Athamantha roxburghianum* (Benth.) Wall., *T. involucreatum* Marie) belongs to the family Apiaceae native to tropical Asia and is cultivated in Bangladesh, India and Indo-China. Fruits are used as condiment, stimulant and carmine [1]. According to Kirtikar and Basu [2], the seeds are useful in hiccup, vomiting and pain in the bladder. They form ingredients of carminative and stimulant preparations and are very useful in dyspepsia and flatulence. Fruits of *C. roxburghianum*, often used in Indian cuisine, are a kind of very strong spice with characteristic smell similar to parsley. A couple of pinches can easily overpower a curry [3]. In Bengali cuisine the seeds are used in whole, quickly fried in very hot oil until they crackle. They are part of a local panch phoran (Bengali five spice) mixture, where they replace the more commonly used mustard seed; the other ingredients are white cumin seed, fenugreek seed, fennel seed and kalongi [4]. The main component of seed oil was limonene. Other notable constituents were sabinene, terpinen-4-ol, (Z)-

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ligustilide and γ -terpinene [5]. According to Chopra *et al.* [6] fruits are carminative, stimulating, and useful in dyspepsia, hiccup, vomiting and pain in bladder. Fruits yield essential oil with d-limonene, α -terpinene, dipentene, d-linalool, terpineol, dl-piperitone, thymoquinol, thymol and a crystalline ketonic acid [7]. *C. roxburghianum* plant oils and extracts have been used for a wide variety of purposes for many thousands of years [8]. In particular, the antimicrobial activity of plant oils and extracts has formed the basis of many applications, e.g. in raw and processed food preservation, pharmaceuticals, alternative medicine and natural therapies [9, 10]. The essential oil shows antibacterial activity [11]. But there is no published report in the literature about the chemical composition of *C. roxburghianum* essential oil from Bangladesh. So, an attempt has been made to investigate the chemical components of essential oil obtained from the leaves and fruits of *C. roxburghianum* grown in Bangladesh.

2. Materials and Method

Plant materials: The leaves and fruits of *Carum roxburghianum* were collected from the experimental field of BCSIR laboratories, Chittagong, during December 2007 and February 2008. The oils were isolated by hydro-distillation using Clevenger's apparatus for 4 hrs [12] and then dried over anhydrous sodium sulphate.

GC-MS analysis: The leaves and fruits of essential oils *Carum roxburghianum* were analyzed by Electron Impact Ionization (EI) method on GC-17A Shimadzu Gas Chromatograph, coupled to a GC-MS QP 5050A Shimadzu Mass Spectrometer; fused silica capillary column (30m x 2.5mm; 0.25 μ m film thickness), coated with DB-5 ms (J&W) were utilized. Column temperature of 40°C (2 min) to 170°C at the rate of 3°C/min was maintained with carrier gas helium at a constant pressure of 90 kPa (Acquisition parameters full scan; scan range 40-350 amu). Samples were injected by splitting with the split ratio 1:20.

Identification of the compounds: Identification of compounds was done by comparing the NIST library data of the peaks and mass spectra of the peaks with those reported in literature. Percentage composition was computed from GC peak areas on DB-5 ms column without applying correction factors.

3. Results and Discussion

Essential oils from the leaves and fruits of *C. roxburghiana* were analyzed by GC-MS. The yield from leaf and fruit was found to be 0.65% and 1.15%, respectively.

Table 1 and Table 2 report the composition of the leaf and fruit essential oils of *C. roxburghianum*. Twenty components have been identified in leaf essential oil which are dominated by apiol (20.81%), 2(3H)-furanone,dihydro-5-pentyl-(17.21%), 1,3-benzodioxole, 4-methoxy-6-(2-propenyl)- (9.51%), citronellol (6.62%), 4-isopropyl-1,6-dimethyl-1,2,3,4,4a,7,8,8a-octahydro-1-naphthalenol (5.99%), geraniol (5.86%), patchuli alcohol (3.53%), 1,6-cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)- (4.79%), benzene, 1-methoxy-4-(1-propenyl) (3.33%) and cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1s-(1.alpha.,2 beta., 4.beta.)]- (3.01%). On the other hand twenty

Table 1. Chemical constituents of essential oil of *C. roxburghianum* leaves.

Sl.	Name of Compounds	%
1.	Menthol	1.61
2.	Citronellal	2.26
3.	3,6-Dimethyl-2,3,3a,4,5,7a-hexahydrobenzofuran	2.89
4.	Citronellol	6.62
5.	Geraniol	5.86
6.	Benzene, 1-methoxy-4-(1-propenyl)	3.33
7.	Phenol, 2-methoxy-4-(1-propenyl)-, (Z)	2.29
8.	2,6-Octadiene, 2,6-dimethyl	2.50
9.	2(3H)-Furanone, dihydro-5-pentyl-	17.21
10.	Neryl propionate	1.72
11.	cis-4,4-dimethylbicyclo(6.3.0)undecane-2,6-dione	1.98
12.	1,6-cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-	4.79
13.	1,3-Benzodioxole, 4-methoxy-6-(2-propenyl)-	9.51
14.	β -Elemene	3.01
15.	Apiol	20.81
16.	γ -Eudesmol	0.98
17.	4-isopropyl-1,6 dimethyl-1,2,3,4,4a,7,8,8a-octahydro-1-naphthalenol	5.99
18.	Juniper camphor	2.05
19.	Patchuli alcohol	3.53
20.	3,7,11,15-tetramethyl-2-hexadecen-1-ol	0.91

Table 2. Chemical constituents of essential oil of *C. roxburghianum* fruits.

Sl.	Name of Compounds	%
1.	α -pinene	0.04
2.	Sabinene	0.03
3.	β -Pinene	0.01
4.	β -Myrcene	0.02
5.	α -Phellandrene	0.82
6.	Limonene	17.11
7.	Ocimene	0.02
8.	α -4-Dimethylstyrene	0.17
9.	Decane, 3-methyl-	0.02
10.	Cis-p-Mentha-2,8-dien-1-ol	0.03
11.	α -Pinene oxide	0.10
12.	Limonene oxide, trans-	0.06
13.	2-Aminoimidazole	0.08
14.	3,6-Dimethyl-2,3,3a,4,5,7a-hexahydrobenzofuran	0.04
15.	Dihydrocarvone	7.89
16.	Trans-Carveol	0.16
17.	2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)-	40.03
18.	2-Cyclohexen-1-one, 3-methyl-6-(1-methylethenyl)-	0.11
19.	3-Hexadecyne	0.11
20.	Eugenol	1.68
21.	Myristicin	12.30
22.	Elemicin	0.16
23.	Apiol	18.71

three components have been identified in fruits oil, which were characterized by the presence of a high 2-cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- (40.03%) followed by apiol (18.71%), limonene (17.11%), myristicin (12.30%), dihydrocarvone (7.89%) and eugenol (1.68%).

Results show that both the leaf and fruit oils are a complex mixture of numerous compounds, many of which are found in trace amounts. It is worth mentioning that there is a great variation in the chemical composition of the leaf and fruit of *C. roxburghianum* oil. Apiol and 2-cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- is the most important and main component in leaf and fruit oil of Bangladesh but it is totally absent in all other reported oils. So, we can conclude that apiol and 2-cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- are the first reported components in *C. roxburghianum* leaf and fruit oil. Terpinen-4-ol, (Z)-ligustilide and γ -terpinene, which have been reported as major constituents in the fruits oil of Indian origin [5, 7], are totally absent in our sample. This confirms that the reported variation in oil is not due to geographic divergence and ecological conditions, it may be a different chemotype. On the basis of the above fact it may be concluded that *C. roxburghianum*, grown widely in Bangladesh, may be utilized as a source for the isolation of natural apiol, 2-cyclohexen-1-one and 2-methyl-5-(1-methylethenyl)-. Their high concentration in leaf and fruit oil makes it potentially useful in medicine because they exhibit antibacterial activities [11]. The oil has been known to be used in folk medicine in the treatment of dyspepsia, hiccough, vomiting and pain in bladder.

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