



GC-MS analysis of essential oil from the rhizomes of *Alpinia calcarata* Roscoe

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Abstract

Essential oil from the rhizomes of *Alpinia calcarata* Roscoe was extracted by hydro-distillation method and characterized by Gas Chromatography-Mass Spectrometry (GC-MS) method. Total 25 compounds were identified and the yield of essential oil was 0.19 %. The total identified compounds accounted for about 100% of the oil. The major identified compounds were Methyl cyclohexane (53.22%), Fenchyl acetate (9.14%) and 1,8-Cineole (5.38%).

Keywords: *Alpinia calcarata* Roscoe, chemical composition, essential oil, GC-MS analysis

Introduction

Alpinia calcarata Roscoe is an important essential oil yielding perennial herb belongs to Zingiberaceae family. It is widely cultivated in India and commonly known as Indian ginger, Kulanjan and Sugandhamoola (Arambewela and Arawwawala, 2010). It gives essential oil upon steam distillation or hydro-distillation. The rhizomes of *Alpinia calcarata* Roscoe have several biological activities and used since thousands of years for the treatment of arthritis, inflammation, cough, asthma, chronic bronchitis, indigestion, obesity, fever, cholera, diarrhea, rheumatic pain and malaria. The fine powder of the dried rhizomes of this plant mixed with water has been used orally in a little quantity to improve the immunity of children. *Alpinia calcarata* Roscoe is reported in Ayurveda as a source of Rasna (taste) and used several Ayurvedic formulations (Joshi *et al.*, 2011), (Prabhu *et al.*, 2012). The flowers of this plant may be picked and seeds have been used for prevent vomiting, colic and diarrhea. Recent studies suggested the antifungal, antioxidant, antitumor, antidiabetic, analgesic, antiinflammatory, insect repellent, properties of rhizomes essential oil of *Alpinia calcarata* Roscoe as per Arambewela *et al.*, 2010), George and Pandalai (1949), Raj *et al.* (2011), Rahman *et al.* (2012), Paranagama *et al.* (2004). The aim of the present study was to identify the chemical constituents of essential oil

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extracted from the rhizomes of *Alpinia calcarata* Roscoe by Gas Chromatography-Mass Spectroscopy (GC-MS) method.

Materials and Methods

Collection of Plant Material

Fresh rhizomes of *Alpinia calcarata* Roscoe were collected and authenticated from the staff of Dr. Shushila Tiwari herbal garden, Rishikesh, Uttarakhand, India in June, 2013. Fresh rhizomes of the plant were washed with water and dried in shade for 4 weeks.

Extraction of Essential Oil

100g Dried rhizomes of *Alpinia calcarata* Roscoe were hydro-distilled for 4 h by using a Clevenger-type apparatus. Thereafter, the oil was extracted from the distillate with n-hexane and dried over anhydrous sodium sulfate. The extracted oil was stored in a dark colored glass bottle until analyzed by Gas Chromatography-Mass Spectrometry method.

Gas Chromatography-Mass Spectrometry Analysis

GC-MS analysis was done using a Gas Chromatography (FID) coupled with Mass Spectrometer (EI) QP-2010 (Shimadzu Corporation Japan). Rxi-5 Sil MS non polar (30 m length x 0.25mm diameter x 0.10 μ m thickness) capillary column was used. The oven temperature was programmed from 50°C (5 min.) to 280°C (10 min) at 4°C/min. The injector temperature was 250°C and split injection ratio 1:20. Helium was used as carrier gas at a constant flow rate of

0.7ml/min. 1.5 µl of the oil diluted with n-hexane was injected. The ionization energy was 70eV, EI mode and ion source temperature was 200°C. The scan mass range was 40-600 a.m.u. The individual components of the essential oil were identified by computerized matching of their mass spectra with those gathered in the NIST, FFNS and WILEY-MS library of the GC-MS data system and Kovat indices with the literature values.

Results and Discussion

The Gas Chromatography-Mass Spectrometry analysis of essential oil from the rhizomes of *Alpinia calcarata* Roscoe is shown on Table 1.

Table1. Chemical constituents of *Alpinia calcarata* Roscoe essential oil

RT	% Area	Compound
2.543	0.51	Nonanal
2.663	53.22	Methyl cyclohexane
2.713	4.01	Ethyl cyclopentane
2.753	2.40	1,2,4-Trimethyl cyclohexane
2.813	1.70	1,2,3-Triethyl cyclohexane
2.903	0.79	Isoamyl isobutyrate
2.953	2.42	2-Methyl heptane
2.980	2.48	Methyl benzene
3.030	1.04	2,4-Dimethyl hexane
3.130	3.94	1,3-Dimethyl cyclohexane
3.230	0.84	1,1-Dimethyl cyclohexane
3.270	0.37	4-Methyl cyclohexane
3.353	3.73	Octane
3.467	0.62	1,3-Dimethyltrans cyclohexane
3.793	0.68	Hendecane
3.913	0.84	Ethyl cyclohexane
3.987	0.28	1,1,3-Trimethyl cyclohexane
5.510	0.77	Nonane
6.993	0.96	Camphene
9.903	5.38	1,8-Cineole
13.810	0.82	Camphor
14.680	0.64	Borneol
15.490	1.27	α-Terpineol
16.230	9.14	Fenchyl acetate
26.690	1.18	Carotol
100%		Total identified constituents

Result showed that total 25 compounds were identified from the essential oil of the rhizomes of *Alpinia calcarata* Roscoe by Gas Chromatography-Mass Spectrometry analysis. Methyl cyclohexane (53.22%), fenchyl acetate (9.14%) and 1,8-cineole (5.38%) were found as major components, other prominent identified constituents were ethyl cyclopentane (4.01%), 1,3-dimethyl cyclohexane (3.94%), methyl benzene (2.48), 2-methyl heptane (2.42%), 1,2,4-trimethyl cyclohexane (2.40%), 1,2,3-triethyl cyclohexane (1.70%) and carotol (1.18%). Intense studies on *Alpinia calcarata* Roscoe essential oil composition have been already published Kaul *et al.* (2005), Rout *et al.* (2005), Bhuiyan *et al.* (2011).

The essential oils composition determined in this communication showed a relatively similar pattern to those published for other geographical regions: fenchyl acetate (37.6%), camphene (13.6%) and 1,8-cineole (15.6%) were reported as the major components in essential oil of *Alpinia calcarata* Roscoe by Kaul *et al.* (2005), β-pinene (3.5-4.7%), camphene (9.0-12.3%) and 1,8-cineole (15.1-15.5%), fenchyl acetate (39.1-45.2%) and geraniol (0-4.2%) were reported as the major components by Rout *et al.* (2005), on the other hand, the Bhuiyan *et al.* (2011) showed fenchyl acetate (51.34%) and borneol (11.44%) as the main constituents *Alpinia calcarata* Roscoe rhizomes oil Bhuiyan *et al.* (2011).

Results of recent studies showed that fenchyl acetate and 1, 8-cineole are the common constituents of all the reported oils of *Alpinia calcarata* Roscoe worldwide including the present study.

Conclusion

The essential oil was extracted from the rhizomes of *Alpinia calcarata* Roscoe by hydro-distillation method and analyzed on Gas Chromatography-Mass Spectrometer, Shimadzu QP-2010 (Japan). The major constituents were found methyl cyclohexane (53.22%), fenchyl acetate (9.14%) and 1,8-cineole (5.38%). In conclusion, the essential oil of *Alpinia calcarata* Roscoe rhizomes may be used for the extraction of two important chemicals; fenchyl acetate and 1,8-cineole.



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