# COMPOSITION OF ESSENTIAL OIL OF *ELETTARIA CARDAMOMUM* MATON LEAVES

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**ABSTRACT:** Essential oil of *Elettaria cardamomum* leaves was analyzed by GC-MS. Sixteen components constituting 93.62% of the total were identified. The identified components were monoterpenes (27.37%), oxygenated monoterpenes (63%), acetates (0.63), sesquiterpenes (1.43) and fatty acid ester (1.17%). Among these 4-terpineol (30.261%) and 1:8 cineol (25.74%) were found as major components whereas other components were found to be α- terpinolene (9.807 %), p-cymene (5.300%) and α-Terpinene (4.675%). α-Tujene(1.633%), α-Pinene(1.165%), Sabinene(2.069%), γ- Terpiene(2.675%), Linalool(2.675%), Menth-2-en-1-ol (0.754%), α –Terpineol(3.44%) and Endbornyl acetae(0.593).

**Key words:** *Elettaria cardamomum* Maton, Essential oil, MS.

## INTRODUCTION

*Elettaria cardamomum* Maton is a tall perennial herbaceous plant belonging to the family *Zingiberaceae*. The leaves are lanceolate, green or dark green, glabrous on both surfaces with acuminate apex. The fruit are tri-ocular, ovoid, oblong or greenish-brown capsules containing about 15-20 reddish brown seeds. It is found commonly in southern India mainly in Kerala, Tamilnadu and Karnataka, on the shady slopes of the Western Ghats. It is also cultivated in Nepal, Sri Lanka, Guatemala, Mexico, Thailand and Central America (Ravindran and Madhusoodanan 2002; Telja *et al.,* 2006; Narong, 1996 and Susheela, 2007).

*Elettaria cardamomum* Maton has well established culinary values, and is used in a wide range of sweets and confectionery. In Arab countries and India, it is a common flavoring ingredient for coffee and tea (Susheela, 2007). In Scandinavia, as well as in Germany and Russia, it is used to flavor cakes, pastries, and sausages.

In Eastern and Western medicinal practices it is used for curing ailments like influenza, infections, asthma, bronchitis, cardiac disorders, diarrhea, nausea, cataracts, and for strengthening nervous system (Hussain *et al.,* 1988; Usmanghani *et al.,* 1997, Adegoke *et al.,* 1998; Gurudutt *et al.,* 1996; Nasir and Ali, 1974 and Pieribattesti *et al.,* 1986; Nadkarni, 1976 and James et al, 2002).

The seed oil of *Elettaria cardamomum* Maton has antimicrobial, anticarcinogenic, anti-inflammatory and antioxidant activities (Kubo *et al.,* 1991; Vijayan *et al.,* 2002 and Al Tahir *et al.,* 1997). Oil is also extensively used as a fragrance component in soaps, cosmetics and perfumes, especially oriental types (Ravindran and Madhusoodanan KJ, 2002, Telja *et al.,* 2006, Narong, 1996 and Susheela, 2007).

The oil of *Elettaria cardamom* Maton has many applications and a lot of work done on it but leaf oil has yet not been studied. The aim of present study was to determine the composition of leaf oil and to determine its scope in perfumery and as flavoring agent.

## MATERIALS AND METHODS

**Cultivation of *Elettaria cardamomum* in nursery:** The *Elettaria cardamomum* Maton plants were cultivated in PCSIR Labs. Lahore. For cultivation, area was cleaned from all existing vegetation, stumps, roots, stones etc. and beds of one meter width, 30 cm height and appropriate length were prepared. Fully ripened capsules were collected from nearby market. Seeds were removed and washed with water to remove the mucilage, mixed with wood ash, dried in shade and sown immediately. After sowing, seeds were covered with a thin layer of the soil. Then beds were covered with mulch material pothagrass or paddy straw. Beds were watered to sufficient moisture conditions. When sprouting was observed, mulch was removed and bed was covered with thinly sliced mulch material.

Germination commenced 20 to 25 days after sowing and continued upto 30 to 40 days.

**Extarction of oil:** The *Elettaria cardamomum* leaves were collected from the nursery. They were cleaned from extraneous matter and cut into small pieces. The essential oil was extracted through hydro-distillation (Sattar, 1989). The steam distillate was removed, dried over anhydrous sodium sulphate and stored at low temperature.

**GC-MS analysis:** The analysis of the essential oil was carried out on GC-MS of Agilent Technologies, Model 6890N. The oil sample was injected to a 30 m × 0.25 mm DB-5 capillary column using helium as carrier gas, oven temperature was maintained at 40 °C for 5 min, programmed at the rate of 40-140°C at 10°C/min and 150°C for one min hold. Injector temperature was 40°C and MSD temperature was 280°C. The comparison of fragmentation pattern of the individual components of the oil using MS library helped in the identification and confirmation of the components.

## RESULTS AND DISCUSSION

GS-MS analysis of essential oil of *Elettaria cardamomum* revealed the presence of 36 components, out of which 16 components constituting 93.62 % of the total were identified from their fragmentation pattern by mass spectrometry using NIST library (Table-1). These components were classified in four fractions; monoterpene hydrocarbon fraction(27.37%) constituted p-cymene (5.300%) α-Tujene(1.633%), α-pinene(1.165%), Sabinene(2.069%), α- terpinene(4.675%) and γ-Terpniene(2.675%), Oxygenated monoterpene fraction(63.05%) constituted 1:8 cineol(25.74%) Linalool(2.675%), Menth-2-en-1-ol (0.754%), 4-Terpineol(30.261%) α- terpineol(3.447%), and Apiole(0.6), sesqiterpine fraction constituted trans- Caryphyllene(1.43%) while palmitic acid methyl ester(1.17) was found as fatty acid ester fraction of the oil.

The oxygenated monoterpene 4-Terpineol (30.261%) and 1:8 cineol (27.37%) were the major components. Hussain et al 1988, Pieribattesti et al, 1986, Marongiu et al, 2004 and Brano et al, 2004, reported 1:8 cineol (23.5%) as major component of cardamom seed oil. 1:8 cineol due to its pleasant spicy aroma and taste, is used in flavorings, fragrances, and cosmetics (Anonymous, 2002). The α- terpinolene (9.807 %), p-cymene (5.300%) and α-Terpinene (4.675%) were also present in considerable quantity. α-Tujene(1.633%), α-Pinene(1.165%), Sabinene(2.069%), γ-Terpiene(2.675%), Linalool(2.675%), Menth-2-en-1-ol (0.754%), α –Terpineol(3.44%) and Endbornyl acetae(0.593) were minor components of the oil. α- terpinolene with its typical lilac odor is one of the most frequently used fragrance compounds in soaps and cosmetics.

Sabinene, myrcene, α-Pinene, Linalool and caryphyllene has also been reported in cardamom seed oil (Susheela, 2007 and Anonymous, 2002). Linalool is used frequently in perfumes(Kurt, 1985).

It is concluded that the composition of seed oil(Susheela, 2007, Okugawa, 1988 and Anonymous, 2002) and leaf oil is comparable and due to presence of 4-Terpineol, 1:8 cineol, α-terpinolene and linalool it can be used in high class perfumery and as a flavoring agent in beverages, syrups, baking products ice creams and pharmaceuticals after deterpination/ fractionations etc.

**Table # 1: The main constituents, relative percentages and MS data of *Elettaria cardamomum* leaves**

| S # | Components | % age | M/Z Values |
|---|---|---|---|
| 1 | α-Tujene | 1.633 | $M^+$(136,10)(105,5)(93,100) (79,10)(77,10)(53,5)(41,10) |
| 2 | α-Pinene | 1.165 | $M^+$(136,10)(121,18)(93,100) (77,20)(53,8)(43,8) |
| 3 | Sabinene | 2.069 | $M^+$(136,12)(121,6)(105,2)(93,100)(77,22) (69,10)(43,6) |
| 4 | α-Terpinene | 4.675 | $M^+$(136,40)(121,100)(105,10)(93,90)(77,30)(65,10)(53 ,8)(43,20) |
| 5 | p-Cymene | 5.300 | $M^+$(134,30)(119,100)(117,10)(77,8)(65,6)(41,4) |
| 6 | 1:8 Cineol | 25.748 | $M^+$(154,40)(139,39)(125,10)(108,70)(81,100)(71,90)(5 5,40)(43,74) |
| 7 | α-Terpiene | 9.807 | $M^+$(136,72)(121,100)(105,18)(93,92) (79,40)(53,14)(43,20) |
| 8 | γ-Terpiene | 2.675 | $M^+$(136,30)(121,28)(105,10)(93,100) (77,28)(53,4)(43,15) |
| 9 | Linalool | 2.675 | $M^+$(154,1)(136,10)(121,22)(93,100)(71,92)(55,55)(41, 55) |
| 10 | Menth-2-en-1-ol(cis) | 0.754 | $M^+$(154,18)(139,70)(93,80)(69,40)(55,38)(43,100)(39, 40) |
| 11 | 4-Terpineol | 30.261 | $M^+$(154,10)(136,10)(121,5)(111,40)(93,44)(71,100)(55 ,20)(43,0) |
| 12 | α-Terpineol | 3.447 | $M^+$(154,2)(136,50)(121,55)(93,58)(81,34)(67,15)(59,1 00)(43,22) |
| 13 | Endbornyl acetae | 0.593 | $M^+$(196,4)(154,8)(136,30)(121,50)(108,30)(95,100)(93 ,50)(43,8) |
| 14 | Trans-caryphyllene | 1.425 | $M^+$(204,12)(189,20)(161,28)(133,75)(107,40)(93,100)( 69,90)(5)(41,70) |
| 15 | Apiole | 0.616 | $M^+$(222,100)(207,20)(177,35)(149,20)(121,15)(77,25)( 45,50) |
| 16 | Hexadecanoic acid | 1.165 | $M^+$(270,18)(239,10)(185,5)(43,15)(87,84)(74,100)(55, 15)(41,15) |

## REFERENCES


Adegoke, G.O., M. L. R. Jagan and N.B. Shankaracharya. A comparison of essential oils of *Aframomum danielli*(Hook.F), *K.schum* and *Amomum subulatum* roxb. *Flavour Fragr. J.*, **13**:349-352 (1998).

Al Tahir K.E.H; H. Shoeb; Al-Shora, H. Exploration of some pharmacological activities of cardamom seed (*Elettaria cardamomum)* volatile oil. Saudi Phram J. 5(2-3): 96-102 (1997).

Anonymous, Oncology Reports **9**: 757 760,(2002).

Gurudutt, K.N., J.P. Naik, P. Srinivas and B. Ravindranath. Volatile constituents of large cardamom (*Amomum subulatum* roxb). *Flavour Fragr. J.*, **11**: 7-9 (1996).

Hussain, A., O.P. Virmani, A. Sharma, A. Kumar and L.N. Misra. *Major Essential Oil-Bearing Plants of India*, Central Institute of Medicinal and Aromatic Plants, Lucknow, India (1988).

James, A.D; Jo B.G; Mary Judi ducellier; A.D. Peggy Hand book of medicinal herbs.2nd Ed.CRC press London New York. pp153-154, (2002).

Kurt B. D. G. Common fragrance and flavour components of cardamom *Elettaria cardamomum* (zingeberaceae) ssd. J. Agri. Food. Chem,. 39(11): 1984-1986 (1991)

Kubo, I. H. Masaki, M. Hisae. Antimicrobial activity of flavour components of cardamom *Elettaria cardamomum(* zingberaceae) seed. J. Agric.Food Chem.39(11):1984-6. (1991).

Marongiu, B., A. Piras, and S. Procedda, Comparative analysis of the oil and $CO_2$ extract of *Elettaria cardamomum* (L) Maton. Journal of Agri. and Food Chem., 52(20), 6278-6282 (2004 ).

Nadkarni, A.K.Indian Materia Medica.Vol.1 part 1.pp 475-476 (1976).

Narong C. Spice Production in Asia - An Overview. Unpublished paper presented at the IBC's Asia Spice Markets '96 Conference, Singapore, 27-28 (1996).

Nasir E. and S. I. Ali, *Flora of West Pakistan, Fakhri Printing Press Karachi Pakistan*pp 1028 (1974).

Okugawa H; M. Moriyasu., S. Matasushita; K. Saiki; Y. Hashimoto, K. Matsumoto,; A. Fujioka; A. Kato. Evaluation of crude drugs by a combination of enfleurage and chromatography(IV). On flavor components in seeds of Amomum cardamomum and Elettaria cardamomum. 42(1),94-7. (1988).

Pieribattesti, J. C., J. Smadja and J.M. Mondon.In *Flavors and Fragrances* – A World Perspective, Ed. B. M.Lawrence,B.D. Mookherjee and B.J. Willis, Elsevier, Amsterdam, Netherlands, p.697-706 (1986).

Ravindran P.N., K.J; Madhusoodanan (editors). Cardamom: The Genus Elettaria. Medicinal and Aromatic Plants—Industrial Profiles. London, United Kingdom: Taylor and Francis. pp. 269-283 (2002).

Sattar,A. Extarction and technology of essential oils..In: Proceeding of the first National Symposium on Essential Oil, Perfumes and Flavour.pp 7-12 PCSIR Laborties Complex, Lahore. (1989).

Susheela R. Handbook of Spices, Seasoning, and Flavoring. 2nd Edition. CRC Press, Tylor and Francis group.London, New York. pp 79-82 (2007).

Telja R., L. Olavl, Q. Roberto. Small Cardamom-precious for people, Harmful for Mountain forests. Possibilities for sustainable cultivation in the east Usambaras,Tanzania. Mountain Research and Development Vol 26 (2) (2006).

Usmanghani, K. , A. Saeed and M. T. Alam, *Indusyunic Medicines, Traditional Medicines of Herbal, Animal and Mineral Origins in Pakistan*, B.C.C.&T. Press, University of Karachi, Pakistan (1997).

Vijayan, K.K; K.J; Madhusoodanan V.V; Radhakrishnan, P.N. Ravindran Properties and uses of cardamom. Medicinal and aromatic plants-Industrial profiles.30(cardamom), 269-283 (2002).