GC-MS analysis of bioactive compounds in methanolic extract of Seeds of Elletaria cardamomum

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Abstract

Elletaria cardamomum or small cardamom is known as the, 'Queen of Spices', since its dried fruit is highly priced as a spice around the world, and in India it is considered the second essential 'national spice'. The GC-MS analysis of methanolic extract of seeds was perfomed to confirm the chemical composition of seeds of Elletaria cardamomum. The GC-MS analysis confirmed presence of 39 compunds. The major compounds were trisdibutylphenyl phosphate (48.19 %), nonadecane (6.04%), cetane (4.55 %) with other compounds like clionasterol (2.84%), heneicosane (2.58 %), glycidyl oleate (2.51%) and anozol (2.27 %). This study confirmed the presence of many phytochemical compounds with antimicrobial activity.

Keywords: *Antibacterial, Chemical composition, Elletaria cardamomum, GC-MS, phytochemicals, trisdibutylphenyl phosphate.*

INTRODUCTION

Elletaria cardamomum L. Maton sometimes written cardamon, is an herbaceous perennial plant of the Zingiberaceae family that produces whole or ground dried fruits or seeds as a spice. The seeds have a flavour that is warm, slightly spicy, and intensely aromatic—almost like camphor. Traditionally, it is known as the 'Queen of Spices', since its dried fruit is highly priced as a spice around the world, and in India it is considered the second essential 'national spice'. They are a well-liked seasoning in Scandinavian pastries and South Asian foods, especially curries. Although it is possible to gather wild cardamom fruits from plants that are native to the damp woods of Southern India, the majority of cardamom is grown in India, Sri Lanka, and Guatemala (Joshi et al., 2013). Just before they reach maturity, the fruits are plucked or trimmed off the stems, cleaned, and dried in the sun or in a heated curing chamber. Cardamom can be bleached to a creamy white hue in the sulphur-burning gases. After drying and curing, the capsules' minute stems are removed by winnowing. The dried, husked seeds that make up embellished cardamom are used. Additionally, from a medicinal perspective, it is used to treat a number of conditions, including heart, stomach, and kidney problems, cataracts, asthma, bronchitis, gum infections, and nausea. Cardamom essential oils (EOs) are beneficial in treating a variety of illnesses because they contain a wealth of medicinal volatiles, including the monoterpenes 1,8-cineole, limonene, linalool,

terpinolene, myrcene, and -pinene. According to published studies, this plant's EOs have a variety of biological actions, including anti-inflammatory, anti-hypertensive, anti-diabetic, laxative, antispasmodic, antibacterial, anti-platelet-aggregation, and anticancer properties (Jamal et al., 2005; Verma et al., 2009; Abdullah et al., 2010; Sharma et al., 2011; Savan and Kucukbay, 2013). Various methods have been reported for the fractionation and quantification of cardamom bioactive components. Mostly, spectrophotometer is used for simple analyses depending on the color development of the sample. However, for detailed categorization of bioactive components, gas chromatography mass spectroscopy (GC–MS) is recommended (Amma et al. 2010). The present study was designed to determine the bioactive compounds in the methanolic extract of seeds of Elletaria cardamomum.

Materials and Methods

Collection of Material: Plant materials were bought from a Shahjahanpur local market and identified by the Head of Department, Botany at a G.F. college.

Extraction: A Soxhlet device was used to extract 10 g of tiny cardamom seeds in a 1:10 ratio from 100 ml of a separate solvent, methanol. For a total of 36 hours, the solvent extraction time was set at 4 hours per day. Any leftover solvent was rotary evaporated after the generated extract was removed from the solvent chamber. The resulting residue was kept chilled for use in later research.

GC-MS Analysis: All test samples underwent GC-MS analysis at the Jawaharlal Nehru University's Advanced Instrumentation Research Facility (AIRF) in New Delhi. In their respective solvents, extracts were dissolved at a concentration of 1 mg/ml. By comparing the peak mass spectrum with the mass spectral database of the Wiley and National Institute of Standard and Technology (NIST) libraries, the composition of the test samples was ultimately determined.

Results and Discussion

Table 1:- List of Major compounds idnetified by GC-MS analysis of Elletaria cardamomum

Peak	R.Time	(Similarity Index) SI	Area%	Name	Formula
1.	6.425	98	1.88	Bihexyl	$C_{12}H_{26}$
2.	9.232	97	1.02	Tetradecane	$C_{14}H_{30}$
3.	11.496	92	1.73	E-Nerolidol	$C_{15}H_{26}O$
4.	11.784	97	4.55	Cetane	$C_{16}H_{34}$
5.	11.968	92	2.27	Anozol	$C_{12}H_{14}O_4$
6.	13.346	89	1.62	Eicosane	$C_{20}H_{42}$
7.	13.999	96	6.04	Nonadecane	$C_{19}H_{40}$
8.	15.298	66	1.26	Impruvol	$C_{15}H_{24}O$
9.	15.782	97	1.98	Elaol	$C_{16}H_{22}O_4$
10.	16.014	97	2.58	Heneicosane	$C_{21}H_{44}$
11.	17.021	89	2.08	Methyl oleate	$C_{19}H_{36}O_2$
12.	18.793	86	1.98	Glycidyl palmitate	$C_{19}H_{36}O_3$
13.	20.267	87	2.51	Glycidyl oleate	$C_{21}H_{38}O_3$
14.	20.712	94	1.35	Dioctyl phthalate	$C_{24}H_{38}O_4$
15.	21.137	78	1.32	Octadecyl chloride	$C_{18}H_{37}Cl$
16.	29.894	91	2.84	Clionasterol	$C_{29}H_{50}O$
17.	31.278	93	48.19	Trisdibutylphenyl phosphite	$C_{42}H_{63}O_3P$

The peaks of GC-MS examination were identified on the basis of their retention time and molecular weight by analyzing similarity with NIST/WILEY libraries.

The GC-MS analysis confirmed presence of 39 compunds. The major compound was trisdibutylphenyl phosphate (48.19 %) at retention time 31.278. In NIST compound library it showed similarity index of 93 % with chemical formula C42H63O3P.The second highest compound was nonadecane (6.04%) at retention time 13.999. It showed 96% similarity index with chemical formula C19H40. Cetane was third highest compound which was 4.55 % at retention time 11.784 with similarity index 97%. Other compounds were clionasterol (2.84%), heneicosane (2.58 %), glycidyl oleate (2.51%) and anozol (2.27 %). Most of the major phytochemical compounds are either pharmacologically active compounds or the compounds useful for various industries. Numerous studies have depicted that cardamom essential oil contains bioactive components, which represent its beneficial impact, such as α-terpinyl acetate (21.3–44.3%), 1,8-cineole (10.7–28.4%) and linalool (6.4–8.6%). GC–MS analysis of green cardamom essential oil (CEO) resulted in identification of twenty-six compounds with α-terpinyl acetate (38.4%), 1,8-cineole (28.71%), linalool acetate (8.42%), sabinene (5.21%), and linalool (3.97%) as major bioactive components. Essential oils (EO) are mixtures of different volatile lipophilic molecules (in some cases, more than 100), which are responsible for the plant's distinctive flavour, scent, and aroma. In particular, 1,8-cineole, limonene, and α-terpinyl acetate have been found to have the strongest flavour identity in cardamom capsules and seed essential oils. Along with these three flavours, the essential flavouring elements of cardamom oil include α-pinene, β-pinene, terpineol, citronellal, linalool, and allo-aromadendrene (Menon et al., 1999; Singh et al., 2008; Olivero-Verbel et al., 2010; Savan and Kucukbay, 2013; Mehyar et al., 2014).

Conclusion

In the present study, Elletaria cardamomum seeds have shown to have various secondary metabolites which possess many pharmacological properties of which antimicrobial activity is one. The GC-MS analysis confirmed presence of 39 compunds. The major compound was trisdibutylphenyl phosphate, nonadecane, cetane, clionasterol, heneicosane, glycidyl oleate and anozol. Isolation of individual components would however, help to find new drugs.

Figure 1: GC-MS chromatogram of methanolic extract of Elletaria cardamomum

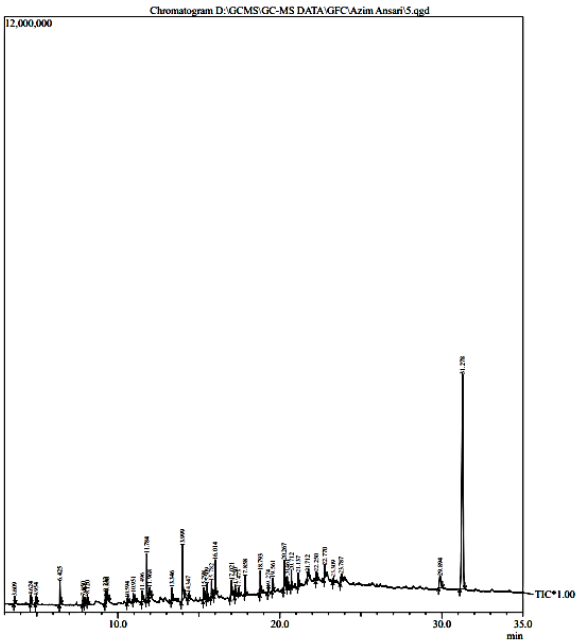


Figure 2: GC-MS chromatogram of Trisdibutylphenyl phosphite

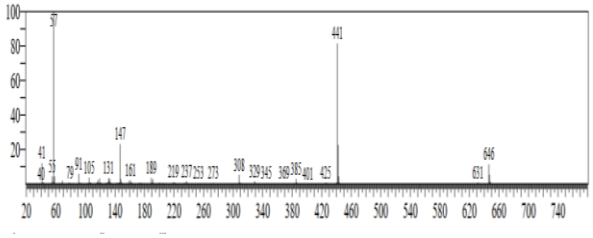


Figure 3: GC-MS chromatogram of Nonadecane

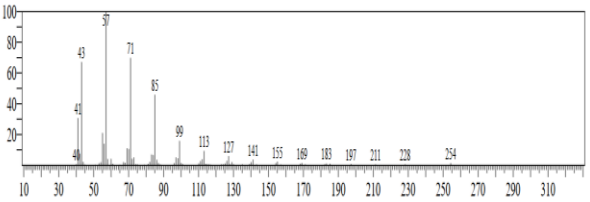
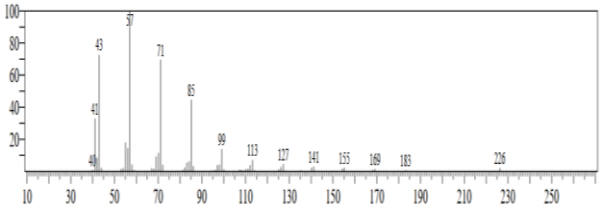


Figure 4: GC-MS chromatogram of Cetane



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