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International Journal of Current Research
Vol. 3, Issue, 7, pp.215-217, July, 2011

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

PHYTOCHEMICAL CONSTITUENT OF Syzygium *aromaticum* L.

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ARTICLE INFO

Article History:
Received 22nd May, 2011
Received in revised form
17th June, 2011
Accepted 29th June, 2011
Published online 16th July 2011

Key words:
Syzygium aromaticum L.,
Eugenol,
Chemical composition.

ABSTRACT

The objective of this study was to assess the oil composition of clove bud commercial available from local market of India. The hydro-distilled clove oil obtained from Delhi, Kannauj and Kanpur were analysed by GC and GC-MS, which led to the identification of 11 compounds representing 99.8, 99.7 and 99.7% respectively of the total oil. Eugenol the main constituent was found in the range of 82.3-91.4% followed by trans-β-caryophyllene (6.3-12.7%). The oil yields were 3.8, 4.2 and 4.4 % (v/w) respectively. α-humulene, eugenyl acetate, trans (β)-caryophyllene and chavicol were other constituents. Broadly major component of the oil were qualitatively similar in among collected and comparative samples but variation among other constituents have been noticed.

INTRODUCTION

Syzygium aromaticum L. belongs to family Myrtaceae. In Hindi this plant is known as laung. It is an evergreen tree, native of Indonesia and Mallaca islands distributed in tropics of the old world. It is cultivated in Tanzania, Indonesia, Penang, Malagasy, Mauritius and Srilanka. In India it is grown in Tamilnadu and Kerala. It is a natural analgaesic and antiseptic used primarily in dentistry for its main ingredient eugenol. It can also be purchased in pharmacies over the counter, as a home remedy for dental pain relief, mainly toothache; it is also often found in the aromatherapy section of health food stores. The oil produced by cloves can be used in many things from flavouring medicine to remedies for bronchitis, the common cold, a cough, fever, sore throat and tending to infections. The main oil-producing countries are Madagascar and Indonesia. It is also used for anaesthetizing and, in higher doses; euthanizing fish clove oil is also the active ingredient in a weed and grass killing herbicide. It is effective in killing many types of plants. Clove oil is also used in oil painting. The anti-oxidant effect of the eugenol delays the drying (oxidation) of the drying oils (linseed, safflower, poppy, walnut) in the paint on the palette (Anonymous, 1976). There have been numerous studied on chemical composition of clove bud oil. Essential oil from clove (*Syzygium aromaticum* L.) was obtained from steam-distillation method, and its chemical composition was analyzed by GC and GC-MS. The results showed that the essential oils mainly contained about eugenol (87.0), eugenyl acetate (8.01) and β-Caryophyllene (3.56%) (Alma *et al*. (2007). The essential oils of *Syzygium aromaticum* were isolated from its buds and leaves by hydrodistillation. The oils were analyzed by high resolution GC and GC-MS. Twenty-eight and 35 constituents representing 99.9% each were identified from the bud oils of Indian and Madagascan origins, respectively. On the other hand leaf oil from Madagascar resulted in the identification of 22 constituents representing 99.9% of the oil. The major constituents in bud and leaf oils were eugenol and β-caryophyllene. (Srivastava *et al* 2005). A total of nine chemical compounds were detected in the essential oil, with eugenol (49.0) and caryophyllene (7.5%) being the major compounds. The results of the present study indicate that the essential oil of *S. aromaticum* shows a huge potential to substitute commercial antibiotics as antimicrobial agents for aquaculture use (Seongwei *et al.,* 2009). Sixteen volatile compounds were identified from the n-hexane extract of the buds of *Syzygium aromaticum* by using GC-MS. The major components were eugenol (71.56) and eugenol acetate (8.99%). The dichloromethane extract of the buds yielded limonene and ferulic aldehyde, along with eugenol. (Mahmoud *et al*., 2007). Supercritical fluid extraction (SFE) of essential oil from clove buds analyzed by GC-MS detection to compare the extraction methods. Twenty three compounds in the clove oils have been identified, showing that the composition of the clove oil extracted by different methods is mostly similar, whereas relative concentration of the identified compounds is apparently different. (Wenqiang *et al*., 2007). The cloves are grown as plantation crops in the agro climatic conditions of the Indian island of Little Andaman. The dried leaves, on

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Table 1. Comparison of chemical composition (percent content) of *Syzygium aromaticum* L. oil from Delhi, Kannauj and Kanpur

S. NO.	Compounds	Present Report			Turkish (Alma *et al*. 2007)	Lucknow (Srivastva *et al*. 2005)
		Delhi	Kannauj	Kanpur		
1.	α-cubebene	0.2	t	0.1	absent	absent
2.	α-copaene	0.3	t	0.2	0.10	0.1
3.	β-caryophyllene	12.7	7.9	6.3	3.56	-
4.	α-humulene	1.5	1.1	0.7	0.40	1.9
5.	germacrene-D	0.1	absent	absent	absent	0.1
6.	δ-cadinene	0.3	t	0.2	0.04	0.2
7.	Trans-anethol	0.1	absent	0.3	absent	absent
8.	β-caryophylene oxide	0.1	0.4	0.1	0.10	0.4
9.	Eugenol	82.3	90.1	91.4	87.00	70.0
10.	Eugenyl acetate	1.9	0.1	0.2	8.01	2.1
11.	Chavicol	0.3	0.1	0.2	absent	t
	Total	99.8%	99.7%	99.7%		

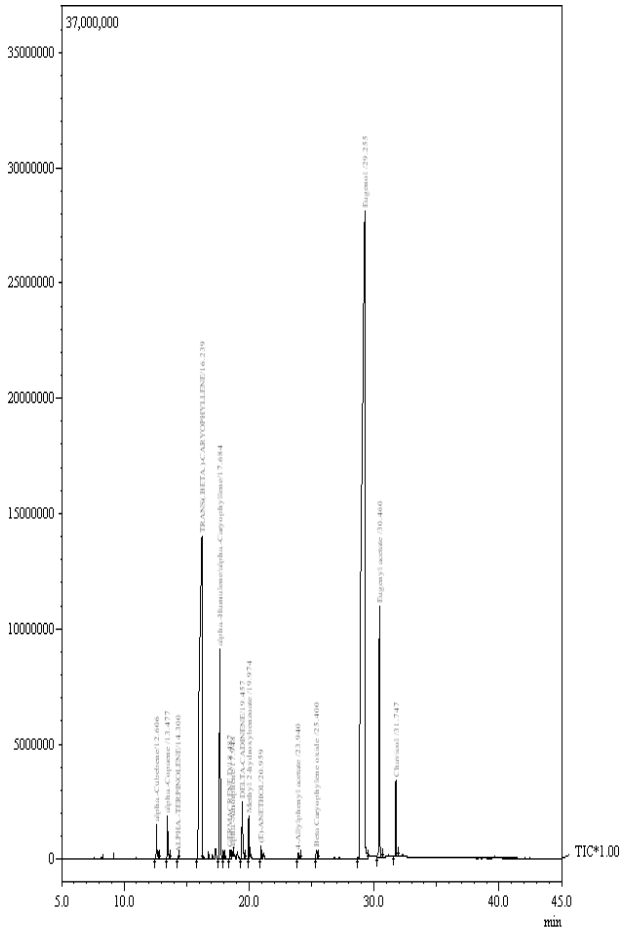

Fig. 1 Chromatogram showing the peaks of the clove oil constituents

hydrodistillation, gave 4.8% of the oil. GC and GC-MS analysis of the oil resulted in the identification of 16 compounds. The major compound was eugenol (94.4%) followed by caryophyllene (2.9%). The clove oil from Little Andaman was found to be comparable with the best oil produced in south India in terms of its eugenol content. It is suggested that clove can be grown as an economically viable crop in the Andaman, Nicobar and Lakshadweep islands. (Raina *et al*. 2001). The analysis of *Syzygium aromaticum* L. bud essential oils, both from genuinely collected and commercially used material, was carried out using GC-MS. The clove bud essential oil contained eugenol (89.5), aceto-eugenol (70.0) and β-caryophyllene (2.0%) as major constituent. α-copaene, α-humulene, methyl salicylate were other constituents. (Pal *et al*. 2008). The present communication deals with essential oil composition of *Syzygium aromaticum* L. of commerce.

MATERIAL AND METHOD

Clove seeds purchased from the local market of Kanpur and Delhi in April 2011 were identified by Dr. Vandana Mishra**,** Associate Professor, Department of Botany, D.G.P.G., College, Kanpur. The semi-crushed seeds were hydro distilled in a Clevenger type apparatus for 4 hrs yielding oil in 3.8, 4.2 and 4.4 % (v/w) respectively. The oils were dried over anhydrous sodium sulphate and stored in a sealed glass vials in refrigerator. Quantitative analysis of the essential oil of clove was carried out using a Shimadzu GC-2010. Nitrogen was used as carrier gas at 10 psi inlet pressure with FID and AB inno-wax column (60 m X 0.25 mm id, film thickness 0.25 µm). Injector and detector temperatures were 270˚ and 280˚C, respectively. Column temperature programmed from 60˚ to 180˚C at 3˚C/min with hold time of 2 min and from 180˚ to 250˚C at 5˚C/min with hold time 20 min respectively. The flow rate of carrier gas was 1.2 ml/min and split ratio was 80:1. The data were processed on GC solutions software for oil composition.

GC-MS analysis was obtained on a Shimadzu Mass Spectrometer-2010 series system using same column and conditions as GC. Helium was used as carrier gas. EI source and mass range were 70 eV and 40-750 amu respectively. The identity of the components was assigned by comparing their GC retention times with those of authentic samples as well as with known components of standard essential oils and composition of the fragmentation pattern with that reported in Nist and Wiley computer libraries.

RESULT AND DISCUSSION

Extraction of clove bud gave 3.8, 4.2, 4.4% essential oil. The GC and GC-MS analysis of clove oil, obtained from local market of Delhi, Kannauj and Kanpur, were done for the identification and quantification of oil components. The analysis resulted in 15 compounds, of which eugenol was major component, with 82.3%, 90.1% and 91.4% of total constituent from Delhi, Kannauj and Kanpur, respectively. Other major constituents of oils were trans- (β)-caryophyllene

which constituted 12.7% (Delhi), 7.9% (Kannauj) and 6.3% (Kanpur). Interestingly, trans-(β)-caryophyllene formed 3.56% of Turkish oil, however could not be determined in Lucknow oil. Delhi oil also contained α-humulene (1.5%) and eugenyl acetate (1.9%) in significant amount while all the other components of all the oils were below 1% or in traces amount in composition. These oils were compared with oils from Turkey and Lucknow in respect to percent content of its major compounds. Again, eugenol was the major component of the oils from these locations, albeit with different percentage composition. The oils from Turkey contained 87% while Lucknow oil had only 70% of its total oil composition as eugenol. Another interesting fact was significantly higher percentage composition of eugenyl acetate (8%) in Turkish oil. Percentage composition of α-humulene and eugenyl acetate in Lucknow oil was 1.9 and 2.1%, respectively. The remaining components of clove oil from various regions analyzed amounted between traces to < 0.4% (Table 1 and Fig. 1).

It has been well established fact (from earlier and the present study) that eugenol is that most abundant component of clove oil. It is noteworthy that eugenol has many clinical implications as good local antioxidant, antiseptic, local anaesthetic and analgesic. Eugenol is also used to make zinc-oxide eugenol *paste* for temporary fillings and for the production of iso-eugenol for the manufacture of vanillin which is an artificial substitute for vanilla. Eugenol is found in insect attractants as well as UV absorbers. Affects of eugenol are mostly beneficial; however, eugenol overdose may cause symptoms like shallow and rapid breathing, coughing up blood, blood in urine, burns in mouth and throat, abdominal pain, nausea, rapid heartbeat, dizziness, seizures, and even coma. Considering the medical importance of eugenol, our finding that Eugenol content is comparatively higher in Kanpur and Kannauj regions that in Lucknow and Delhi regions, becomes very significant. In other words clove seeds from Kanpur and Kannauj regions would provide a better source of eugenol.

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