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SHORT COMMUNICATION

Chemical composition of *Ocimum gratissimum* essential oil from the South Western Ghats, India

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ABSTRACT

The essential oil from aerial parts of *Ocimum gratissimum* (Rama tulsi) growing in the South Western Ghats, India was examined for the first time. The essential oil was extracted by hydro-distillation and resulted in 1.31% oil (w/v) on a dry weight basis. Gas chromatography-mass spectrometry (GC-MS) analysis of *O. gratissimum* resulted in 18 chemical constituents comprising 99.4% of the oil. The main fractions were found to be classified as phenylpropene (55.73%), sesquiterpenes (27.49%) and monoterpenes (16.14%). The major constituents were eugenol (54.42%), germacrene D (15.43%), β-ocimene (12.37%), and caryophyllene (4.59%). These major constituents can be utilized for aroma, perfumery and pharmaceutical industries.

Keywords: *Ocimum gratissimum*; essential oil; GC-MS; eugenol; germacrene D; β-ocimine; caryophyllene

INTRODUCTION

Ocimum gratissimum (L.) belongs to family Lamiaceae and is commonly known as Rama tulsi in India. It's native to Asia and is predominantly distributed and cultivated in India, Sri Lanka, Nepal, Nigeria and West Africa (Nadkarni, 1999). Leaves of this plant widely used folk medicine in teas and infusion of leaves to treat cough, cold, abdominal pain, anxiety, headache, and bronchitis (Matasyoh et al., 2007). Several scientific reports say that *O. gratissimum* has potential antioxidant, antimicrobial (Joshi, 2013), anti-inflammatory (Ajayi et al., 2014), anthelmintic (Aderibigbe and Idowu, 2020), antimutagenic (Gontijo et al., 2014), antidiarrhoeal (Offiah and Chikwendu, 1999), anticancer and antidiabetic activities (Aguiyi et al., 2000). Hydrodistillation, steam distillation, microwave, ultrasound-assisted and supercritical fluid methods are used to extract the essential oil from plants (Azwanida, 2015; Ashokkumar et al. 2020a; Ashokkumar et al., 2020b). Among them, hydrodistillation method is most commonly used by several researchers across the world, due to its less cost of Clevenger apparatus and solvent as water (Ashokkumar et al., 2020c). The essential oil yield of *O. gratissimum* is varied between 0.21% and 0.70% (Dubey et al., 2000; Matasyoh et al., 2007; Joshi, 2013). The essential oil of *O. gratissimum* has predominant in phynelypropene (eugenol & methyl eugenol), sesquiterpenes (germacrene D & caryophyllene, γ-muurolene) monoterpenes (β-ocimene) and other constituents (Matasyoh et al., 2007; Padalia, and Verma, 2011; Joshi, 2013). Several studies have been carried out essential oil of the plant from across the world (Matasyoh et al., 2007; Padalia, and Verma, 2011). Based on the above interest and our knowledge, this study was the first report of essential oil composition from aerial parts of *O. gratissimum* growing from southern Western Ghats, India. Thus, the present study was aimed to evaluate the essential oil yield and its chemical composition from aerial parts of *O. gratissimum*.

MATERIALS AND METHODS

The aerial parts of *O. gratissimum* were collected from the garden of Cardamom Research Station, Pampadumpara, Idukki (Western Ghats, India) during, July 2020. A voucher specimen (CRS/BIOTECH/22-07-2020), is preserved for future reference. Freshly collected aerial parts were shade dried at room temperature for ten days or until moisture content reached nearly 10%. *O. gratissimum* were ground well in a blender, and the finely powdered samples were subjected to hydrodistillation for 3 hours using Clevenger apparatus (Ashokkumar et al. 2020d). The collected essential oil was dried over anhydrous sodium sulphate and stored in a sealed glass vial at -4°C for until analyzed. Essential oil yield was calculated as a volume by weight basis using the following formulae: Essential oil (%, v/w) = volume of oil collected (ml)/weight of the sample (g) x 100. The qualitative analysis of *O. gratissimum* essential oil was carried out through GC-MS analyzer (SHIMADZU, Japan). Chromatographic conditions were followed our laboratory previous studies report (Ashokkumar et al., 2020d). The chemical constituents of *O. gratissimum* essential oil were identified after comparison with those available in NIST and Wiley library attached to GC-MS analyzer. The individual constituent concentration (%) of oil expressed as per cent peak were relative to the total peak area from GC-MS analysis of essential oil.

RESULTS AND DISCUSSION

EO extraction

The aerial parts of *O. gratissimum* used for the determination of essential oil yield using hydrodistillation method. An average essential oil yield, three technical repeats was 1.31% (Table 1). Other studies have been reported yield of *O. gratissimum* essential oil ranged from 0.21% to 0.70% (Dubey et al., 2000; Matasyoh et al., 2007; Joshi, 2013). The higher level of essential oil content could be due to change in soil type, environmental condition, origin of the sample and harvesting stage (Ashokkumar et al., 2020b).

GC-MS analysis

The obtained essential oil was analyzed by GC-MS, which resulted in identifying 18 total constituents comprising (99.36%) of aerial parts of *O. gratissimum* (Table 1). The essential oil profile of aerial parts of *O. gratissimum* was presented in Figure 1. The essential oil was characterized by high concentration of oxygenated phenylpropene (55.73%) followed by sesquiterpene hydrocarbons (27.34%), monoterpene hydrocarbons (13.51%), oxygenated monoterpenes (2.63%), and oxygenated sesquiterpenes (0.15%). Among the phenylpropenes, eugenol (54.42%) is the predominant constituent followed by methyl eugenol (1.31%). The major sesquiterpene constituents were germacrene D, and caryophyllene and the corresponding concentration were 15.43% and 4.59%. Though, the concentration was greater than previously reported 4.3% (germacrene D) and 1.7% (caryophyllene) in Kenya grown *O. gratissimum* (Dambolena et al., 2010). β-ocimene is main monoterpene constituents and others were trace level. Similar reports were observed from the earlier studies of Nigeria grown *O. gratissimum* essential oil (Martins et al., 1999). Furthermore, the present study gave extensive variation in essential oil constituents chemical composition compared to previous reports. Change in the essential oil composition is due to various factors, including origin of the sample, oil extraction methods, varieties, harvesting time and methods and storage conditions.

CONCLUSION

The chemo-profiling of aerial parts of *O. gratissimum* essential oil through GC-MS analysis discloses that eighteen chemical constituents represent 99.36 % total oil. Phenylpropene concentration was predominant, followed by sesquiterpene and monoterpenes. *O. gratissimum* essential oil was predominantly accumulated with

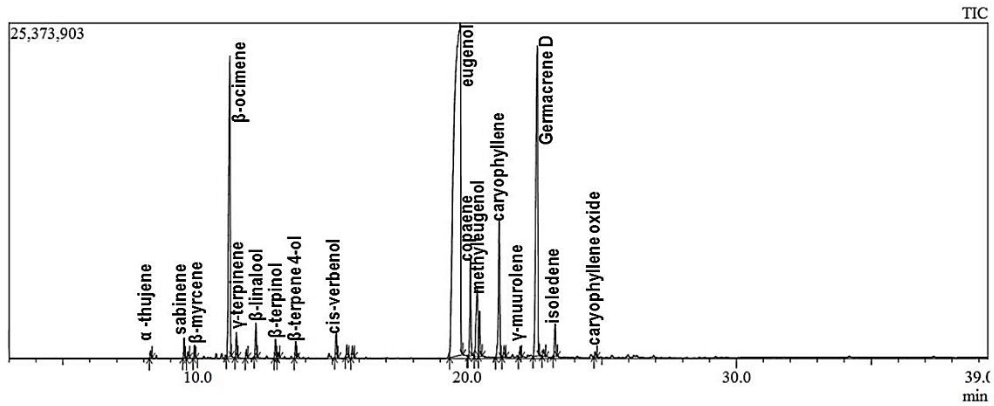

Figure 1. GC-MS analysis of essential oil profile of aerial part of *Ocimum gratissimum*

Table 1. Profiling chemical constituents of essential oil from aerial parts of *Ocimum gratissimum*

Sl. No.	Compound name	Type	RT[a]	RI[b]	RI[c]	Area (%)
1.	α-thujene	Monoterpene	8.25	924	930	0.17
2.	sabinene	Monoterpene	9.54	946	946	0.47
3.	β-myrcene	Monoterpene	9.89	958	950	0.29
4.	β-ocimene	Monoterpene	11.43	976	976	12.37
5.	γ -terpinene	Monoterpene	11.80	1054	1059	0.21
6.	linalool	Monoterpene	12.88	1087	1095	0.48
7.	β-terpineol	Monoterpene	12.99	1158	1159	1.43
8.	cis-verbenol	Monoterpene	15.54	1136	1137	0.72
9.	eugenol	Phenylpropene	19.50	1356	1359	54.42
10.	copaene	Sesquiterpene	20.08	1374	1376	2.77
11.	methyleugenol	Phenylpropene	20.41	1451	1453	1.31
12.	caryophyllene	Sesquiterpene	21.18	1464	1466	4.59
13.	humulene	Sesquiterpene	21.95	1454	1454	0.30
14.	γ-muurolene	Sesquiterpene	22.40	1478	1479	3.05
15.	germacrene D	Sesquiterpene	22.52	1480	1481	15.43
16.	γ-elemene	Sesquiterpene	22.83	1499	1490	0.24
17.	isoledene	Sesquiterpene	23.25	1419	1379	0.96
18.	caryophyllene oxide	Sesquiterpene	24.75	1582	1583	0.15
		Total monoterpene	-	-	-	16.14
		Total sesquiterpene	-	-	-	27.49
		Total phenylpropene	-	-	-	55.73
		Total constituents (%)	-	-	-	99.36
		Total essential oil (%)	-	-	-	0.6%

eugenol, germacrene D, caryophyllene, γ-murrolene and copane. These bioactive molecules' existence as chief constituents from the *O. gratissimum* essential oil serves as a novel potential source of phenylpropene, sesquiterpene, and monoterpenes can be used in food, aroma, perfumery, and pharmaceutical applications.

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