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Hyptis suaveolens (L.) Poit (Bush Tea): Volatile composition of fruits and stems essential oils

Emmanuel E Essien, Ime R Ekanem, Sampson D Umoh and Mohammad I Choudhary

Abstract
Hyptis suaveolens is an aromatic and medicinal plant harvested in the wild. The volatile oils isolated from the fresh fruits and stems of *H. suaveolens* were subjected to gas chromatography-mass spectrometry (GC-MS). GC-MS analyses permitted the identification ofthirty-six constituents, accounting for 98.0% and 99.4%composition of the fruits and stems oils respectively. The oxygenated terpenes (66.8%) and terpenoid hydrocarbons (75.5%) predominated the fruits and stems oils respectively. The fruits volatile oil was characterized by the abundance of 1, 8-cineole (29.5%), fenchone (17.2%), fenchol (9.5%), and sabinene (8.4%). The main components of the stems oil were β-pinene (20.9%), estragole (16.3%), β-caryophyllene (11.1%), and α-pinene (6.8%). The composition of the fruits essential oil of *H. suaveolens* is reported for the first time.

Keywords: *Lamiaceae, Hyptis suaveolens,* essential oil composition, 1, 8-cineole, β-pinene, fenchone

1. Introduction
Hyptis suaveolens (L.) Poit, belongs to the family Lamiaceae. The plant has been considered as an obnoxious weed, distributed throughout the tropics and subtropics. Different parts of the plant have been used by traditional healers in the treatment of various ailments and disease conditions [1-2]. *H. suaveolens* is popularly used in the treatment of respiratory and gastrointestinal infections, indigestion, colds, pain, fever, cramps, and skin diseases. In the northern part of Nigeria, a decoction of the leaves is used for treating boils, eczema and diabetes mellitus [3]. The chemical composition of essential oil of *H. suaveolens* leaves has been investigated by many researches in various parts of the world. The various chemotypes reported reveals a combination of some of these constituents: sabinene, β-caryophyllene, 1, 8-cineole, limonene, β-phellandrene, *trans*-α-Bergamotene, element, β-pinene, eugenol, Germacrene D and fenchone [4-9]. In particular, the composition of the leaves essential oil of *H. suaveolens* from Nigeria presents sabinene, *trans*-α-bergamotene, and β-caryophyllene [6]; α-pinene, sabinene, *p*-cymene, and terpinen-4-ol [10]; β-caryophyllene, α-phellandrene, and caryophyllene oxide as major constituents [11]. *H. suaveolens* leaf oils have shown variouspharmacological activities like antifungal, antibacterial, antioxidantand mosquito-repellant activities [9-12-14]. All parts of *H. suaveolens* are characterized by strong aromatic fragrance (minty odor) when crushed, and hence the interest to investigate their essential oils. Exhaustive literaturesurvey reveals that there are few reports available for the composition of the stems oil from Brazil and Cote d' Ivoire [15, 16], and no report on the fruit or seeds essential oils. Therefore, this present study is aimed at evaluating the volatile components of the fruits and stems of *H. suaveolens*; as an integral part of our investigation on the poorly studied aromatic flora of Nigeria [17].

2. Materials and methods
2.1. Plant Sample
H. suaveolens was collected in the wild within Uyo Local Government Area, AkwaIbom State, Nigeria, in the month of October 2016. The samples were identified by a taxonomist in the Department of Botany and Ecological Studies, University of Uyo, where voucher specimens were deposited. The essential oils were obtained by hydrodistillation (4 h) of the fresh fruits and stems using a Clevenger-type apparatus. The oils were dried over sodium sulfate and stored in refrigeration (4 °C) immediately after estimation of percentage yield.

2.2. Gas Chromatography-Mass Spectrometry (GC–MS)

The volatile oils were subjected to GC-MS analysis on an Agilent system consisting of a model 7890 N gas chromatograph, a model mass detector Triple Quad 7000 A in EI mode at 70 eV (m/z range 40–600 amu) (Agilent Technologies, Santa Clara, CA, USA), and an Agilent Chem Station data system. The GC column was an HP-5 ms fused silica capillary with a (5% phenyl)-methyl poly siloxane stationary phase (30 m × 250 µm × 0.25 µm). The carrier gas was helium with a column head pressure of 9.7853 psi and flow rate of 1.2 mL/min. Inlet temperature and MSD detector temperature was 250 °C. The GC oven temperature program was used as follows: 50 °C initial temperature, held for 5 min; increased at 6 °C/min to 190 °C for 20 min; increased 7 °C/min to 290 °C for 15 min; increased 7 °C/min to 300 °C for 10 mins. The sample was dissolved in dichloromethane, and 2 µL was injected (split ratio 10:1; split flow 12 mL/min). The components were identified by comparison of their mass spectra with NIST 1998 library data of the GC-MS system as well as by comparison of their retention indices (RI) with the relevant literature data [18]. The relative amount of each individual component of the essential oil was expressed as the percentage of the peak area relative to the total peak area. RI value of each component was determined relative to the retention times of a homologous *n*-alkane series with linear interpolation on the HP-5 ms column.

3. Results & discussion

The chemical compositions of essential oils of *H. suaveolens* are presented in Table 1. Twenty-three volatile components of the fruits accounted for 98.0% of the total oil composition, while the 23 compounds also identified in the stem oil constituted 99.4%. The fruits essential oil consisted mainly of 1, 8-cineole (29.5%), fenchone (17.2%), fenchol (9.5%), and sabinene (8.4%). The main components of stems oil were β-pinene (20.9%), estragole (16.3%), β-caryophyllene (11.1%), and α-pinene (6.8%).The fruits and stems oils composition were quantitatively and qualitatively different; though ten volatile constituents were common to both oils, among the total of thirty-six identified. The major compounds in the fruits oil, sabinene, 1, 8-cineole, fenchone, and fenchol were not detected in the stems oil. Likewise, β-pinene and estragole occurring in relative abundance in the stems oil were not detected in the fruits oil.

The percent composition of various classes of compounds in the fruits and stems oils of *H. suaveolens*, respectively, were: monoterpene (81.6% and 55.3%), sesquiterpene (16.4% and 27.8%), oxygenated terpenes (66.8% and 7.6%), and phenyl propane (0.0% and 1.2%) and non-terpenes derivatives (0.0and 16.3%).

The monoterpene, β-pinene (20.9%) (Table 1) is indicated as a minor component of the stems oil from Cote d' Ivoire; estragole (16.3%) in the stems oil from Nigeria was not detected in the Ivoire sample, but contained higher amount of β-caryophyllene[16]. On the contrary, diterpenes and palustrol identified as major components of the Ivoire stems oil were not detected in the stem oil in this study. Spathulenol was identified as a minor component of the stems oil (Table 1) and in the Brazil sample [15], but is reported as a major component in stems oils from Cote d' Ivoire [16] respectively. The major components of *H. suaveolens* oils in this study, such assabinene, 1, 8-cineole, β-pinene, fenchone, and β-caryophyllene were also reported as prominent volatile constituents of the leaves of *H. suaveolens* from some regions of the world [4-9].In contrast, one of the major components of *H. suaveolens* leaf oil from Nigeria, *trans*-α-bergamotene [6], was not identified in the stems oil of *H. suaveolens* in this study. Similarly, fenchol and estragole, relatively abundant in the fruits and stems oils respectively (Table 1), were not reported as components of the leaf essential oils of *H. suaveolens* from Nigeria [6, 10, 11].

Table 1: Composition of essential oils of fruits and stems of *Hyptis suaveolens*

Compound	LRI [a]	Relative abundance (%) [b, c]		QI [d]
		Fruits	Stems	
α-Thujene	933	0.7	-	93
α-Pinene	941	3.3	6.8	94
Sabinene	977	8.4	-	93
β-Pinene	981	-	20.9	92
Myrcene	993	1.0	-	90
α-Phellandrene	1006	0.7	3.5	91
p-Cymene	1028	-	6.1	95
1,8-Cineole	1034	29.5	-	90
(*Z*)-β-Ocimene	1042	-	1.7	92
γ-Terpinene	1063	6.3	4.7	94
Fenchone	1089	17.2	-	94
Terpinolene	1090	0.8	3.4	93
Linalool	1101	-	0.9	90
exo-Fenchol	1119	9.5	-	94
Camphor	1145	0.8		96
Borneol	1168	1.2	-	95
Terpinen-4-ol	1179	1.8	0.8	94
α-Terpineol	1191	0.4	1.4	91
Sylvestrene	1195	-	3.4	90
Estragole	1197	-	16.3	94
Bornyl acetate	1287	-	0.6	90
Myrtenyl acetate	1327	-	1.1	90
β-Cubebene	1391	0.3	-	91

α-Copaene	1377	-	1.7	93
α-Gurjunene	1410	-	3.0	91
β-Caryophyllene	1419	6.6	11.1	96
trans-α-Bergamotene	1437	1.0	-	96
Elixene	1445	2.5	-	94
Germacrene D	1482	-	4.6	94
β-Selinene	1487	0.2	-	95
δ-Cadinene	1538	-	1.5	93
α-Humulene	1564	0.4	3.1	95
Spathulenol	1577	0.9	0.4	95
Caryophyllene oxide	1582	0.7	1.5	93
Globulol	1584	-	0.9	90
trans-Bergamotol	1694	3.8	-	94
Total identified		98.0	99.4	

a LRI, Linear retention indices; b Order of elution on HP-5ms capillary column; identification by comparison of the mass spectral and retention index data; d QI, 'quality index', reflects the fit comparison of experimental mass spectrum and NIST library mass spectrum; - = not detected.

4. Conclusions

The essential oils composition of *H. suaveolens* fruits and stems are reported in this study; 1, 8-cineole, fenchone, fenchol, sabinene, β-pinene, estragole, β-caryophyllene, and α-pinene were the major constituents identified. The oxygenated terpenes dominated the fruit oil while the hydrocarbon components prevailed in the stems volatile oil.

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