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1-Nitro-2-phenylethane dominates the chemical composition of the leaf essential oil of *Uvaria chamae* from Badagry, Nigeria

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ABSTRACT

The leaf essential oil of *Uvaria chamae* (Annonaceae) was obtained by hydrodistillation and analyzed by GC-MS. A total of 69 compounds were identified in the leaf oil (99.6% of the composition), which was dominated by 1-nitro-2-phenylethane (63.2%), linalool (9.9%), and germacrene D (6.6%). The bioactivities of the major constituents account for the traditional uses of *U. chamae* leaves to treat fevers, wounds, swellings, and injuries.

Keywords: *Uvaria chamae*, Essential Oil Composition, 1-nitro-2-phenylethane, Linalool

1. Introduction

The Annonaceae is a large family of shrubby aromatic plants composed of 112 genera with about 2,150 species [1]. *Uvaria chamae* P. Beauv., commonly known as "finger root" or "banana", is a climbing shrub that grows to about 3.6 m to 4.5 m tall and is found in the tropical wet and dry forests of west and central Africa along coastal scrubland. The fruit is edible and widely eaten, and the plant has been used for treatment of fevers, tumor growth, stroke and cases of venereal disease [2, 3]. The leaves of *U. chamae* have been used to treat wounds and sores, injuries, swellings, and to treat "yellow fever" [4, 5]. Leaf extracts of *U. chamae* have been reported to possess antibiotic, antispasmodic and anti-inflammatory properties [3]. Previous studies of *U. chamae* have shown the plant to be rich in sesquiterpene hydrocarbons dominated by germacrene D and γ-cadinene [6, 7]. In this report we present the chemical characterization of the leaf essential oil of *U. chamae* collected from Badary, Nigeria.

2. Materials and Methods

2.1 Plant Material

Leaves of *U. chamae* were collected from a mature tree on April, 2011. The plant was identified at the University of Lagos herbarium and a voucher specimen (LUH 3626) has been deposited in the herbarium of the Botany Department. The leaves of the plant (350 g) were air-dried, chopped and hydrodistilled using Clevenger apparatus [8] to yield 0.75 g light yellow essential oil. The essential oil so obtained was stored in a sealed glass bottle with screw lid cover under refrigeration at 4 °C.

2.2 GC-MS Analysis

The volatile oil sample was subjected to GC-MS analysis on an Agilent system consisting of an Agilent model 6890 Gas Chromatograph, an Agilent 5973 mass selective detector (EIMS, electron energy = 70 eV, scan range = 45-400 amu, and scan rate = 3.99 scans/sec) and an Agilent Chemstation data system. The GC column was a HP-5ms fused silica capillary with a (5% phenyl)-methylpolysiloxane stationary phase, film thickness 0.25 μm, length 30 m, and internal diameter of 0.25 mm. The carrier gas was helium with a column head pressure of 7.07 psi and a flow rate of 1.0 mL/min. Inlet temperature was 200 °C and MSD detector temperature was 280 °C. The GC oven temperature program was used as follows: 40 °C initial temperature, hold for 10 min, increased at 3 °C/min to 200 °C, increased 2 °C/min to 220 °C.

The sample was dissolved in dichloromethane and a splitless injection technique was used. Identification of the constituents of the volatile oil was achieved based on their retention data (retention indices) determined with reference to C_9-C_{21} *n*-alkane homologous series, and by comparison of their mass spectral fragmentation patterns with those reported in the literature [9] and stored on the MS library [NIST database (G1036A, revision D.01.00) / ChemStation data system (G1701CA, version C.00.01.08)]. The chemical composition of *Uvaria chamae* essential oil is summarized in Table 1.

Table 1: Chemical Composition of *Uvaria chamae* Leaf Essential Oil

RI	Compound	%		RI	Compound	%
941	α-Pinene	0.3		1459	(*E*)-β-Farnesene	0.2
953	Camphene	Tr		1460	Alloaromadendrene	0.1
964	Benzaldehyde	Tr		1463	*cis*-Cadina-1(6),4-diene	tr
978	β-Pinene	0.2		1474	*trans*-Cadina-1(6),4-diene	0.1
992	Myrcene	0.2		1479	γ-Muurolene	0.2
1004	α-Phellandrene	Tr		1483	**Germacrene D**	**6.6**
1010	δ-3-Carene	Tr		1487	β-Selinene	1.0
1016	a-Terpinene	Tr		1492	*trans*-Muurola-4(14),5-diene	0.3
1024	*p*-Cymene	0.4		1495	*epi*-Cubebol	0.7
1028	Limonene	0.1		1497	Bicyclogermacrene	0.3
1030	1,8-Cineole	0.6		1501	α-Muurolene	0.3
1038	(*Z*)-b-Ocimene	0.1		1505	Germacrene A	0.2
1049	(*E*)-b-Ocimene	1.9		1511	(*E*,*E*)-α-Farnesene	0.1
1058	γ-Terpinene	0.2		1516	Cubebol	0.8
1100	**Linalool**	**9.9**		1525	δ-Cadinene	2.1
1139	Benzeneacetonitrile	0.1		1533	*trans*-Cadina-1,4-diene	0.1
1143	(*E*)-Epoxyocimene	Tr		1537	α-Cadinene	tr
1164	Borneol	0.1		1550	Elemol	0.1
1176	Terpinen-4-ol	Tr		1557	Germacrene B	tr
1189	α-Terpineol	0.1		1566	(*E*)-Nerolidol	1.4
1231	(3*Z*)-Hexenyl 2-methylbutanoate	Tr		1570	(3*Z*)-Hexenyl benzoate	0.2
1285	Bornyl acetate	Tr		1578	Spathulenol	0.2
1296	**1-Nitro-2-phenylethane**	**63.2**		1583	Caryophyllene oxide	0.3
1325	(3*Z*)-Hexenyltiglate	0.1		1582	Gleenol	tr
1349	α-Cubebene	0.2		1610	Humulene epoxide II	0.1
1375	α-Copaene	0.4		1628	1-*epi*-Cubenol	0.4
1384	β-Bourbonene	0.2		1641	τ-Cadinol	tr
1390	β-Cubebene	0.2		1643	τ-Muurolol	0.7
1392	β-Elemene	0.2		1646	α-Muurolol (= Torreyol)	0.2
1419	(*E*)-Caryophyllene	1.7		1655	α-Cadinol	0.5
1428	β-Copaene	0.1		1715	Pentadecanal	0.1
1436	α-*trans*-Bergamotene	0.1		1762	Benzyl benzoate	0.9
1443	6,9-Guaiadiene	Tr		1956	Palmitic acid	0.2
1451	*cis*-Muurola-3,5-diene	0.1		2108	(*E*)-Phytol	0.1
1453	α-Humulene	0.6			Total Identified	**99.6**

3. Results and Discussion

The leaf oil of *U. chamae* in this study was dominated by 1-nitro-2-phenylethane (63.2%) with lesser quantities of linalool (9.9%) and germacrene D (6.6%), and therefore, is notably different compared to previously reported samples [6, 7]. Although nitro-containing compound are relatively rare phytochemicals, 1-nitro-2-phenylethane has been found to be an abundant constituent of *Aniba canelilla* and *Ocotea pretiosa* wood and bark oils [10-12]. 1-Nitro-2-phenylethane has shown anti-inflammatory and antinociceptive activity [13, 14], as well as anticandidal [11] and brine shrimp lethality [15] effects. In addition, linalool has shown anti-inflammatory [16], antinociceptive [17], and antimicrobial [18] activities.

4. Conclusions

The bioactivities of the major constituents of *Uvaria chamae* leaf oil are consistent with the traditional medicinal uses of this plant

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