Volatiles Constituents from Leaves of *Morinda morindoïdes (Rubiaceae):* A Medicinal Plant from the Ivory Coast

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Abstract: The essential oil of *Morinda morindoïdes,* a famous medicinal herb from the Mid-West Ivory Coast, was isolated in low percentage 0,2%w/w and studied by GC and GC/MS. The analysis showed the presence of 50 compounds (91.8%). These consisted of 3 diterpenes (29.6%), 30 sesquiterpenes (35.4%) 10 monoterpenes (14.7%) and 7 aromatics compounds (12.1%). The main components were *trans*-phytol (28.4%), 6, 10, 14-triméthylpentadecan-2-one (9.6%) and linalol (8.4%) as secondary products.

Keywords: *Morinda morindoïdes,* hydrodistillation, diterpenes, *trans*-phytol, 6,10,14-triméthylpentadecan-2-one, linalol.

INTRODUCTION

Morinda morindoïdes (Baker) Milne-redheat (Rubiaceae) is a small tree which grows in forest locations. In the Ivory Coast, people have used the aqueous extract of the leaves of this plant in the treatment of paludism, measles and chicken-pox because of its fever-attenuating properties. Several studies based on the biological activity of the aqueous or organic extract of this plant were described particularly with regard to antimalaria and antibacterial activities. The ethanol and methylene chloride extracts from *Morinda morindoïdes* have been used for the treatment of malaria in the Congo and have been shown to inhibit *Plasmodium falciparum* growth *in vitro* [1]. Ethanolic, dichloromethane and lyophilized aqueous extracts of *Morinda morindoïdes* have been shown to be effective *in vivo* against *Plasmodium berghei* ANKA in mice [2]; a petroleum ether extract showed significant *in vitro* inhibition of antiplasmodial activity when compared to an ethanolic extract [3]. Five iridoids isolated from an 80% methanolic extract from an aqueous decoction of leaves of *Morinda morindoides* exhibited promising anti-amoebic activity [4]. Recently, an acetic acid extract (ACE) of *Morinda morindoïdes* (Baker) Milne Redheat leaves showed *in vitro* antibacterial activity on the growth of *Escherichia coli,* which is responsible for diarrhea in children [5].

The goal of this study is to identify the structures of volatile components of the essential oil of the leaves of *Morinda morindoïdes* from Ivory Coast, which might be responsible for the reported biological activity of this plant. .

EXPERIMENTAL

Plant Materials

Fully matured leaves of *Morinda morindoïdes* were freshly collected in May, 2008 at 8 am local time from trees growing at a location in the village of Bobia in the Ivory Coast. Voucher specimens were identified by Professor Ake Assi from the Floristic Center of Cocody University of the Ivory Coast. 500g of leaves were conditioned to be distilled in water.

Isolation of Essential Oil

The fresh leaves of the plant (500g) were distilled in 200 mL of water for 2 h in a Clevenger-type apparatus. The collected essential oil was dried over anhydrous sodium sulphate and preserved in a sealed sample tube and stored at 0°C until GC and GC-MS analyses.

Chemical Analyses

The essential oil was investigated first by gas chromatography (GC) and then by GC coupled with mass spectral detection (GC-MS). Concerning GC analysis, the gas phase chromatography was carried out using a Delsi DI 200 instrument equipped with a flame ionization detector and a DB5 column (25m x 0.25 mm, df: 0.25 micro m) with a split flow rate of 60mL/min. Nitrogen was used as carrier gas; temperature programming was 5min at 50°C and 30°C/min up to 220°C, injector temperature was 220°C and detector temperature was 250°C. For GC-MS, the essential oil was analyzed using a Hewlett-Packard gas Chromatograph Model 6890 coupled to a Hewlett-Packard MS Model 6890 equipped with an HP5 column(30m x 0.25mm df: 0.25 micro m) programmed from 50°C (5min) to 300°C at 50°C/min and 5 min hold. The carrier gas was He (1.0 mL/min); injection was set in the split mode (1/10). Injector and detector temperatures were 250°C and 320°C, respectively. Ionization was by electron impact at 70 eV, the electron multiplier was set at 2200 V, and ion source temperature was 230°C. Mass spectral data were acquired in the scan mode in the m/z range of 33-450. Identification of compounds was carried out by calculating Retention Indices (RI) or Kováts Indices (KI) and comparing mass spectra with those in data banks, i.e. Adams [6] or Mc Lafferty and Stauffer [7].

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Table 1. Chemical Composition of Essential oil of Leaves of *Morinda morindoïde*

N°	KI	RI	Compound	Content %, w/w
			Monoterpenes	
1	1060	1060	gamma terpinene	0.2
2	1072	1068	n-octanol	0.1
3	1101	1096	linalol	8.4
4	1104	-	hotrienol	0.1
5	1193	1195	alpha terpineol	1.4
6	1197	1190	methyle salicylate	1.2
7	1221	-	beta cyclocitral	0.3
8	1225	1230	nerol	0.7
9	1251	1255	geraniol	1.5
10	1283	-	vitispirane	0.8
			► Total monoterpenes	***14.7***
			Sesquiterpenes	
11	1322	1330	hex-3-enyle tiglate	0.2
12	1337	1340	delta elemene	0.4
13	1380	1380	(E)-beta-damascenone	0.9
14	1391	1389	béta elemene	0.6
15	1424	1418	béta caryophyllene	3.1
16	1429	1430	(E)-alpha ionone	0.1
17	1447	1453	geranyl acetone	0.6
18	1460	1454	alpha humulene	0.7
19	1464	1463	6-demethoxy ageratochromene	1.2
20	1480	1485	D -germacrene	1.3
21	1485	1489	(E)-beta ionone	0.4
22	1493	1498	alpha selinene	0.8
23	1499	1498	tiglate de benzyle	0.9
24	1503	1506	(E,E)-alpha farnesene	0.8
25	1516	1514	gamma cadinene	0.3
26	1520	1523	delta cadinene	0.3
27	1529	-	zingigerone	0.2
28	1551	1549	elemol	0.5
29	1561	1564	nerolidol	0.3
30	1613	1613	tetradecanal	0.5
31	1628	1624	10-epi-gamma eudesmol	1.3
32	1655	1654	alpha cadinol	0.2
33	1660	1664	7-epi-gamma eudesmol	0.4
34	1666	1669	'hex-3-enyle salicylate	0.1

(Table 1). Contd…..

N°	KI	RI	Compound	Content %, w/w
			Monoterpenes	
35	1702	1700	eudesm-7(11)-en-4-ol	0.4
36	1715	-	pentadecanal	4.8
37	1836	1837	6,10,14-trimethyl pentadecan-2-one	9.6
38	1872	-	octadecan-9-yne	1.3
39	1878	-	methyle linolenate	2.9
40	1886	-	farnesyle acetone	0.3
			► Total sesquiterpenes	***35.4***
			Aromatic compounds	
41	1026	1025	para cymene	0.2
42	1291	1290	thymol	7
43	1573	1578	Z -hex-3-enyle benzoate	1
44	1581	1580	hexyle benzoate	0.5
45	1587	1588	E- 'hex-3-enyle benzoate	0.8
46	1770	1760	benzyle benzoate	0.9
47	1860	1866	benzyle salicylate	1.7
			► Total aromatics compounds	***12.1***
			Diterpenes	
48	1918	1944	isophytol	0.1
49	1945	1987	acide hexadecanoïque	1.1
50	2111	-	Phytol trans	28.4
			► Total diterpenes	***2.,6***
	TOTAL	**TOTAL**		**91.8**

RESULTS AND DISCUSSION

Morinda morindoïdes is an odorless plant, but the hydrodistillation of the fresh leaves of this plant gave essential oil in low yield (i.e. less than 0.2%). The chemical constituents identified by GC and GC-SM are listed in Table **1**.

Fifty compounds were identified representing 91.8% of volatiles. These volatiles were composed of 10 monoterpenes, 36 sesquiterpenes, 7 aromatic compounds and 3 diterpenes, amounting to 14.7%, 35.4%, and 29.6% w/w, respectively. The essential oil was dominated by the presence of the diterpene phytol (28.37%), followed by 6,10,14-trimethyl pentadecan-2-one (9.65%) and thymol (7.02%). We observed initially that the yield of volatiles was comparable with that of *Chromolaena odorata*, a famous aromatic antipaludic and antiinflammatory plant used in the Ivory Coast [8]. Secondly, the diterpene phytol was one of constituents of chlorophyll, and was present in the extract of several previously described plants [9] [10]. Yoshihiro *et al.* showed that phytol had antibacterial activity, inhibiting the growth of *Staphylococcus aureus* [11]. Our study suggests that *Morinda morindoïdes* may be a potential source of *trans*-phytol for antiplasmodial (malaria), antibacterial (*Escherichia coli*) (diarrhea) and *Entamoeba histolytica* (amoebic pains) use in medicine.

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