Pelagia Research Library

Der Chemica Sinica, 2012, 3(5):1276-1279

Pelagia Research Library
ISSN: 0976-8505
CODEN (USA) CSHIA5

Chemical composition of *Vetiveria nigritana* from Koulikoro Area

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ABSTRACT

Oil was obtained from roots of Vetiveria nigritana (Benth.) Stapf collected in Koulikoro and analyzed by GC and GC/MS. Fifty-four constituents (79.7% of the whole oil) were identified. Prezizanoic acid (15.0%), preziza-7(15)-en-12-ol (9.5%), cedren-8-en-15-ol (6.2%), preziza-7(15)-en-3α-ol (6.0%) and zizanoic acid (5.9%) were the major componelits of Vetiveria nigritana oil.

Key Words: *Vetiveria nigritana*, Poaceae, essential oil composition, prezizanoic acid.

INTRODUCTION

The first botanical descriptions of this plant were published in *Niger Flora* [1] and in *Flora of Tropical Africa* [2]. In some countries of Africa, in particular Senegal, Gabon, Mali and Niger, roots of *Vetiveria nigritana* were used in the following fields: perfume, cosmetics and medicine. Macerations or infusions of roots were added 10 drinking water or used as an antidiarrheal for children [3].

In spite of traditional use, there was no work about any Components of these roots. Only a few articles were previously published about Angolan root oil Cardoso et al. [4, 6] and Nigam et al. [7]. Hutchinson et al. made reference to the variations of percentage of essential oil certainly relating to the soils [8]. In the book on genus *Vetiveria* published in 2002, Maffei [9] reported ail studies concerning *V. zizanioides*, but only mentioned *V. nigritana* without any comment.

In this work, we have analysed the composition of the oil from the roots of *V. nigritana* from Koulikoro.

MATERIALS AND METHODS

- Vegetable material

Roots of *Vetiveria nigritana* were collected from Koulikoro, near Bamako (Mali, Africa) in March 2010. Plant material was identified by Aymonin G (Muséum d'Histoire Naturelle, Paris, France). A voucher specimen of the whole plant has been deposited in the Herbarium of the University of Clermont-Ferrand (France).

- Plant Part

The oil was obtained from air dried roots by steam distillation in Kaiser & Lang-type apparatus for 12 h to produce yellow oil in 2% w/w yield.

Table I. Percentage composition of the essential oil of *Vetiveria nigritana*

Compounds [a]	RRI [b]			
	1	2	MW	%
α-cubebene	1351	1628	204	0.2
$C_{14}H_{20}$ *	1369		188	0.9
α-funebrene	1385	1532	204	0.2
$C_{14}H_{22}$ *	1387		190	2.2
β-cubebene	1390		204	1.2
β-cedrene	1424		204	1.6
β-gurjunene	1334		204	0.4
preziza-7(15)-ene	1452	1666	204	1.7
γ-gurjunene	1472		204	0.1
ar-curcumene	1480		204	0.2
α-vetispirene	1481	1754	204	t
germacrene D	1485		204	0.2
α-muurolene	1500		204	0.3
β-bisabolene	1506		204	0.1
γ-cadinene	1514		204	0.1
β-curcumene	1516		204	0.2
Isocalamenene	1517		204	0.2
myristicin	1519		192	0.2
spirovetiva-1(10,7(11)-diene	1523	1759	204	t
eremophila-1(10),7(11)-diene	1525	1764	204	0.1*
γ-vetivenene	1525	1837	204	0.2
ω-cadinene	1526		204	0.2
α-calacorene	1527	1946	204	0.1
elemol	1550	2093	222	0.2
15-nor-prezizaan-7-one	1572		206	0.2
ar-turmerol	1583		218	0.1
12-nor-preziza-7(15)-en-2-one	1593		204	2.7
15-nor-funebran-3-one	1599		206	0.2
13-nor-eudesma-5-en-11-one (epimer B)	1603		206	1.1
12-nor-ziza-6(13)-en-2-one (khusimone)	1604	2219	204	0.7
12-nor-ziza-6(13)-en-2 β-ol	1610		206	1.7
funebren-15-al	1618		218	5.1
10-epi--eudesmol	1624	2135	222	0.8
Preziza-7(15)-en-3α-ol	1640		220	6.0
β-eudesmol	1651	1651	222	1.0
cyclocopacamphan-1 2-ol (epimer A)	1663	2358	220	0.7
ziza-6(13)-en-3-one (3β- methyl group)	1682		218	0.6
2-epi-ziza-6(13)-en-3α-ol	1683	2427	220	0.5
prezizaan-l 5-al	1683		220	2.2
2-epi-ziza-6(13)-en-12-al	1689		220	0.3
khusian-2-ol (helifolan-2-ol)	1694	2359	222	1.9
cedren-8-en-15-ol	1695		220	6.2
ziza-6(13)-en-12-yl methyl ether	1698		248	0.1
eudesm7(l1)-en-4α-ol (juniper carnphor)	1700		222	0.2
ziza-6(13)-en-3β-ol	1705	2442	220	0.8
(E)-opposita-4(15),7(11)-dien-12-al	1707		218	0.2*
ziza-5-en-12-ol	1713	2434	220	1.6
ziza-6(13)-en-12-ol (khusirnol)	1743	2547	220	2.3
preziza-7(15)-en-12-ol	1761		220	9.5
isovalencenol	1782		220	0.8
isozizanoic acid	1786		234	0.3
vetiselinenol	1793		220	0.7
(Z)-isovalencenal	1812		218	0.2
zizanoic acid	1871		234	5.9
prezizanoic acid	1884		234	15.0
$C_{15}H_{22}O_2$ *acid			234	7.5
Hexadecanoic acid			256	2.4
TOTAL				**90.3**

[a]components Iisted in order cf elution trama HPS MS colunin; [b]RRI relative retenhion indices, calculated relative o 06— C32 nalkanes on the HPS MS (1) and HP Innowax (2)

capillarycolumns, respectively; unknownconp000ds2m/z 188(M) (95)173(86). 159 (20), 145 (100), 132 (35), 131 (55), 117 (68), 105 (25), 91 (50): 4: miz: 190 (M') (55), 175 (68), 161 (36),147 (27), 120 (47), 119(100), 105 (40), 92(36), 91 (70); 56: mjz: 234 (M') (22), 219(20). 189 (42), 173 (28), 164 (47), 147 (30), 145 (47), 131 (36), 119(60), 117(100), 108 (48), 105(37),91(56), 79(37), 67(23)

- GC and GC/MS

GC analyses were performed on a Hewlett Packard HP 6890 equipped with a split/splitless injector (280°C), a split ratio 1:10, using a HP-5 capillary column (25 m x 0.25 mm, film thickness 0.25µm). The temperature program was 50°C (5 mm) rising to 300°C at a rate of 5°C/min. Helium was used as the carrier gas at flow rate of 1.1 mL/min. The injection of the sample consisted of 1.0 µL of the oil diluted to 10% v/v with acetone.

GC/MS analyses were performed by a Hewlett Packard 5973/6890 system operating in EI mode (70 eV), equipped with a split/splitless injector (280°C), a sp ratio 1:10, using two different columns: a fused silica HP-5 MS capillary column (25 m x 0.25 mm, film thickness 0.25 tm), and a HP-Innowax capillary column (60 m x 0.25 mm, film thickness 0.25 µm).

The temperature program for the HP-5 MS column was 50°C (5 min) rising to 300°C at a rate of 5°C/min and for the HP- Innowax column, 50°-250°C at a rate of 5°C/min. Helium was used as the carrier gas at a flow rate of 1.1 mL/min. Retention indices for all compounds were determined according to the Van den Dool approach [10]. The identification of components was based on comparison of their mass spectra with those of Mc Lafferty and Stauffer [11], Adams [12] and Joulain [13] libraries, as well as by comparison of their retention indices with literature data.

RESULTS AND DISCUSSION

The composition of the oil from the roots of *V. nigritana* is summarized in Table I.

Fifty-seven compounds were detected (90.3% of the oil), among those, 54 were identified (79.7%).This oil was principally characterized by the presence of only sesquiterpene compounds. Alcohols and acids were the most important components (33.7% and 31.1%, respectively). Among the alcohols, preziza-7(15)-en-12-ol (9.5%), cedren-5-en-15-ol (6.2%), preziza-7(15)-en- 3-ol (6.0%), were the main compounds. The major acids were prezizanoic acid (15.0%), compound n°56 (7.5%) and zizanoic acid (5.9%). The sesquiterpene hydrocarbons (10.5%) were mainly represented by compound n°4 (2.2%), preziza-7(15)-ene (1.7%) and -cedrene (1.6%). 12-Nor-preziza-7(15)-en-2-one (2.7%) was the main ketone arnong a low percentage of total ketones (5.5%). Other components were found to be aldehydes (8.0%) and esters (0.1%).

The composition of oil of *V. nigritarza* ‘vas compared to those of oils of *V. zizanioides* from different countries. Wey erstahl reported the composition of an Haitian oil [14], and more recently, Champagnat et al. studied *V zizanioides* oils from nine different geographical origins (unpublished work). The results of these authors are concordant and show that *V. zizanioides* olis from any geographical origin were characterized by the presence of 40-57% alcohols, 15-25% hydrocarbons, 13-16% ketones, approximately 5% aldehydes, a very low amount of esters (< 1%), and especially by a 1ow percentage of acid compounds (< 2%).

As a result, the composition of the oil of V. *nigritana* (from Koulikoro) was mainly different from that of V. *zizanioides*, regarding the hydrocarbon and acid contents of these oils.

Acknowledgment
We are grateful to Aymonin G (Muséum dHistoire Naturelle, Paris) for helpful assistance in botanical identification.

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