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Constituent of Leaf Oil of *Croton zambesicus* Muell. Arg Growing in North Central Nigeria

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Abstract: Pulverized leaves of *Croton zambesicus* afforded oil in the yield of 0.21% v/w. GC, GC/MS analysis of the oil revealed the abundance of hydrocarbon and oxygenated monoterpenoids (64.7 and 20.7% respectively). Predominant monoterpenoids were; limonene (40.3%), γ-terpinene (12.1%), β-pinene (10.4%), neral (9.4%) and geranial (6.3%). Sesquiterpenoids that exist in appreciable quantities were; β-bisabolene (1.3%), germacrene D (1.2%) and bicyclogermacrene (1.0%).

Key words: *Croton zambesicus* · Essential oil · Limonene · γ-terpinene · β-bisabolene · Germacrene D.

INTRODUCTION

Croton Zambesicus Muell. Arg (Euphorbiaceae) is a Guinea-congolese species widely used in tropical Africa. It is grown as ornamental plant in Nigeria where it is commonly known as Ajeobale by the Yorubas [1]. Its use in traditional medicine for the treatment of several ailments like, hypertension, diabetics, urinary tract infections, malaria, gonorrhea anthritis, diarhoea and impotence have been reported [1,2]. The therapeutic properties of the plant have been established by various workers. For instance, non-volatile extracts of the plant are known to possess; vesorelaxant, antidiabetic, antimalaria and antimicrobial properties [3-5].

Three trachylobanes, one isopimarene, a trans-phytol and two diterpenes have been isolated from the leaves of C. Zambescus [6,7]. Menut *et al.*[8] have investigated the leaf oil of central African grown C. Zambesicus. The principal constituent of the oil were; p-cymene, linalool and β-caryophyllene. β-caryophyllene, α-copanene, linalool and β-pinene have been identified as the major constituents of Benin grown C. Zambesicus [9]. Less polar diterpenes; ent-trachyloban-3-one, ent-trachyloban-3β-ol, isopamara-7-,15-dien-3β-ol, ent-trachylobane, sandara copimaradiene and kaurene were also identified in the oil. Fekam et al. [10] investigated the leaf oil of Cameroonian grown C. Zambesicus, their report revealed the abundance of hydrocarbon monoterpenoids in the oil.

In continuation of our systematic study of the essential oils of Nigerian medicinal plants, we investigated the leaf oil of *Croton zambesicus.*

Experimental

Plant Materials: The fresh leaves of *C. zambesicus* were obtained in Ilorin, Kwara State, North Central Nigeria. Identification was carried out at the herbarium of the Department of plant Biology University of Ilorin, were voucher specimens were deposited

Oil Isolation: Pulverized leaves were hydrodistilled for 3h in a Clevenger-type apparatus, according to the British Pharmacopoea Specification [11]. The resulting oil was collected, preserved in a sealed sample tube and stored under refrigeration until analysis.

Gas Chromatography: GC analysis were performed on an orion micromat 412 double focusing gas chromatography system fitted with two capillary columns coated with CP-Sil 5 and CP-Sil 19 (fused silica, 25m × 0.25mm, 0.15μm film thickness) and flame ionization detector (FID). The volume injected was 0.2μL and the split ratio was 1:30. Oven temperature was programmed from 50°C-230°C respectively. Qualitative data were obtained by electronic integration of FID area percents without the use of correction factors.

Gas Chromatography/Mass Spectrometry: A Hewlett Packard (HP 5890A) GC interfaced with a VG Analytical 70-250S double focusing mass spectrometer was used. Helium was the carrier gas at 1.2ml/min. The MS operating conditions were: ionization voltage 70ev, ion source temperature 230°C. The GC was fitted with a 25m×0.25mm, fused silica capillary column coated with CP-Sil 5.

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The film thickness was 0.15μm. the GC operating conditions were identical with those of GC analysis. The MS data were acquired and processed by online desktop computer equipped with disk memory. The percentage compositions of the oil were computed in each case from GC peak areas. The identification of the components was based on the retention indices (determined relative to the retention times of series of n-alkanes) and mass spectra with those of authentic samples and with data from Literature [12-14].

RESULTS AND DISCUSSION

Pulverized leaves of *Croton zambesicus* on hydrodisstillation afforded oil in yield of 0.21%v/w. the yield compared favourably well with the yield from the leaf of Cameroonian grown *C. zambesicus* [10].

Table 1 shows the retention indices, relative percentages and identities of the constituents of the oil. A total of 28 compounds representing 96.4% of the leaf oil were identified from their mass spectra. The constituents of the oil were; hydrocarbon monoterpenoids (64.7%), Oxygenated monoterpernoids (20.7%), hydrocarbon sesqiuterpenoids (5.3%), oxygenated sesquiterpenoids (1.5%) and aromatic compounds (4.2%).

Quantitatively, the oil was characterized by the abundance of limonene (40.3%), β-pinene (10.4%), γ-terpinene (12.1%), neral (9.4%) and geranial (6.3%). The aforementioned compounds are the principal constituents of the oil. Other compound that existed in appreciable proportions in the oil includes; borneol (1.5%), β-bisabolene (1.3%), ethylcinammate (1.2%), germacrene D (1.2%), eugenol (1.2%), 1,8-cineole (1.1%) and bicyclogermacrene (1.0%).

Comparison of the composition pattern of the oil with Benin, Cameroon and Central African grown *C.zambesicus* revealed qualitative and quantitative differences [8-10]. The principal constituents in this study such as limomene, β-pinene, γ-terpinene , neral and geranial existed as minor constituents in the oil of Benin and Cameroonian grown *C. zambesicus*. Other principal constituents of the oil also existed as minor constituents in the oil of Central African grown *C. zambesicus* except β-pinene. P-cymene and linalool that constituted sizeable proportions of the leaf oil of Central African grown *C. zambesicus* were not identified in this study. Meanwhile, linalool that constituted a sizeable proportion of leaf oil of Benin grown *C. zambesicus* was found as predominant compound in Central African grown *C. zambesicus*. On the other hand, caryophyllene oxide and α-copaene that existed as predominant compounds sin Benin grown *C. zambesicus* could not be identified in Nigerian grown *C. zambesicus*. However, β-caryoophyllene one of the major constituents of Central African and Benin grown *C. zambesicus* occurred as a minor constituents in the oil of Nigerian grown *C. zambesicus*. Both qualitative and quantitative variation in the constituents of the oils from the three countries may be due to the variation in their geographical and agro climatic conditions. From the above facts it is evident that the quality of the essential oils obtained from the three countries varies considerably.

Table 1: Chemical composition (%) of leaf oil of *Croton* zambesicus

Compound[a]	RI[b]	Percentage composition
α-thujene	925	0.6
α-pinene	933	0.5
sabinene	971	t
β-pinene	976	10.4
myrcene	990	0.7
limonene	1027	40.3
1,8-cineole	1029	1.1
cis-ocimene	1035	0.1
γ-terpinene	1057	12.1
borneol	1162	1.0
terpinen-4-ol	1175	0.5
α-terpineol	1187	0.9
neral	1238	9.4
geranial	1268	6.3
borneol acetate	1284	1.5
eugenol	1354	1.2
α-copane	1375	0.5
β-elemene	1391	0.4
β-caryophyllene	1418	0.9
ethyl cinamate	1460	1.2
germacrene D	1479	1.2
bicyclogermaerene	1494	1.0
β-bisobolene	1509	1.3
acetyl eugenol	1523	0.5
elemicin	1553	0.4
viridiflorol	1589	0.9
torreyol	1643	0.6
benzyl benzoate	1761	0.9
Total		96.4

[a]Compounds are listed in order of elution from silica capillary column coated in CP-Sil 5; [b]retention indicies on fused silica capillary column coated with CP-Sil 5 t=trace (<0.1%)

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