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GC/MS Analysis and Evaluation of Antimicrobial Performance of Aframomum Latifolium Leaf Essential Oil from South West Nigeria

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ABSTRACT

This study was conducted to analyze the chemical constituent and to evaluate the antimicrobial properties of the leaf essential oil of Aframomum latifolium.

The leaves of this plant was subjected for hydro distillation using all glass Clevenger apparatus. The volatile oil obtained was analysed by means of gas chromatography/mass spectrometry (GC/Ms). The oil yield was 0.08% v/w. Seventeen components were identified in the leaf essential oil accounting for 99.90% of the total oil fraction. The leaf oil was dominated by oxygenated monoterpenes (51.26%) and monoterpenes (36.22%). Cajeputol, an oxygenated monoterpene is the component with the highest percentage composition 45.05%, cyclofenchene 7.82%. Peperitone is the component with the lowest percentage 0.43%. The oil displayed high antimicrobial Potentials to Staphylococos aureus, Escherichia Coli, Bacillus subtilis, Pseudomonas aeruginosa, Candida albican and aspergillus niger at 100%, 50% and 25% and a moderate inhibition at 12.5 and 6.25%

The result obtained from this study justifies the use of the leaf of this plant in ethnomedical practices.

KEYWORDS: *Aframomum latifolium, oxygenated monoterpenes, fungi, gram negative bacteria, gram positive bacteria*

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INTRODUCTION

The genus Aframomum is in the ginger family Zingiberaceae. It is spread across tropical Africa and some island of the Indian ocean [.1]. The genus comprises of 50 species and it is the largest genus in the family [2]. They are perennial and every part of the plant is aromatics [3,4]. In south west part of Nigeria, *Aframomum latifolium* is not cultivated but it occurs in the wild. In Nigeria the genus Aframomum is used in combination with other pepery and spicy plant part to make medicinal soup popularly called pepper soup. *Aframomum latifolium* is not popular in the genus unlike *Aframomum melegueta* because it is not as peppery and spicy. In south west Nigeria, the seed in the fruit is consumed as a fruit and it is consumed to relive cough. The rhizome is consumed as a purgative, while the decoction of the leaf is used in the treatment of cough.

A lot of biological investigations have been conducted on Aframomum species and they were found to have antimicrobial, antifungal, antiprotozoal, aphrodisiac, antitussive, analgesic, antiulcer and antioxidant potentials [5,6,7,8,9,10].

There are several reports on the essential oil composition of Aframomum species, there is a clear evidence that the volatile component is rich in monoterpenoids, sesquiterpinoids and few diterpenoids [17,18]. Labdaine diterpenoids, flavonoids, sesquiterpinoids and some other non volatile constituents have been isolated as a non-volatile constituent in this genus.

However, existing literature on the chemical composition and the evaluation of the antimicrobial potential of the specie is scanty, therefore, this paper reports the GC/MS analysis and the evaluation of the antimicrobial potential of *Aframomum latifolium* growing in south west part of Nigeria.

MATERIALS AND METHODS

Plant Material and Isolation of Essential Oil

Aframomum latifolium plants were collected from isemi ile area, in the northern part of Oyo State South West Nigeria in September 2018. The plant was authenticated at Forest Research Institute of Nigeria, Ibadan. Fresh sample of the plant (500g) was washed and the leaves were removed, cut into small pieces and blended with a fast rotating blender. The pulp obtained were subjected to hydro-distillation using an all glass Clevenger apparatus according to European Pharmacopoeia 2008 [17]. The oil was collected and kept in the refrigerator without further treatment before Gc-Ms analysis.

Gas Chromatography/Mass Spectrometry Analysis

The chemical composition of the volatile oil was analyzed using GC/Ms technique. The mass spectrometer was SHIMADZU GcMs-QP2010 plus (Shimadzu Corporation, Japan) the electron impact (EI) ionization mode (70ev) and Hp-5Ms (bonded 0.25Vμm) capillary column.

Injector and detector temperature were set at 250^{0}C. The oven temperature was held at 60^{0}C_for 30 minutes, then programmed to 240^{0}C at rate of 5^{0}C/Min. Helium was the carrier gas at a flow rate of 1ml/min diluted samples (1/100 in hexane v/v) of 1.0ml were injected automatically. The linear velocity of the column was 36.8cm/sec, each peak was then analysed and assigned a number in the order that it was detected. The identification of the components was based on comparison of their mass spectra with those of NIST library, mass spectra data base and literature.

RESULTS AND DISCUSSION

The hydro-distillation of the leaf of *Aframomum latifolium* from south west Nigeria produced a pale yellow essential oil. The volatile oil yield is 0.08% v/w of the wet sample. The yield is quite the same as obtained from previous works on other species in this genus [14, 16]. The chemical components identified by GC/Ms is presented in Table 1. Seventeen components were identified from the leaf essential oil. The volatile oil was constituted mainly by oxygenated monoterpenes (51.26%) and monoterpenes (36.22%). Cajeputol an oxygenated sesquiterpenes has the highest concentration in the volatile oil (45.05%) followed by a monoterpene, **β**-pinene (20.97%). Piperitone, 0-menth-8-ene-methanol, alpha, alpha dimethyl-1-vinyl-, (1s,2s,4R) – (-) – are the components with the lowest concentration with 0.43 and 0.44% respectively.

Table 1: Chemical Constituents of the leaf Essential oil of *Aframomum Latifolium*

S/N	Retention Index	Component	% composition
1	729	Cyclofenchene	7.82
2	873	Beta-Thujene	0.63
3	943	Nopinene	0.71
4	943	**β**-Pinene	20.97
5	969	Alpha-fellandrene	6.09
6	1054	Isoamyl Valerianate	0.73
7	1059	Cajeputol	45.05
8	1131	L-trans-pinocarveol	0.61
9	1137	L-terpinen-4-ol	3.00
10	1143	Alpha-Terpineol (-)	1.44
11	1158	Piperitone	0.43
12	1386	Aromadendrene	2.90
13	1431	Gamma-Elemene	4.94
14	1522	0-menth-8-ene-methol, alpha, alpha-dimethyl-1-vinyl-, (1s,2s,4R)	0.44
15	1530	Globulol	2.32
16	1530	Ledol	0.90
17	1536	Spathulenol	0.92
	Monoterpenes	Monoterpenes	36.22
	Oxygenated monoterpenes		51.26
	Sesquiterpenes		7.84
	Oxygenated sesquiterpenes		4.58
	Total		99.90

In addition, *The oil displayed high antimicrobial Potentials to Staphylococos aureus, Escherichia Coli, Bacillus subtilis, Pseudomonas aeruginosa, Candida albican and aspergillus niger at 100%, 50% and 25% and a moderate inhibition at 12.5 and 6.25%*shown in table 2.

Table2: Zones of Inhibition (mm) Showing the Antimerobial Activity of the leaf Essential oil of *Aframomum latifolum*

	Staphylococos aureus	*Escherichia coli*	*Bacillus Subtilis*	*Pseudomonas aeruginosa*	*Candida albicans*	*Aspergillus niger*
1	26	24	22	20	16	18
2	22	20	18	18	14	16
3	18	18	16	14	12	14
4	14	14	12	12	10	10
5	10	10	10	10	-	-
-ve	-	-	-	-	-	-
+ve	38	40	40	38	28	26

Key

-ve- DMSO
+ve Gentamicin 10μg/ml (Bacteria)
Tioconazole 70% Fungi
1 → 100%
2 → 50%
3 → 25%
4 → 12.5%
5 → 6.25%

CONCLUSION

The result obtained in this study showed that Aframomun Latifolium leaf posses essential oil and the result obtained differ slightly from the one reported in literature from cote d'ivoire and Benin Republic. The Yield is in the same range as reported for other specie in the genius. The presence of ledol, an antifungal, toxic sesquiter penoid which exhibits expectorant and antitosive effect justifies the use of the leaf of this plant as cough expectorant and an anti tussive agent. Further work may be done on the characterization of the volatile constituents of other parts of the plant and also the cytotoxicity of the volatile oil should be conducted because of the presence of ledol.

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