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Gas chromatography–mass spectrometry (GC-MS) analysis of leaf, stem-back and root extracts of *Alstonia boonei*

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Medicinal plants have had a crucial role in human culture and civilization. *Alstonia boonei* De Wild is a medicinal plant commonly found in West African and is popularly known as God's tree. The plant parts have been traditionally used for painkiller, antimicrobial, antimalarial and antidiabetic which have also been proved scientifically. Previous studies revealed little information on phytochemcial components of *A. boonei.* The present work aims at investigating and comparing the chemical components of the leaf, the stem and the root of the plant in order to provide sufficient baseline information for future work and for commercial exploitation. Leaf, stem and root extracts of *A. boonei* were prepared by maceration using 1:1 EtOAc/MeOH and 100% dichloromethane (DCM) as extraction solvents. Gas chromatography and Mass spectroscopy studies were performed to identify the phytochemical constituent of the plant. The Gas chromatography–mass spectrometry (GC-MS) analysis of DCM extract of the leaf revealed ten chemical components with Eugenol as major component (54.58%); DCM extract of the stem showed forty one components with alpha-amyrin (32.25%) while DCM extract of the root revealed twenty components with 1,2-benzenedicarboxylic acid (49.2%) as major component. This study shows that the *A. boonei* extracts of the leaf, stem-back and root consist of different types of compounds with few compounds common to two of the parts. The most identified compound by GC/MS were Eugenol, benzenedicarboxylic acid and alpha-amyrin

Key words: Phytochemicals, *Alstonia boonei*, gas chromatography/mass spectroscopic studies.

INTRODUDUCTION

A. boonei De Wild belongs to the family Apocynaceae. It's a herbalmedicinal plant of West African origin, popularly known as cheese wood and known locally among Yoruba in Nigeria as Ahun. All the parts of the plant are very useful but the thick bark cut from the matured tree is the part that is most commonly used for therapeutic purposes.Therapeutically, the bark has been found to possess antirheumatic, anti- inflammatory (Abbiw, 1990), analgesic, antimalaria, antidiabetic, antihelminthic, antimicrobial and antibiotic properties

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Table 1. Chemical composition of leaf, stem-back and root of *A. boonei*.

S/N	Constituent	% composition		Root
		Leaf	Stem-back	
1	Eugenol	54.58(9.730)	0.14(9.722)	-
2	4-Tetradecene	-	-	1.39(10.185)
3	Caryophyllene	6.99(10.631)	-	-
4	Phenol	2.01(12.148)	-	0.56(11.970)
5	1H-2-Benzopyran-1-one	-	0.54(12.434)	-
6	Cyclododecane	-	0.28(12.943)	-
7	Dichloroacetic acid	-	-	4.83(12.943)
8	Hexadecane	-	0.16(13.033)	1.32(113.029)
9	2H-Pyran-2-one	-	1.54(13.161)	-
10	2-Ethyl-3-methoxypyrazine	-	0.34(14.334)	-
11	1-Octadecene	-	0.37(15.324)	6.59(15.323)
12	Octadecane	-	0.15(15.398)	1.35(15.392)
13	Cyclononasiloxane	-	0.20(15.713)	-
14	Bicyclo(3.1.1)heptane	2.61(15.833)	-	-
15	1,2-Benzenedicarboxylic acid	-	-	49.20(16.210)
16	Phthalic acid	-	0.15(16.216)	-
17	7,9-Di-tert-butyl-1-oxaspiro(4,5) deca-6,9-diene-2,8-dione	-	-	1.13(16.777)
18	Hexadecanoic acid	2.13(16.765)	0.67(16.777)	-
19	n-Hexadecanoic acid	5.40(17.183)	1.40(17.303)	-
20	Dibutyl phthalate	-	-	2.61(17.200)
21	6H-Furo[2',3':4,5]oxazolo[3,2-a]pyrimidin-6-one	-	0.24(17.338)	-
22	Heptafluorobutyric acid	-	0.25(17.458)	-
23	n-Nonadecanol-1	-	0.28(18.391)	5.90(17.452)

(Hadi and Bremner, 2001; Fakae et al., 2000; Kam et al., 1997). A wide array of chemical compounds has been isolated from *A. boonei*. These include alkaloids, tannins, iridoids, and triterpenoids (Ayiku, 1992). The alkaloids isolated from the plant include echitamine,echitamidine and voacangine (Ayiku, 1992; Kucera et al., 1972; Croquelois et al., 1972; Oguakwa, 1984). Echitamine possess a battery of pharmacological and autonomic activities (Ojewole, 1984, 1983) including anticancer activities (Chandrasekaran and Nagarajan, 1983; Saraswathi et al., 1997; Saraswathi et al., 1998a, b; Saraswathi et al.,1999; Viswanathanet al .,1997; Kamarajan et al., 1991; Keawpradub et al., 1997). Iridoids isolated from *A. boonei* include boonein and loganin. Loganin is a key intermediate in the biosynthesis of indole alkaloids. The triterpenoids isolated from *A. boonei* include lupeol, ursolic acid and â-amyrin.

MATERIALS AND METHODS

Sample preparation

A. boonei leaf, stem-back and root were collected at a farmland in Akinmarin village, Oyo and were identified at the Department of Botany, University of Ibadan, Ibadan. The air-dried plant materials: (204.7 g) leaves, (282.5 g) stem-bark, and (102.9 g) root of, *A. boonei*, exhaustively extracted separately with 1:1 EtOAc:MeOH for 3days. The extracts were filtered separately, concentrated on rotary evaporator to about 50 mL and evaporated to dryness under vacuum. Each extract was marcerated with DCM to obtain DCM fraction of the three parts. Obtained fractions were evaporated to dryness and stored in a refrigerator at +4°C until use.

Gas chromatography (GC)–mass spectrometer (MS) analysis

GC-MS: Hewlett-Packard 5890 gas chromatograph,combined with a Jeol JMS-HX 110 mass spectrometer with sourceat 270°C at 70 eV. Injector was set at 270°C with splitting ratio1:30. The analysis was performed on the aforementionedprogramme on equivalent column HP-5 (25 m × 0.22 mm and 0.25 ìmdf). A mass spectral survey was performed using the NISTmass spectral search program.

RESULTS AND DISCUSSION

GC-MS analyses of DCM fraction of the leaf, the stem-back and the root column of *Alstonia boonei* are presented in Table 1. Constituents were listed in order of elution from HP-5 capillary column (Table 1). Gas chromatography-mass spectrometry analysis of the leaf extract resulted in the identification of ten (10)

Table 1. Cont'd

24	Eicosane	-	0.16(20.365)	1.34(17.509)
25	Ethanone	-	-	1.30(17.767)
26	1-Heneicosanol	2.88(17.950)	-	-
27	Behenic alcohol	-	-	3.21(18.373)
28	9,12-Octadecadienoic acid	-	0.34(18.488)	-
29	11-Octadecenoic acid	-	0.26(18.545)	-
30	Phytol	1.63(18.665)	-	-
31	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	-	0.33(18.820)	-
32	Oleic Acid	-	0.46(18.986)	-
33	1-Octadecene	-	0.19(19.192)	-
34	1-Docosene	13.28(22.585)	-	3.65(19.392)
35	2-Eicosanol	-	0.14(19.398)	-
36	Docosane	-	-	0.66(19.438)
37	6-Acetamido-2-methylbenzothiazole	-	0.78(20.090)	-
38	Cyclotetracosane	-	-	2.56(21.337)
39	Hexasiloxane	-	0.40(21.686)	-
40	2(3H)-Furanone	-	-	0.82(22.430)
41	1-Heptadecene	-	-	0.92(22.659)
42	Tetratetracontane	-	0.95(22.693)	-
43	Oxirane	-	0.27(23.186)	-
44	Olean-12-ene	-	0.63(24.948)	-
45	1S,6R,9S)-5,5,9,10-	-	1.29(25.245)	-

compounds, forty one (41) compounds in stem-back extract and twenty (20) compounds in root extract. A comparative analysis of chemical profiles of the leaf and stem-back showed that Hexadecanoic acid and n- Hexadecanoic acid were present in the two parts but in higher proportion in the leaf while phenol and 1-Docosene were present in the leaf and the root. Hexadecane, 1-Octadecene, Octadecane, n-Nonadecanol-1 and Eicosane were present in both stem-back and root. The results revealed that Eugenol (54.58), 1-Docosene(13.28), 2, 6, 10, 14, 18, 22-Tetracosahexaene (8.50), Caryophyllene (6.99) and n-Hexadecanoic acid (5.40) were found as the five major components in the leaf extract, the minor compound was Phytol. The major constituents of stem-back extract werealpha-amyrin (32.25), 2(1H) Naphthalenone (10.32), 9, 19-Cycloergost-24(28)-en-3-ol (9.13)and Urs-12-en-3-ol (7.76) while the major component found in root were 1,2-Benzenedicarboxylic acid (49.20), 1-Octadecene(6.59) and n- Nonadecanol-1(5.90).

Conclusion

The present study represents the comprehensive analysis of phytochemical constituents of*Alstonia boonei*leaf, stem-back, and root DCM extracts. The presence of various phytochemicals contributes to the medicinal activity of the plant. The results will form the basis for selection of plant species for further investigation in the potential discovery of new natural bioactive compounds.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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