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Volatile constituents, antioxidant and antibacterial properties of essential oil from *Daniella klainei*

[Short paper presented to the IeCBEN 2008]

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Antioxidants, essential oils, volatile constituents

1 INTRODUCTION

Daniella Klainei Pierre ex A.Chev (Cesalpiniaceae) has long been used in traditional medicine in Gabon. It is a perennial tree about 45m height with deciduous leaves and widely distributed in the tropical rain forest (Aubreville, 1970). The resin of this plant is used to heal sores and against numerous microbial infections (*own unpublished data*).The traditional use of this plant suggests it possesses antioxidant and antibacterial effects.

Recently, there has been a growing interest in substances exhibiting antioxidant and antibacterial properties that are supplied to humans or animals as specific pharmaceutics. It is also well known that essential oils have antibacterial activities (Özer *et al.*, 2007). This study aimed to determine the chemical composition, antioxidant and antibacterial properties of *D. klainei.*

2 MATERIALS AND METHODS

Daniella klainei resin was collected in March 2007 from Sebang Herbarium of IPHAMETRA, Libreville, Gabon. The essential oil was extracted from the resin (500g) by hydrodistillation in a clavenger-type apparatus for 4h and was dried, after decantation, over anhydrous sodium sulphate.

Nine reference strains and three clinical bacterial strains were used in the tests. Two methods were carried out to evaluate the antioxidant effect of the resin essential oil: the DPPH radical scavenging activity and the β-carotene bleaching test. The resin oil was analyzed by GC and GC/MS. GC analysis was performed on a Hewlett-Packard HP 6890 while GC/MS analysis was carried out on a Hewlett-Packard 5973/6890 system operating in EI mode (70eV) using the same parameters (Koudou *et al.*, 2008).

The free radical scavenging activity of essential oil was determined according to the method described by Burits and Bucar (2000). Experiments were carried out as describe previously (Kordali *et al.*, 2005). The antioxidant ability of the essential oil was determined according to the method previously described by Dakpevicus *et al.* (1998).

A broth microdilution method (Bassole *et al.*, 2003) was used to determine the minimum inhibitory concentration (MIC) and the minimum bactericidal concentration (MBC). All tests were performed in Mueller-Hinton Broth (Becton Dickinson, USA). Data were expressed as mean ± SEM. A one way variance was use to analyse data, with $P<0.01$ representing significant differences between means (Duncan's multiple range test).

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3 RESULTS AND DISCUSSION

The hydrodistillation of the resin of *Daniella klainei* produced essential oil amounting to 3.85% (w/w) yield. The major constituent of the resin essential oil is myrcene (55.42%) along with α-pinene (5.39%), α-humulène (8.09%) and Germacrene-D (6.06%), (Table 1). Monoterpenoids were predominant (71.91%) while oxygenated compounds accounted for 5.89%.

The essential oil possessed antioxidant and DPPH radical scavenging activities and it inhibited lipid peroxidation (Figures 1 & 2). These activities can be attributed to the presence of some components that have antioxidant activity, e.g. 1, 8 cineol, α-pinene, β-pinene (Houghton, 2004) and terpinen-4-ol (Lee & Shibamoto, 2001).

Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBCs) varied from 0.50 to 8% for all bacterial strains tested (Table 2). The essential oil was bactericidal for *Escherichia coli* CIP NCTC11602, *Staphylococcus aureus* ATCC9244, *Staphylococcus camorum* LMG13567 and *Staphylococcus aureus.* This antibacterial action might be due to the different constituents of the essential oil of this plant such as 1,8-cineol (Sonboli *et al*.,2005), terpinen-4-ol, α-terpineol (Carson *et al*., 2006). Since the proportions of these components were relatively low in this oil; possible synergistic and antagonistic effects of compounds in the oil should be taken into consideration.

Table 1: Constituents of the essential oil of *Daniella klainei* Pierre ex A.Chev.

Peak	RI	Components	%
1	931	- thujene	0.17
2	939	- pinene	5.39
3	954	camphene	0.08
4	975	Sabinene	0,50
5	979	-pinene	2.58
6	991	myrcene	55.42
7	1029	Limonene	0.83
8	1030	-phellandrene	1.12
9	1033	1,8-cineol	0,40
10	1097	linalool	4.93
11	1177	terpinen-4-ol	0.22
12	1195	-terpineol	0.27
13	1339	δ- elemene	0.07
14	1351	-cubebene	0.01
15	1376	-copaene	1.27
16	1384	-bourbonene	0.22
17	1390	-cubebene	0.19
18	1418	-caryophyllene	3.62
19	1454	-humulene	8.09
20	1480	germacrene-D	6.06
21	1520	δ-cadinene	0.19
22	1549	Elemol	0.47
23	1561	germacrene-B	0.34
24	1583	oxyde de caryophyllene	1.02
25	1606	humulene-1,2 epoxyde	1.38
26	1649	-eudesmol	0.50

RI: retention indices

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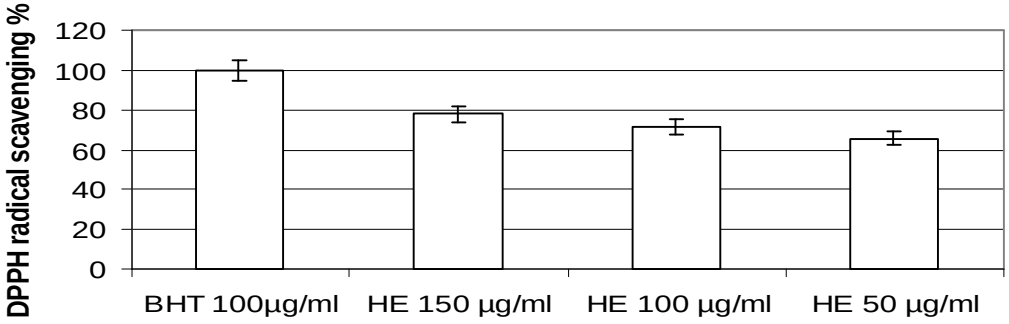

Figure 1. DPPH radical scavenging activity of essential oil of *Daniella klainei* Pierre ex A.Chev.

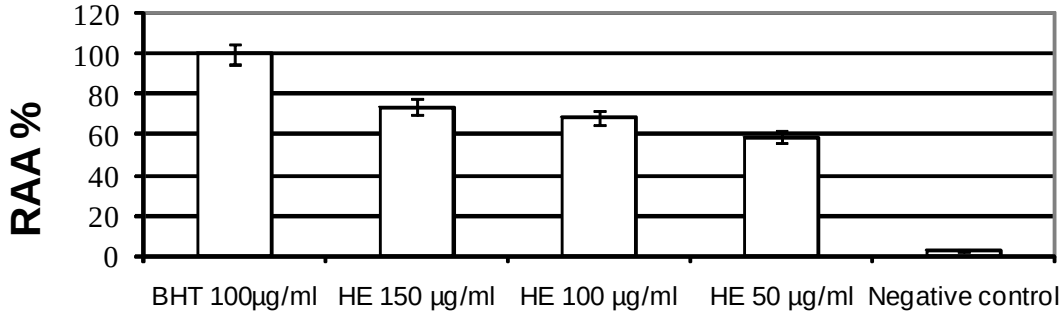

Figure 2. Antioxidant activity by-β-carotene bleaching test of *Daniella klainei* essential oil.

Table 2: Minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) data (%v/v) obtained by microdilution method. Each value represents mean of three different observations.

Strains	**Origin**	**MIC (%)**	**MBC (%)**
Bacillus cereus LMG13569	LMG	1	1
Enterococcus faecalis CIP103907	CIP	2	2
Escherichia coli CIP NCTC11602	CIP	0.5	0.5
Listeria innocua LMG1135668	LMG	2	2
Proteus mirabolis CIP 104588	CIP	4	4
Salmonella enterica CIP105150	CIP	1	1
Shigella dysenteria CIP5451	CIP	1	1
Staphylococcus aureus ATCC9244	ATCC	0.5	0.5
Staphylococcus camorum LMG13567	LMG	0.5	0.5
Hospital strains	Foecal	2	4
Enterococcus faecalis	Vaginal liquid	8	8
Pseudomonas aeruginosa	Vaginal liquid	0.5	0.5
Staphylococcus aureus			

4 CONCLUSION

The essential oil had a small antibacterial spectrum for all strains tested but the total antioxidant activity was significant. The essential oil of *Daniella klainei* might help to prevent oxidative damage in the human body, such as lipid peroxidation which is associated with cancer, atherosclerosis, cardiovascular diseases and diabetes. These results showed

that the essential oil could be used as a potential natural antioxidant and antibacterial agent.

5 REFERENCES

Aubreville, A., 1970. Flore du Cameroun, Légumineuses (Césalpinioidées) vol.9 .

Bassolé, I.H.N., Ouattara, A.S., Nebie, R., Ouattara, C.A.T., Kaboré, Z.I. & Traoré, S.A., 2003. Chemical composition and antibacterial activities of essential oils of *Lippia chevalieri* and *Lippia multiflora.* Phytochemistry **62**, 209-212.

Burits, M. & Bucar, F., 2000. Antioxidant activity of *Nigella sativa* essential oil. Phytother. Res. **14**, 323-328.

Dapkevicius, A., Venskutonis, R., Van Beek, T.A. & Linssen, J.P.H., 1998. Antioxidant activity of extracts obtained by different isolation procedures from some aromatic herbs grown in Lithuania. J. Sci. Food Agric. **77**, 140-146.

Houghton, P.J., 2004. Activity and constituents of Sage relevant to the potential treatment of symptoms of Alzheimer's disease. Herbal Gram. **61**, 38-54

Koudou J., Louis-Clément O., Prosper Edou, Ismael Bassolé , François Eba, Gilles Figueredo, Alfred S. Traore and Jean-Claude Chalchat, 2008. Volatile constituents antioxidant and antibacterial properties of *Daniella Klainei* Pierre ex A. Chev. essential oil. SRE **3(7)**, 316-319.

Lee, K.G. & Shibamoto, T.J., 2001. Antioxidant activities of volatile components isolated from *Eucalyptus* species. J. Sci.Food. Agric. **81**, 1573-1579

Sonboli, A., Saleli, P., Kanani, M.R. & Ebrahimi, S.N., 2005. γ-terpinene, p-cymene antibacterial and antioxidant activities. Z. Naturforsch. **60**c, 534-538.