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Research

Chemical constituents and antioxidant activity of essential oil from the stem of *Lannea acida*

Odusina B. O., Egede D. N., Adeyinka R. A. , Sodiq B. O. and Afolabi Z. M.

Department of Chemical Sciences,

College of Science and Information Technology

Tai Solarin University of Education, Ijagun, Ijebu Ode, Ogun state, Nigeria

Corresponding author < believetng@yahoo.com>

Abstract

The bark of *Lannea acida* is used as medicines for treatment of intestinal parasites, epilepsy and pregnancy disorders by local communities in Nigeria. The essential oil fraction was extracted from the stem of *Lannea acida* using hydrodistillation method. Gas chromatography mass spectrometer was used to determine the chemical constituents in the essential oil. Linalool (11.6%), (+) -2- Bornanone (31.2%), Camphor (0.60%), α – Terpineol (7.3%), Ascaridole glycol (3.9%), alpha copaene (0.82%), caryophyllene (6.12%), Germacrene (6.3%) and isospathulenol (0.87%) were the constituents from the essential oil fraction from the stem of *Lannae acida*. 2,2 diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity was carried out on the essential oil fraction at concentration of 1 mg/mL. The % radical scavenging activity of the essential oil is significant at 30.5 and comparable to the standard drug ascorbic acid with % radical scavenging activity at 41.2 at the same concentration. The presence of these compounds could make *Lannae acida* a potential source of natural substances that could be used in pharmaceutical industries.

Keywords: Essential Oil, DPPH, Gas chromatography mass spectroscopy, antioxidant

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Introduction

Medicinal plants are used for treatment of illnesses and diseases because they have certain healing properties, including synergistic actions. The constituents of the plant may interact with each other and this interaction can be beneficial / harmful for both constituents or eliminate harmful effects of both. The side effects and toxicity of conventional drugs is an important factor in the increase in population demands (Rasool, 2012). Medicinal plants have been used in developing countries because it has comparatively fewer complications (Wichtl, 2004). World Health Organization (WHO) defines medicinal plants as natural plant materials which are used in the absence of industrial processing for the treatment of diseases at a local or regional scale (Tilbert, 2008). Essential oil is defined as volatile lipid soluble portion of plants containing odiferous compounds of vegetable plant matter (Stewart, 2006). These volatile oils are generally liquid and colourless at room temperature. The plant belongs to the family Anacardiaceae. *Lannea acida* is commonly found in Benin, Burkina Faso, Cameroon, Mali , Niger and Nigeria (Oliver-Bever, 1988). *Lannea acida* is used in the treatment of fever and malaria, gynecological and pregnancy disorders, heamorriods, skin diseases and infection (Soladoye, 2010). The bark of *Lannea acida* is applied topically for swellings mixed with cloves of *Parkia biglobosa*. The leaves are mixed with leaves and roots of *Alafia barteri*, *Fluegga virosa, and* pods of *Xylopia aethiopica* as herbal medicine for cancer. The bark is used as medicines for treatment of intestinal parasites (Djoueche, 2011).The aim of this study is to determine the chemical constituents and antioxidant activity of the essential oil fraction extracted from the stem of *Lannea acida.*

Materials and methods

Collection

The stem bark of *Lannea acida* was collected in Ibadan, Oyo state and authenticated at the Forestry Research Institute of Nigeria, (FRIN) with a voucher specimen No FIH.NO. 113011 deposited.

Extraction of Essential Oil

100 g of stem bark of *Lannea acida* was added to 800 ml of distilled water in a 2 L flask. The set was placed on a heater. At the end of distillation, two phases were observed an aqueous phase (aromatic water) and an organic phase (essential oil), less dense than water. The essential oil was collected, dried under anhydrous sodium sulphate and stored in sealed vials in a refrigerator.

Chromatographic analysis of the extracted essential oil

Gas chromatography mass spectrometry analysis was carried out. The carrier gas was helium with a flow rate of 0.8 ml/ min. The temperature of the oven was programmed between 80 ^{o}C to 270 ^{o}C with a gradient of 3.5 ^{0}C / min. A capillary column (30 m x 0.25 mm x 0.32 mm) was used. Samples were auto injected in the gas chromatograph mass spectrometer.

Determination of 2,2-diphenyl-1-picrylhydrazyl (DPPH) Radical Scavenging Capacity of the essential oil fraction

The effect of the essential oil extract on DPPH radical was estimated. A solution of 0.135 mL DPPH in methanol was prepared and 1.0 mL of this solution was mixed with 1.0 mL of extract in methanol containing 1 mg of extract. The reaction mixture was vortexed thoroughly and left in the dark at room temperature or 30 min. the absorbance of the mixture was measured spectrophotometrically at 517 nm. Ascorbic acid was used as standard at concentration of 1 mg/mL.

Results and discussion

Table 1. Chemical composition of the essential oil of stem of *Lannea acida*

Name of Compound	Percentage %
Linalool	11.6
(+) -2- Bornanone	31.2
Camphor	0.60
α Terpineol	7.3
Ascaridole glycol	3.96
Alpha copaene	0.82
Caryo phylene	6.12
Germacrene	6.3
Isospathulenol	0.87

Linalool (11.6%),(+)-2-Bornanone (31.2%), Camphor (0.60%), α–Terpineol (7.3%), Ascaridole glycol (3.9%), alpha copaene (0.82%), caryophyllene (6.12%), Germacrene (6.3%) and isospathulenol (0.87%) were the constituents from the essential oil fraction from the stem of *Lannea acida*. (+)-2-Bornanone was the major constituent with percentage value of 31.2%. The identities and composition of the compounds present are shown in Table 1. This is the first report of these known chemical constituents from the essential oil fraction from the stem of *Lannea acida*. The % radical scavenging activity of the essential oil is significant at 30.5 and comparable to the standard drug ascorbic acid with % radical scavenging activity at 41.2. The biological activities of the chemical constituents of the essential oil from the plant was shown in Table 3. Linalool and α–Terpineol have been reported to possess antioxidant activity (Hatice Zengin, 2014). It is known that caryophyllene and germacrene possess strong antimicrobial activities (Xiong *et al.,* 2013). Copaene was reported to possess antioxidant, antimicrobial, anti-inflammatory and antiplasmodial activities (Wu *et al.,* 2012).The presence of these compounds may be responsible for the antioxidant activity of the essential oil of this plant.

Table 2: Chemical constituents of the essential oil from *Lannea acida* with their respective biological activities

Name of Compound	RT(min)	Molecular Formula	Biological Activities
Linalool	3.12	$C_{10}H_{18}O$	Antibacterial, antioxidant
(+) -2- Bornanone	4.72	$C_{10}H_{16}O$	Antibacterial Antiviral Antinociceptive
α Terpineol	5.32	$C_{10}H_{18}O$	Antioxidant
Ascaridole glycol	6.21	$C_{10}H_{18}O_3$	Antifungal
Alpha copaene	7.48	$C_{15}H_{24}$	Antioxidant, Antimicrobial Anti-inflammatory Antiplasmodial
Caryophylene	8.12	$C_{15}H_{24}$	Antioxidant, Antibacterial Antiproliferative
Germacrene	9.13	$C_{15}H_{24}$	Insecticidal, Antimicrobial
Isospathulenol	13.54	$C_{15}H_{24}$	Insecticidal Antimalaria

Table 3. Antioxidant Activity of essential oil from stem of *Lannea acida* (DPPH radical scavenging activity)

Conc. (mg/ml)	Absorbance(nm)		%Scavenging effect or Inhibition	
	Sample	Standard Drug	Sample	Standard Drug
1.000	1.500	2.159	30.5	41.2

Conclusion

The constituents of the essential oil from the stem of the *Lannea acida* indicate its promising use as pharmaceuticals. Further work should be done to isolate new compounds from the stem of the plant.

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