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SHORT COMMUNICATION

CHEMICAL COMPOSITION AND FREE RADICAL SCAVENGING ACTIVITIES OF VOLATILE ESSENTIAL OIL FROM *Chassalia kolly* FROM NIGERIA

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Abstract

Chassalia kolly is a shrub that belongs to the family Rubiaceae. It is used in the treatment of skin infections, typhoid and fever in traditional medicine practice. In this study, essential oil extracted from the leaves of *Chassalia kolly* was analysed for its chemical constituents and investigated for antioxidant activities. Leaves of *Chassalia kolly* were collected at Ibadan, Nigeria's Oyo State. Hydrodistillation method was used to extract essential oil from the leaves of *Chassalia kolly*. Analysis using the gas chromatography mass spectroscopy technique was used to determine the essential oil's chemical composition. Using the 2, 2-Diphenyl-1 picryl hydroxyl (DPPH) radical scavenging activity technique, the antioxidant activities of the essential oil were investigated at dosages ranging from 200 to 25 µg/ml. The major constituents identified by gas chromatography mass spectrometry (GCMS) examination are curcumene (5.8%), 1,8 cineole (3.76%), nerolidol (5.48%) and α-farnesene (5.07%). Minor elements such as linalool (1.00%), caryophyllene (1.63%) and phytol (1.09%) were also found. The antioxidant test showed that the essential oil had a moderate percentage of radical scavenging activity of 18.61% when its radical scavenging activity at a concentration of 200 µg/ml was compared to the standard ascorbic acid at the same dosage. The ethnomedicinal uses of *Chassalia Kolly* may be due to the presence of these chemical constituents in the essential oil extracted from the leaves.

Keywords: Antioxidant, constituents, DPPH, essential oil

Introduction

Medicinal plants are plants whose parts are used as medicines to treat diseases. This is due to the presence of secondary metabolites with pharmacological properties in the medicinal plants. The use of medicinal plants to treat this condition and disease is prevalent in most cultures in the world and this practice has existed since prehistorical times (Juan, 2021).

Essential oils are concentrated liquids, which contain volatile chemical compounds (Jafari *et al.,* 2020) They are naturally occurring complex compounds, produced by different parts of plants. They have strong odor and volatile nature (Manzour *et al.,* 2023). *Chassalia kolly* belongs to the family Rubiaceae. It is a shrub native to West Africa

(Burkill, 2000), The plant is used by traditional people to treat skin infections, typhoid and fever (Onocha *et al.,*2009).They have been reported to show an anti-inflammatory and antioxidant properties (Kahdoro *et al.,* 2021).*Chassalia kolly* also displayed antimicrobial activities (Onocha *et al.,* 2009). The aim of this study is to determine the chemical constituents of the essential oil from the leaves of *Chassalia kolly* and to determine the antioxidants activities of the essential oil.

Materials and methods

Leaves of *Chassalia kolly* were obtained at Ibadan, Oyo State, southwest Nigeria (7°23'24.73110° N Lat, 3°51'32. 91420°E Lon). It was authenticated at the Forestry Research Institute of Nigeria (FRIN), where a voucher specimen bearing the number 113995 was deposited. Using a Clevenger-style apparatus and the hydrodistillation method, the leaves of *Chassalia kolly* was extracted for five hours. Glass tubes containing the extracted essential oil were kept at 4 °C.

Gas chromatography Mass spectrometry analysis (Andlauer *et al.*, 2000)

The mass spectrometry analysis was carried out using an Agilent 7820A gas chromatography linked to a 5975C inert mass spectrometer with an electron impact source. An HP-5 capillary column (30 m in length, 0.32 mm in diameter, and 0.25 µm film thickness) coated with 5% phenyl methyl siloxane served as the stationary phase. Helium was used as the carrier gas; it had an initial nominal pressure of 1.4902 psi, an average velocity of 44.22 cm/sec, and a constant flow rate of 1.4871 mL/min. The sample was injected once in splitless mode at a temperature of 300 °C in a volume of 1µL. Place the split ventor's 15 ml/min purge flow into a flask with a circular bottom. After a full extraction, the filtrate was transferred. After 0.75 minutes, the gas saver mode was shut off with a total flow of 16.654 ml/min. A ramp of 120°C per minute was used to reach 3000°C (10min) after the first 400°C program. With a 5-minute solvent delay, the run took 32.667 minutes.

The mass spectrometer was operated in electron impact-ionization mode at 70 eV, with an ion source temperature of 230 °C, a quadrupole temperature of 150 °C, and a transfer line temperature of 280 °C. The ions were obtained using scan mode, which involved scanning from m/z 45 to 550 amu at a rate of 2.0 s/scan. The important ingredients were determined (Wiley 275) L. library) by comparing the retention periods and retention indices of the oil constituents with those of earlier research and by matching their mass spectra fragmentation patterns with pertinent data of further mass spectra that have been made available.

Test of antioxidant activity

Determination of 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical Scavenging (Pham-Huy *et al,* 2008)

The effect of the essential oil extract on the DPPH radical was estimated. A solution of 0.1 mM DPPH was prepared in methanol, and 1.0 mL of this mixture was mixed with 1.0 mL of extract in methanol that had different quantities of extract (ranging from 25 to 200 µg/ml). The reaction mixture was gently vortexed and then left to stand at room temperature for half an hour in the absence of light. The mixture's absorbance at 517 nm was estimated using spectrophotometry. Ascorbic acid was the benchmark.

The scavenging effect of DPPH was calculated as a percentage using this formula. (A0-A1)/A0) x 100 = DPPH Scavenging effect (%), where A0 denotes the absorbance of the control sample and A1 the absorbance of the extract or standard sample.

Results and Discussion

In Table 1, curcumene (5.8%), 1,8 cineole

(3.76%), nerolidol (5.48%) and α-farnesene (5.07%) were the major constituents in the essential oil from the leaves of *Chassalia kolly* while linalool (1.00%), caryophyllene (1.63%) and phytol (1.09%) were the minor constituents in the plant essential oil. From previous study carried out on the chemical constituents of essential oil from the family of Rubiaceae, curcumene (0.2%) and linalool (0.3%) were previously identified in *Gardenia ternifolia*, which belongs to the same family with *Chassalia kolly* (Owolabi, *et al.,* 2022). Phytol (56.3%) and 1,8 cineole (20.4%) were also found in the essential oil of a plant specie: *Borreria verticillata* that belong to the same family of (Rubiaceae) of *Chassalia kolly*, (Ogunwande *et al.,* 2010). Caryophyllene (15.2%) was found to be the one of the most abundant compounds in another specie of this plant; *Chassalia charteracea* (Salleh *et al.,* 2021). The presence of caryophyllene, linalool, and phytol which has been reported to possess antioxidant activities could be responsible for the antioxidant activities of this essential oil (Fenguy *et al.,* 2021).

Table 1: Chemical constituents from the essential oil from leaves of *Chassalia kolly*

Compounds	Molecular formula	%composition
1,8, Cineole	$C_{10}H_{18}O$	3.76%
Linalool	$C_{10}H_{18}O$	1.00%
Caryophyllene	$C_{15}H_{24}$	1.63%
Nerolidol	$C_{15}H_{26}O$	5.8%
Phytol	$C_{20}H_{40}O$	1.09%
α-farnesene	$C_{15}H_{24}$	5.07%
Curcumene	$C_{15}H_{22}$	5.80%

In Table 2, the antioxidant activities revealed that at concentration of 200 µg/ml to 25 µg/ml, the essential oil from *Chassalia kolly* showed moderate percentage % radical scavenging activities (18.6 – 1.0 %) when compared with the standard drug ascorbic acid. This may be due to the low percentage composition of caryophyllene (1.63%), linalool (1.00%) and phytol (1.09%) which are known for their antioxidant activities: Curcumene has been reported to have the potential ability to modulate cancer, neurodegeneration, diabetes and inflammation (Obrenovich *et al.,* 2010). This study revealed that *Chassalia kolly* will aid in the prevention of degenerating diseases such as cancer and tumor and is a good source of antioxidants which give an added value to the pharmacological uses of this plant.

Table 2: Antioxidant activities of essential oil from leaves of *Chassalia kolly*

Concentrations µg/ml	% Radical Scavenging activities (essential oil)	% Radical Scavenging activities (Ascorbic acid)
200	18.61	94.36
100	12.66	93.32
50	6.43	91.82
25	2.46	90.32

Conclusion

This study revealed that *Chassalia kolly* is a good source of bioactive compounds with antioxidant activities which give an added value to the pharmacological uses of this plant.

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Disclosure Statement

No potential conflict of interest was reported by the authors

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