



ABSTRACT

African ethnomedicine makes extensive use of African elemi, also known as *Canarium schweinfurthii* Engl.

(Burseraceae).

This study examined the leaf extract's physicochemical characteristics, phytochemical components, and antioxidant capacity.

According to physicochemical examination, the following parameters were all within permissible bounds: moisture

PHYSICO-CHEMICAL, PHYTOCHEMICAL EVALUATION AND ANTIOXIDANT POTENTIAL OF THE LEAVES OF *Canarium schweinfurthii* ENGL. (BURSERACEAE)

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Introduction

Medicinal plants have been of immense importance to health in the past, particularly in developing nations in the African continent, where 80% of the population is dependent on traditional medicines for primary healthcare (WHO, 2023). *Canarium schweinfurthii* Engl, known by the popular name African elemi, family Burseraceae, is a commonly utilized plant in African ethnomedicine. The bluish-purple, glabrous fruit of *C. schweinfurthii* is a tiny drupe that is 1-2 cm thick, 3-4 cm long, and glabrous. In traditional medicine, the root, bark, fruit, seed, leaf, and flower are all often employed in treatment of diseases, as stated by Tchegebebe et al. (2016), who also mentioned that anaemia, ocular diseases, helminth infections, diarrhea, goiter, hypertension, gastrointestinal



content (2.60%), total ash (10.30%), water-soluble ash (2.45%), acid-insoluble ash (2.75%), alcohol extractive value (4.00%), and water extractive value (3.60%). Flavonoids, tannins, saponins, steroids, and cardiac glycosides were detected by phytochemical screening. With an IC_{50} of 9.48 $\mu\text{g/mL}$, which was marginally lower than that of vitamin C (9.49 $\mu\text{g/mL}$), the methanol leaf extract demonstrated significant antioxidant activity and a strong capacity to scavenge free radicals. These results help to standardise the pharmacognostic usage of *C. schweinfurthii* and validate its traditional use.

Keywords: *Canarium schweinfurthii*, physico-chemical, phytochemical, antioxidant, DPPH Assay.

disorders, toothaches, and cardiovascular conditions can all be treated/managed using the plant. The same author stated that in traditional medicine, the leaves are utilized for postpartum constipation, fever, diarrhoea, rheumatism, sexually transmitted diseases and malaria, while chest pain, gonorrhea, food poisoning, stomach complaints, oedema, round worm infections, eczema, leprosy, and ulcers can all be treated with whole plant decoction.

Oxidative stress, which results from an imbalance between free radicals and antioxidants in the body, has been associated with the pathogenesis of most chronic diseases, including cancer, cardiovascular disease, and neurodegeneration (Halliwell & Gutteridge, 2015). Contaminants in the environment, such as UV, radiation that emits ions, pollutants, and heavy metals, significantly increase the production of Reactive oxygen species, creating a situation that damages cells and tissues. Oxidative stress can accelerate the aging process of the body, create acute pathologies (such as trauma and stroke), and induce several chronic and degenerative diseases, e.g., Cancer, if it is not well controlled. The illnesses related to oxidative stress are a significant cause of health morbidity worldwide: for example, cardiovascular diseases alone cause approximately 17.9 million deaths each year and contribute to 32% of all deaths worldwide (WHO, 2021). While there has been a paramount need for cheap and effective antioxidant treatments, research on local flora with possible antioxidant activity has largely been grossly under-explored. Particular attention needs to be devoted to the leaves of *C. schweinfurthii*, which have



not been adequately pharmacognostically described and evaluated for their antioxidant activities by modern scientific procedures.

Because of the huge reliance on herbal medicine in most regions of the globe and the growing load of pathological conditions like oxidative stress, traditionally used medicinal plants must be scientifically proven and standardized. Pharmacognostic examination provides the critical details for the standardization of herbal materials (Solanki 2019), which will help to prevent adulteration and ensure safe utilization. Furthermore, the identification of the antioxidant potential of *C. schweinfurthii* leaves could uncover new natural sources of antioxidants. The study is therefore timely and imperative to fill the knowledge gap between scientific and traditional validation, aiding in the development of quality herbal products and contributing to the global fight against oxidative stress-related diseases.

However, while *C. schweinfurthii* has been traditionally used extensively, hardly any scientific information is available on its physicochemical properties and antioxidant assay on the leaf extract, which acts as an impediment to its formal acceptance for use as an antioxidant and standardization as a herbal medicine. It is also useful to be included in monographs, for establishing standards that will aid in the identification. This work attempts to address the substantial dearth of scientific information on *C. schweinfurthii* leaf extract, particularly with regard to its antioxidant capacity, despite its widespread use (Pisoschi & Pop, 2015; Halliwell & Gutteridge, 2015).

METHODS

The leaves of *C. Schweinfurthii* were collected in May from Jos North. The collected plant part was identified and authenticated by the forestry taxonomist at the Federal College of Forest Herbarium Jos, 2022, and given voucher no.182.

Freshly collected leaves of *C. schweinfurthii* were washed with water, cut into small pieces, and air dried for about 2 weeks at room temperature. They were then pulverized and stored in an air-tight container for future use.

The methanol extract was prepared by maceration of 200g of the plant powder in 1000 ml of the solvent for 72 hours, then filtering with Whatman's filter paper and extracting with a rotary evaporator, then concentrating the sample.

PHYSICO-CHEMICAL PARAMETERS

The physicochemical analysis of the leaves of *Canarium schweinfurthii* was carried out in the biochemistry division of the National Veterinary Research Institute using standard methods as described by The Ayurveda Pharmacopoeia of India (2021).



PHYTOCHEMICAL TESTS

Phytochemical tests for carbohydrates, alkaloids, saponins, tannins, anthraquinones, steroids, and cardiac glycosides were carried out for the methanol extract using official methods as described by Evans (2009) and Sofowora (2012).

IN VITRO ANTIOXIDANT ACTIVITY ASSAY (DPPH Radical Scavenging Assay)

This was carried out using the official method described by Baliyan et al (2022) with some modifications. A 0.1 mM solution of methanolic DPPH was freshly prepared and kept in a clean beaker, and the beaker was covered with aluminum foil to prevent oxidation. Vitamin C was used as a standard in this assay. Six different concentrations of methanol extract and also standard (Vitamin C) were prepared at 10, 20, 40, 60, 80, and 100 µg/ml. After dissolving 1mg of the extract and standard, respectively, in 10 mL of methanol to obtain a concentration of 100 µg/ml, 1, 0.8, 0.6, 0.4, 0.2, 0.1 ml were pipetted into 6 different test tubes each and made up to 1 mL with methanol. Then, 1 mL of 0.1 mM DPPH reagent was added to 1 mL of different concentrations of plant extract and standard, which were shaken and labelled accordingly. The test tubes were kept in the dark for 30 minutes, and the absorbance was measured at 517 nm using a UV spectrophotometer. The values of absorbance of the standard and sample obtained were used to calculate the percentage of DPPH radical scavenging activity. The percentage of DPPH radical scavenging activity was calculated as follows:

DPPH Radical Scavenging Activity (%) = $\frac{(\text{Abs of control}) - (\text{Abs of sample})}{\text{Abs of control}} \times 100$, where: Abs of control = Absorbance of control and Abs of sample = Absorbance of sample/standard

RESULTS

PHYSICOCHEMICAL EVALUATION

Table 1: PHYSICOCHEMICAL CONSTANTS OF LEAF POWDER OF *Canarium schweinfurthii*

Parameters	Values obtained on dry weight basis
Alcohol extractive value	4
Water extractive value	3.6
Moisture content	2.60
Total Ash	10.30
Water soluble ash	2.45
Acid insoluble ash	2.75



PHYTOCHEMICAL SCREENING OF LEAVES OF *Canarium schweinfurthii*

Table 2: Phytochemical screening of *Canarium schweinfurthii* leaf

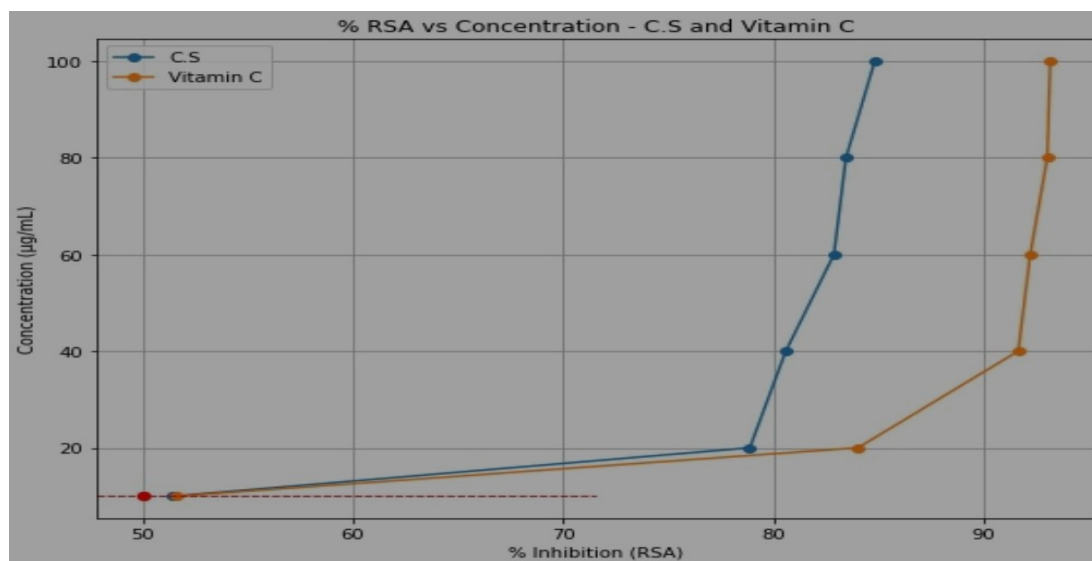
Phytochemical constituents	Tests	Results
Carbohydrates	Molisch's test	+
Alkaloid	Dragendorff's test	-
Saponins	Frothing test	+
Tannins	Braymer's test	+
Flavonoid	Alkaline reagent test	+
Anthraquinones	Borntrager's test	-
Steroid	Salkowski's test	+
Cardiac glycoside	Keller-Killani's test	+

Note: += Present; and - = Absent

ANTIOXIDANT ASSAY

CONCENTRATION	%RSA	CANARIUM SCHWEINFURTHII
	VIT C	
100	93.14	84.80
80	93.00	83.43
60	92.19	82.86
40	91.62	80.57
20	84.00	78.86
10	51.62	51.43

With the maximum inhibition of 84.8% at 100 $\mu\text{g/mL}$, the antioxidant assay demonstrated a dose-dependent increase in radical scavenging activity.





Curve-fitting analysis was used to derive the extract's IC_{50} value from the dose-response curve.

DISCUSSION

In the present study, important diagnostic characters determining the authenticity and purity of the medicinally important leaf part are observed and recorded.

C. schweinfurthii leaf powder was found to have a moisture content of 2.60%. The pharmacopoeial limit for moisture content for herbal drugs is 10 % (Ayurveda Pharmacopoeia of India, 2021). This shows that the plant powder can be stored for long periods and remain stable, especially regarding the active constituents, and that there is less chance of bacteria, yeast, or fungi growing being present. Ash levels are helpful markers of any drug's purity and provide details on any inorganic matter contamination or adulteration. The amount of material left over after burning, or total ash content, is insufficient to accurately represent the quality of the leaves because plant components frequently include silicate, carbonate, and calcium oxalate. More consistent values are obtained from acid insoluble ash, which is primarily composed of silica and indicates contamination with earthly material, as opposed to total ash. The total ash value, acid insoluble ash, water soluble ash was found to be 10.35%, 2.75% and 2.45% respectively. This percentage clearly indicates that the leaf has a high level of purity? and can be used as a standard total ash value for the plant leaves in the monograph.

The water- soluble extractive value of the stem bark powder from this experiment was 3.6 %, while the alcohol soluble extractive value was 4%. From the results, it can be seen that the water- soluble extractive value was lower than the alcohol soluble extractive value, meaning that the stem bark of the plant has more alcohol soluble constituents, so alcohol is a better solvent for the extraction of the active principles. Remarkably for a crude extract, the methanol leaf extract of *C. schweinfurthii* displays antioxidant activity comparable to that of vitamin C (9.49 $\mu\text{g/mL}$), as indicated by the IC_{50} value of 9.48 $\mu\text{g/mL}$. The flavonoids and tannins found during the phytochemical screening may be responsible for the reported antioxidant capacity. By contributing hydrogen atoms or electrons, these substances are known to neutralise free radicals (Panche et al., 2016; Zhang et al., 2015).

Mbopi Yamen et al. (2023) evaluated the antioxidant and antibacterial activities of hydroalcoholic extracts of *C. schweinfurthii* trunk bark, and it demonstrated significant free radical scavenging and bactericidal effects against multi-resistant strains. Bonnard et al. (2022) also investigated the wound healing effect of an



oleoresin essential oil chemotype from *C. schweinfurthii*, and the findings showed dose-dependent wound healing properties and modulates pro-inflammatory responses in human keratinocytes. These findings stated show the plant's multifaceted pharmacological properties.

The findings support traditional beliefs regarding the plant's medicinal properties and call for more research into the identification and isolation of its bioactive compounds. Ethnomedically, the locals employ *C. schweinfurthii*'s roots, stems, and leaves to treat a variety of ailments. Because of the plant *C. schweinfurthii*'s various medical uses, scientists should be encouraged to conduct additional research to learn more about this plant, including characterization of the actual bioactive constituents that elicit antioxidant activity.

CONCLUSION

The study demonstrates that the leaf of *Canarium schweinfurthii* has strong antioxidant capacity, as indicated by its low IC_{50} value, and pharmacognostic characteristics appropriate for monograph inclusion. Its historic medical usage is supported by science. Bioassay-guided fractionation and in vivo confirmation of its antioxidant and therapeutic properties should be the main areas of future research. Therefore, it is recommended that researchers should carry out more pharmacological assays on the plant beyond the antioxidant assay. Also, isolation and structural characterization of the phytochemicals should be done to identify the compounds responsible for phytochemical activity.

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