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Original Research Article

Pharmacological and Phytochemical Review of *Sabicea Brevipes*

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ABSTRACT

Sabicea brevipes , commonly known as Short-stalked *Sabicea*, is a plant in the Rubiaceae family, recognized for its medicinal properties. It is used in various traditional medicine systems to treat a range of ailments. Phytochemical studies of its leaf extract have identified several active compounds, including flavonoids, tannins, saponins, terpenoids, glycosides, steroids, and phenols. Research has shown that *Sabicea brevipes* possess anti-inflammatory, antioxidant, antimicrobial, and aphrodisiac properties. For this review, databases such as PubMed, Google Scholar, Scopus, and Science Direct were searched using terms like "*Sabicea brevipes* ," "phytochemicals," "phenolic compounds," "polyphenols," and "isoprenoids." The review summarizes the pharmacological activities of *Sabicea brevipes* , highlighting the phytochemicals it contains, including flavonoids, tannins, saponins, terpenoids, glycosides, steroids, and phenols. The phytochemicals identified in our study have been reported to offer benefits for conditions such as angina pectoris, cervical lesions, chronic venous insufficiency, dermatopathy, diabetes, gastrointestinal diseases, lymphocytic leukemia, menopausal symptoms, rhinitis, and traumatic cerebral infarction and others. This review provides a comprehensive analysis of the pharmacological benefits and phytochemicals found in *Sabicea brevipes.*

Keywords: Sabicea brevipes , Phytochemicals, Pharmacological activity, Ethno-pharmacology

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Introduction

Sabicea brevipes, commonly known as 'Short-stalked *Sabicea*,' is a shrub that features dark green leaves and small white flowers[1]. It belongs to the Rubiaceae family, one of the largest families of flowering plants[2]. This plant produces its white flowers in dense, terminal panicles. The seeds of *Sabicea brevipes* are small, round, and black[6]. This plant is originally from South America and grows best in tropical and subtropical forests. It thrives in moist, well-drained soils and prefers partial shade[1]. *Sabicea brevipes* is a descendant of the cotton plant[2] and was first described by Herbert Fuller Wernham in 1914[3]. There are approximately 145 species within the genus *Sabicea*, most of which are found in tropical Africa and South America[4]. The aim of this review is to provide a comprehensive analysis of the pharmacological benefits and phytochemical constituents present in *Sabicea brevipes.*

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Materials and Methods

This review includes 44 articles published between 1914 and 2024. The articles were gathered through a comprehensive literature search using databases and search engines such as PubMed, Google Scholar, Scopus, and ScienceDirect. Relevant search terms included *Sabicea brevipes*, phytochemicals, phenolic compounds, polyphenols, and isoprenoids.

Botanical Description

The *Sabicea brevipes* plant, commonly referred to as susu, is a member of the Rubiaceae family, which comprises over 6,500 species. Among these, 152 are classified under the *Sabicea* genus[5]. These plants can be found as vines, twining lianas, or occasionally as small trees. Susu typically grows as an erect or climbing shrub, reaching a height of 0.6 to 1.2 meters. In July, it showcases a vibrant display of red flowers. *Sabicea brevipes* features dark green leaves and produces small white flowers arranged in dense, terminal panicles. The seeds of this plant are small, round, and black. The seedlings feature a single stem and a few leaves. This plant thrives in tropical and subtropical forests, preferring moist, well-drained soils and partial shade. It is native to tropical regions of Africa and South America[6]. For optimal growth, the plant favors full sun or partial shade and requires consistently moist, well-drained soil. Propagation can occur through seeds or cuttings. Seeds should be sown in a well-drained sandy soil mix and kept moist. Cuttings are typically taken in late summer or early fall and should be rooted in a sandy soil mix[6]. In full bloom during July and August, *Sabicea brevipes* produces abundant red flowers and small, juicy red fruits that are commonly consumed in Sierra Leone and eastern Nigeria[7]. Figure 1 shows *Sabicea brevipes* in its natural habitat

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Figure 1: *Sabicea brevipes* in its natural habitat [1]

Ethnopharmacological Profile

Sabicea brevipes has been utilized in certain communities, such as the Oghe community in Ezeagu L.G.A. of Enugu State, as a herbal remedy for treating erectile dysfunction due to its ability to enhance blood flow to the penis. Additionally, it has been recognized for its anti-inflammatory and anti-ulcer properties[8]. Traditional medicine also employs *Sabicea brevipes* to address a variety of ailments, including fever, headaches, and stomachaches. It serves as an ornamental plant, with its leaves commonly used to make tea[6]. Furthermore, the leaves are used to heal wounds and to treat bacterial and fungal infections[1].

Taxonomical Profile

Kingdom	-	Plantae
Phylum	-	Tracheophyta
Class	-	Magnoliopsida
Order	-	Gentianales
Family	-	Rubiaceae
Sub family	-	Cinchonoideae
Tribe	-	Sabiceeae
Genus	-	*Sabicea*
Species	-	brevipes
Binomial	-	*Sabicea brevipes*

Common and Local Names

Sabicea brevipes is called 'Ashananse Ntoroma' In Ghana[9], 'susu' in Oghe, Ezeagu Local Government Area of Enugu state, Eastern Nigeria[8] it is also called 'Short-stalked *Sabicea*[1]

Oral acute toxicity Study

The assessment of oral acute toxicity is a vital step in evaluating the safety of pharmaceutical, agricultural, and industrial compounds. Acute toxicity refers to the harmful effects that occur immediately or soon after a single or multiple doses of a substance, typically within 24 hours[10]. In this study, the oral acute toxicity of the methanol extract of *Sabicea brevipes* was evaluated using Wistar albino rats weighing approximately 47 ± 7 g, following Lorke's method[11,12,13]. The dosages tested ranged from 10 to 5000 mg/kg of the methanol extract. In the first phase, twelve rats were randomly divided into three groups of four. Each group received one of the following doses: 10 mg/kg, 100 mg/kg, or 1000 mg/kg of the extract. The rats were monitored for signs of toxicity, including death, changes in physical appearance, and behavioral alterations, over a 24-hour period. In the second phase, the rats received different doses of the extract: 1600 mg/kg, 2900 mg/kg, and 5000 mg/kg, administered orally. They were again observed for 24 hours for any signs of lethality. The results from both phases of the acute toxicity study indicated no significant signs of toxicity in any of the treatment groups after administering *Sabicea brevipes* methanol extract. The lethal dose (LD^{50}) of the extract was determined to be greater than 5000 mg/kg body weight[1].

Anti-inflammatory Activity

Inflammation is a protective immune response that eliminates harmful external stimuli, promotes healing, and helps maintain the homeostasis of tissues and organs[14,15,16,17]. In a study, the anti-inflammatory activity of extracts and fractions from the aerial parts of *Sabicea brevipes* was evaluated using a carrageenan-induced rat model. The treatment was administered orally at varying doses of 200 mg/kg and 400 mg/kg over 5 hours. The in vivo anti-inflammatory results indicated inhibition rates of 42% and 44% for the methanol extract, 47% and 36% for the n-hexane fraction, 33% and 31% for the ethyl acetate fraction, and 43% and 42% for the methanol fraction at the 200 mg/kg and 400 mg/kg doses, respectively[1].

Antimicrobial Activity

The ongoing challenge of antibiotic resistance has led to a renewed interest in exploring natural compounds as potential antimicrobial agents[44]. Natural products, which can be sourced from medicinal plants, marine organisms, and microbes, are recognized as a rich source of biologically active molecules[18]. Recent research emphasizes the significant potential of these natural antimicrobial compounds, with thousands still awaiting further investigation[19]. Ugorji *et al*[20] reported that different extracts of *Sabicea brevipes* , including the *n*-butanol fraction, ethyl acetate fraction, and *n*-hexane fraction, exhibited antimicrobial activity against several pathogens, with minimum inhibitory concentration (MIC) values detailed in Tables 1-4.

Table 1: Antimicrobial activity of Methanol leaf extract of *Sabicea brevipes* against several pathogens

Pathogens	MIC (mg/mL)
Pseudomonas aeruginosa	6.76
Escherichia coli	6.31
Staphylococcus aureus	7.76
Bacillus subtilis	7.08
Candida albicans	47.86

Table 2: Antimicrobial activity of *Sabicea brevipes* n-butanol fraction against several pathogens

Pathogens	MIC (mg/mL)
Pseudomonas aeruginosa	12.59
Escherichia coli	15.85
Staphylococcus aureus	17.78
Bacillus subtilis	15.85
Candida albicans	47.86

Table 3: Antimicrobial activity of *Sabicea brevipes* ethyl acetate fraction against several pathogens

Pathogens	MIC (mg/mL)
Pseudomonas aeruginosa	50.12
Escherichia coli	28.18
Staphylococcus aureus	25.12
Bacillus subtilis	26.92
Candida albicans	50.12

Table 4: Antimicrobial activity of *Sabicea brevipes* n-hexane fraction against several pathogens

Pathogens	MIC (mg/mL)
Pseudomonas aeruginosa	48.98
Escherichia coli	47.86
Staphylococcus aureus	50.12
Bacillus subtilis	50.12
Candida albicans	50.12

These tables above indicate varying degrees of antimicrobial efficacy of the different fractions of *Sabicea brevipes*

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Antioxidant activity

Antioxidants are essential for maintaining the balance between free radicals and the body's defense mechanisms, which helps preserve cellular integrity and prevent various chronic diseases[21,43]. Ugorji *et al*[20] investigated the antioxidant activity of *Sabicea brevipes* by measuring IC_{50} values, where a lower IC_{50} value indicates higher antioxidant activity and potency. The results from DPPH assay showed that the IC_{50} values for the methanol extract, the butanol fraction of *Sabicea brevipes* , and standard ascorbic acid were 0.867 µg/mL, 1.417 µg/mL, and 1.539 µg/mL, respectively. This indicates that both the methanol extract and the butanol fraction exhibit better antioxidant properties than standard ascorbic acid. In the Total Antioxidant Capacity (TAC) assay, Ugorji *et al*[20] also reported IC_{50} values for the methanol extract and butanol fraction of *Sabicea brevipes* , along with those for standard ascorbic acid. The values were 0.798 µg/mL, 1.352 µg/mL, and 1.563 µg/mL, respectively. These findings suggest that the methanol extract and butanol fraction of *Sabicea brevipes* possess superior antioxidant properties compared to standard ascorbic acid when evaluated using the TAC model. Overall, the IC_{50} values for both the methanol extract and the butanol fraction are lower than that of standard ascorbic acid, reinforcing their effectiveness as antioxidants.

Aphrodisiac Activity

Aphrodisiacs are substances that are believed to enhance sexual desire and performance, and they have fascinated humans for centuries. Various plant-based and synthetic compounds have been claimed to stimulate arousal and improve sexual function. The quest for effective aphrodisiacs has a rich history that spans different cultures and traditions[22]. A study utilizing thin-layer chromatography on the petroleum spirit and ethanol extracts of the roots of *Sabicea brevipes* has identified several compounds, including *Dehydro-epi-androsterone* (DHEA) (Figure 2), 17-Hydroxyprogesterone (Figure 3) steroids, and a type of glycoside. The roots of *Sabicea brevipes* are recognized for their stimulating and tonifying effects on muscles, making them potentially beneficial for enhancing male potency. Research has indicated that Dehydro-epi-androsterone can influence the in vitro growth of vascular smooth muscle cells, revealing its potential use in managing erectile dysfunction. Moreover, *17-Hydroxyprogesterone* is crucial for regulating blood pressure, which helps maintain proper blood flow to the penis and can enhance erections. The glycosides found in *Sabicea brevipes* support the effects of the steroids present in the plant. These active compounds may contribute to sexual enhancement by dilating coronary arteries, blocking calcium channels, and reducing capillary fragility. This reinforces the historical use of *Sabicea brevipes* root as a sex enhancer, particularly among men experiencing erectile dysfunction in Oghe, Enugu State, Nigeria[7]

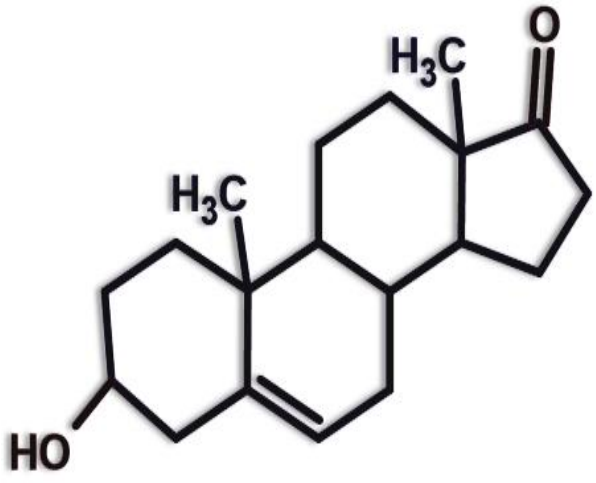

Figure 2: Structures of Dehydro-epi-androsterone (DHEA)[7]

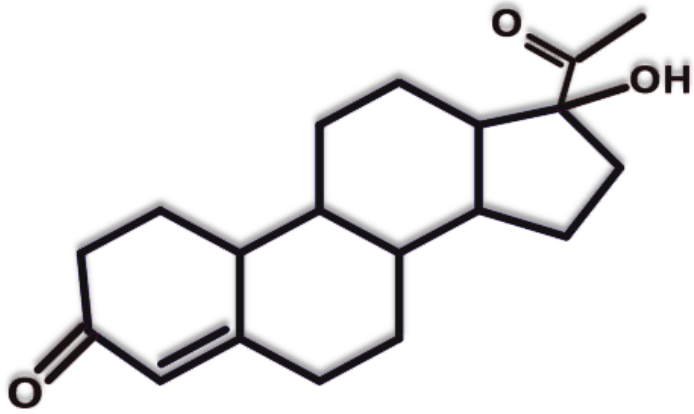

Figure 3: Structures of 17- Hydroxyorigesterone [7]

Phytochemicals

Phytochemicals are the diverse array of bioactive compounds found in plants, they have garnered significant attention for their potential health benefits[23]. These plant-derived compounds serve as protectants against environmental stresses and attractants for pollinators. Research has demonstrated that they possess a wide range of therapeutic properties, including antioxidant, anti-inflammatory, and anticarcinogenic effects[24]. A phytochemical screening of the aerial parts of the *Sabicea brevipes* plant revealed the presence of alkaloids, terpenoids, tannins, glycosides, and flavonoids[1]. The phytochemical analysis of methanol leaf extract, with its butanol and ethyl acetate fraction of *Sabicea brevipes* shows the presence of flavonoids, tannins, saponins, terpenoids, glycosides, steroids, and phenols, its N-hexane fraction revealed the presence of flavonoids, saponins, terpenoids, glycosides and steroids. The quantitative analysis of total phenolics, total flavonoids, and tannin content reveals that the methanol extract contained the highest levels of phenolics, measuring 110.78 ± 1.06 mg GAE/g. In contrast, the ethyl acetate fraction had the lowest total phenolic content at 50.55 ± 2.91 mg GAE/g. A similar pattern was observed for total flavonoid content; the methanol extract recorded 418.40 ± 14.03 mg QE/g, while the ethyl acetate fraction showed a total of 192.40 ± 3.06 mg QE/g. Regarding total tannin content, the methanol extract had 102.22 ± 7.58 mg GAE/g, compared to just 27.33 ± 0.77 mg GAE/g for the ethyl acetate fraction[20].

Polyphenols

Polyphenols are a group of natural compounds known for their phenolic structures. This family consists of four main subclasses: flavonoids, stilbenes, phenolic acids, and lignans. Beverages like olive oil, tea, and red wine are considered excellent sources of polyphenols[25,26]. Phenolic compounds can either be formed naturally through the action of various organisms or be produced industrially[27]. Plant tannins, a type of polyphenol, are commonly found in terrestrial and some marine plants[28,29]. Animals and humans cannot synthesis tannins, which are vegetable polyphenols[29]. Ugorji *et al*[20] reported the presence of flavonoids, phenols, and tannins in the leaves of *Sabicea brevipes* . The health benefits of polyphenols include their ability to combat free radicals and provide protective effects against cardiovascular diseases, cancers, and other age-related conditions, as well as helping to prevent inflammation and allergies[31,32,33,26]. Flavonoids have been shown to provide benefits for a range of health issues, including angina pectoris, cervical lesions, chronic venous insufficiency, dermatopathy, diabetes, gastrointestinal diseases, lymphocytic leukemia, menopausal symptoms, rhinitis, and traumatic cerebral infarction[34]. Tannins have a variety of properties that include anti-inflammatory, antidiarrheal, antiparasitic, antiviral, antibacterial, and antioxidant effects[29]. Additionally, phenol can be injected into muscles to treat muscle

spasticity, a condition where the brain fails to coordinate effectively with the spinal cord and nerves. It is also commonly used in medical procedures for treating ingrown toenails[35]. Furthermore, phenolic compounds have been found to exhibit anti-plasmodial activity[36].

Isoprenoids

Isoprenoids, also known as terpenoids, are a class of natural compounds that include terpenes, sesquiterpenes, limonoids, ubiquinone, menthol, and camphor[26]. These compounds are found in plants such as *Sabicea brevipes* [1,20]. Isoprenoids are organic compounds characterized by the arrangement of two or more hydrocarbons in a specific pattern[26]. Some common isoprenoids found in plants include limonene, myrcene, and pinene. Limonene, in particular, is the most prevalent monoterpene found in aromatic plants and fruits, imparting a lemon-like flavor and aroma[33]. Isoprenoids offer several health benefits; they can help reduce appetite, alleviate stress and anxiety, support digestion, possess antioxidant properties, have potential effects in treating Alzheimer's disease, promote better sleep, and aid in pain relief[37].

Saponins

Saponins are a diverse group of naturally occurring glycosides that possess surface-active properties. These compounds have gained significant attention due to their impressive versatility and wide-ranging applications. Saponins are found in many plant species, particularly among dicotyledonous angiosperms, and they exhibit a broad spectrum of biological activities[38,39]. They have a unique structure, consisting of a hydrophilic sugar moiety attached to a hydrophobic aglycone (sapogenin) backbone, which gives them their characteristic surfactant properties[40].
Ugorji *et al*[20] reported the presence of saponins in the methanol leaf extract of *Sabicea brevipes* . Saponins are glycosides found in plants and consist of a sapogenin and sugar moieties[41,42]. Saponins are known to exhibit various biological activities, including hypoglycemic, virucidal, antifungal, antimicrobial, and hypolipidemic effects. Additionally, their effects on conditions such as acute injuries, erectile dysfunction, venous edema due to chronic deep vein incompetence, and systemic lupus erythematosus have also been documented.

Conclusion

This review focuses on the traditional uses, pharmacological potential, and phytochemical analysis of *Sabicea brevipes*. Scientific studies have validated that *Sabicea brevipes* possesses anti-inflammatory, antioxidant, antibiotic, and aphrodisiac properties. The phytochemical constituents found in *Sabicea brevipes*, including flavonoids, have been reported to be beneficial for various conditions such as diabetes, angina pectoris, chronic venous insufficiency, cervical lesions, dermatopathy, gastrointestinal diseases, menopausal symptoms, lymphocytic leukemia, traumatic cerebral infarction, and rhinitis. Saponins found in *Sabicea brevipes* are noted for their hypolipidemic, hypoglycemic, antimicrobial, virucidal, and antifungal effects. Additionally, tannins present in the plant have demonstrated anti-inflammatory, antidiarrheal, antiparasitic, antiviral, antibacterial, and antioxidant activities. The phenolic compounds also found in *Sabicea brevipes* have shown anti-plasmodial activity. It is recommended that the activities of the phytochemicals associated with *Sabicea brevipes* be scientifically validated, along with its ethnobotanical applications for wound healing and analgesic effects.

Conflict of Interest

The authors declare no conflict of interest.

Author's Declaration

The authors hereby declare that the work presented in this article is original. Any liability for claims relating to this article will be borne by us.

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