

**Phytochemical Constituents and Pharmacological Activities of *Globimetula braunii* (Loranthaceae): A Review**Suleiman Danladi^{1*}, Aisha M. Alhassan¹, Mohammed I. Sule², Aliyu M. Musa², Abdullahi H. Yaro³¹Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Bayero University, Kano, Nigeria²Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria³Department of Pharmacology and Therapeutics, Faculty of Pharmaceutical Sciences, Bayero University, Kano, Nigeria

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ABSTRACT

Globimetula braunii (Loranthaceae) is a hemiparasitic shrub that grows on dicotyledonous trees; the plant is used traditionally in the treatment of various diseases. This study aims to review the ethnomedicinal uses, scientific and pharmacological studies as well as phytochemistry of *G. braunii*. Information related to the ethnomedicinal uses, scientific and pharmacological studies as well as phytochemistry of the *G. braunii* was obtained by searching using the keyword *G. braunii* in the following databases; Google Scholar, PubMed, ScienceDirect and Web of Science. The literature search revealed that *G. braunii* is widely distributed in tropical countries like Malaysia, Cameroun, Ghana and Nigeria, and is used traditionally to treat pulmonary diseases, hypertension, ulcer, cancer, epilepsy and pain. Scientific studies have shown that *G. braunii* possessed anticonvulsant, central nervous depressant, oxytocic, analgesic, anti-inflammatory, laxative, antihypertensive, anti-hyperglycemic, antioxidant, anticancer, antibacterial, antifungal and antiplasmodial activities. Approximately, thirty-two (32) compounds were isolated from the plant. Some of these compounds include; 7 α ,15 α -epoxy-lup-20(29)-ene-30-hydroxyl-3 β -O-tetracosanoate, Lupeol, quercetin, (+)-catechin, quercitrin, rutin, avicularin, and 6-methoxy-2H-inden-5-ol. *G. braunii* should be used in the development of new plant-derived drugs and used as herbal supplements for the management of various diseases. In addition, studies on the clinical safety and efficacy of the plant should also be carried out.

Keywords: *Globimetula braunii*, Phytochemistry, Pharmacological study, Ethnomedicinal uses.

Introduction

Natural products are chemical substances derived from plants, animals or microorganisms having pharmacological or biological activities.¹ The use of natural products, especially plants, for healing is as ancient and universal as medicine itself.² The use of indigenous drugs of plant origin forms a major part of traditional and complementary medicine.³ In developing countries, people living in rural areas use herbal medicinal plants for their primary health care needs.⁴ According to the World Health Organization, about 80% of the world's population uses medicinal plants in the treatment of various ailments.⁵ About 70,000 species of plants are used in the treatment of various diseases but only about 15% have been investigated for their medical use.⁶

G. braunii is a medicinal plant used traditionally in the treatment of various diseases. It is a hemiparasitic shrub that grows on dicotyledonous trees such as *Terminalia catappa*, *Khaya senegalensis*, *Citrus grandis* and *Terminalia mantaly*.⁷⁻⁹ It is known as "Mistletoe" (English), "Kauchii" (Hausa) and "Afomoonishano" (Yoruba).⁸ The aim of this study is to review the ethnomedicinal uses, scientific and pharmacological studies as well as the phytochemistry of *G. braunii*.

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Materials and Methods

Information relating to the ethnomedicinal uses, scientific and pharmacological studies as well as phytochemistry of the *G. braunii* was collected by searching using the keywords "*Globimetula braunii*, Phytochemistry, Pharmacological study" in the following databases; Google Scholar, PubMed, ScienceDirect and Web of Science. The primary information such as ethnomedicinal uses, pharmacological studies, biological activities and phytochemical constituents of *G. braunii* (regardless of the host plant) are included in this review. The structures of all isolated compounds from *G. braunii* were drawn using ChemDraw Ultra 7.0. Only papers published in English were reviewed and there is no limit on the year of the papers or studies reviewed.

Results and Discussion

To the best of our findings, limited studies reported the ethnomedicinal uses, pharmacological studies and phytochemical constituents of *G. braunii*, detailed information is presented in the sections that follow.

Description of *G. braunii*

G. braunii belongs to the family Loranthaceae. The image of *G. braunii* growing on *Terminalia catappa* L. (Combretaceae) in its Natural Habitat is shown below (Plate I). The plant is widely distributed in tropical countries like Malaysia, India,¹⁰ Cameroun, Ghana and Nigeria.⁷ The botanical classification of *G. braunii* is presented below (Table 1).

Ethnomedicinal uses of *G. braunii*

The plant is used traditionally in the treatment of various diseases. In southwestern Nigeria, the plant is used as an analgesic and in the treatment of pulmonary diseases.¹⁰



Plate I: *G. braunii* (Loranthaceae) growing on *Terminalia catappa* L. (Combretaceae)

Table 1: Taxonomy of *G. braunii*

Kingdom	Platae
Phylum	Tracheophyta
Division	Angiospermae
Class	Magnoliopsida
Order	Santalales
Family	Loranthaceae
Genus	<i>Globimetula</i>
Species	<i>braunii</i>

Table 2: Medicinal Uses of *G. Braunii*

Part	Medicinal uses	Reference
Leaf	Management of rheumatism, headaches, pains, diabetes, diarrhea, pulmonary problems, hypertension and epilepsy	[7,10,11]
Root	Ulcer and cancer treatment	[7]
Flower	Hypertension	[7]
Fruit	Hypertension	[7]

Different parts of the plant such as leaves, fruits and flowers are used to treat hypertension; however, the roots are employed for other therapeutic uses such as ulcer and cancer treatment.⁷ The plant was reported to be used in the treatment of epilepsy.¹¹ Table 2 summarizes ethnomedicinal uses of different parts of *G. braunii*.

Scientific Studies on *G. braunii*

Scientific investigations have shown that *G. braunii* has various pharmacological activities (Table 3). A study showed that the ethyl acetate fraction of *G. braunii* leaf demonstrated significant anticonvulsant activity; the fraction protected mice against pentylenetetrazole and significantly delayed the onset of myoclonus jerk and tonic seizures indicating its anticonvulsant activity.⁸ Similarly, the ethanol leaf extract of *G. braunii* (growing on *Terminalia catappa*) was reported to possess central nervous system depressant activity and the effect was found to be comparable to that of diazepam.¹²

Hexane fraction of the ethanol leaf extract of *G. braunii* (growing on *Terminalia catappa*) was also found to have significant central nervous system depressant activity.¹³ Furthermore, the aqueous extract of *G. braunii* was found to exhibit oxytocic activity on the uterine smooth muscle in a dose-dependent manner; however, the effect was less potent compared to standard oxytocin in an *in vitro* study.¹⁴ In addition, the ethanol leaf extract of *G. braunii* demonstrated analgesic, anti-inflammatory and laxative activities.¹⁵⁻¹⁶ Moreover, a study carried out by Okpuzor *et al.*¹⁰ has shown that *G. braunii* contains some bioactive compounds similar to standard antihypertensive drugs (nifedipine, propranolol and lisinopril) that may lower blood pressure. According to the study conducted by Muhammad *et al.*¹⁷ both hexane and petroleum ether leaf extracts of *G. braunii* were reported to possess

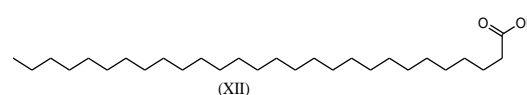
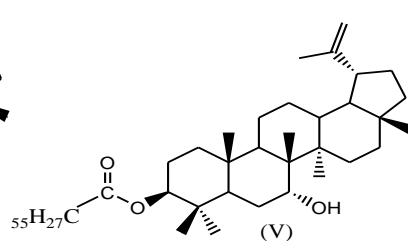
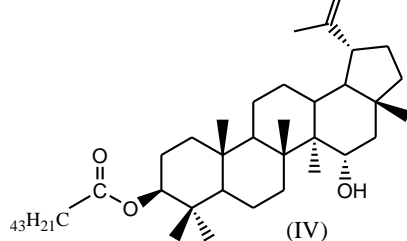
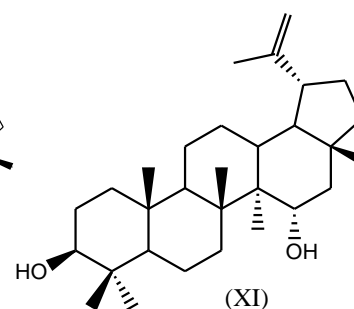
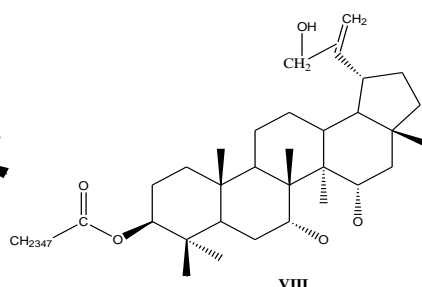
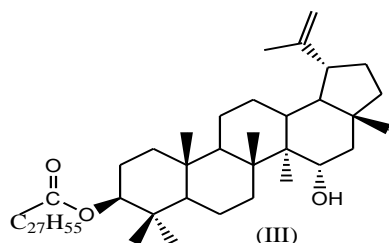
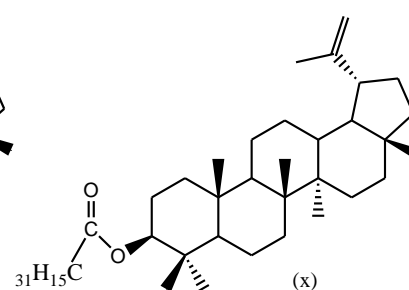
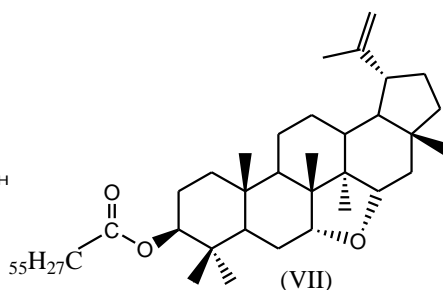
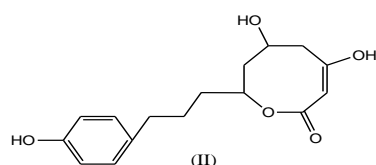
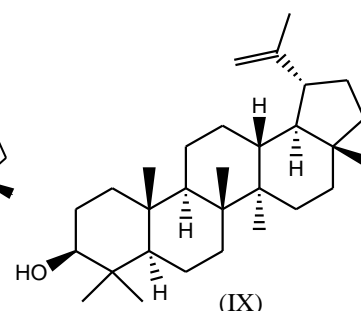
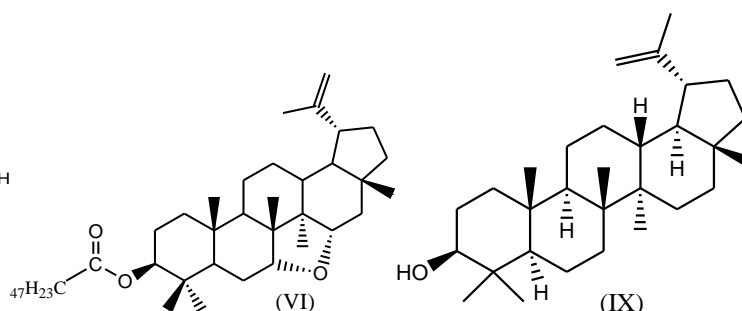
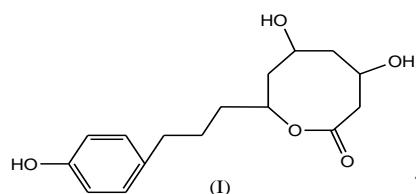
hypoglycaemic and hypolipidemic properties. Additionally, the leaf extract and fractions of *G. braunii* growing on *Azadirachta indica* were reported to have a significant blood glucose reduction effect in adult Wistar rats comparable to metformin. Also, the petroleum ether fraction was found to have the most significant effect.¹⁸ Similarly, the ethanol leaf extract of *G. braunii* was found to have an antihyperglycemic effect comparable to that of glibenclamide. However, the dichloromethane and aqueous partitioned fractions of the ethanol leaf extract were found to be the most promising fractions with antihyperglycemic properties.¹⁹ Furthermore, *G. braunii* exhibited lipid-lowering activity by depressing total cholesterol, triglyceride and malonyldialdehyde in the serum of albino rat.^{11,20,21} Also, the ethyl acetate and methanol leaf extracts of *G. braunii* were found to have strong antioxidant activity.²² Similarly, the n-hexane, dichloromethane, ethyl acetate, n-butanol and aqueous fractions of ethanol leaf and stem extract of *G. braunii* growing on *Leucena leucocephala* have been shown to possess substantial antioxidant activity.²³ Furthermore, methyl-3,5-dihydroxy-4-methoxybenzoate (XXVIII) and guaiacol (XXX) isolated from the leaf of *G. braunii* were reported to have significant antioxidant effects with considerable antimicrobial potential.²⁴ This antioxidant activity may contribute to the plant's various pharmacological activities such as anti-cancer and antihyperglycemic activities. Aqueous leaf extract of *G. braunii* reduced the viability of human pancreatic carcinoma cells (AsPC-1) in a dose-dependent manner,²⁵ and this suggests the anticancer activity of the plant. Similarly, *G. braunii* (growing on *Leucena leucocephala*) fractions were reported to have promising activities against prostate, breast and pancreatic cancer cells.²⁶ The aqueous leaf extract *G. braunii* growing on *Terminalia catappa* was found to have antibacterial activity against some selected test organisms.⁹ However, the leaf extracts (n-hexane, chloroform, ethyl acetate and methanol) of *G. braunii* *Ptilostigma thonningii* plant were reported to have moderate antibacterial activity against *Pseudomonas aeruginosa*.²⁷ The extract of *G. braunii* leaf growing on *Leucena leucocephala*, was investigated for antimicrobial activity and most of the reference strains (*Escherichia coli*, *Candida albicans* and Methicillin-resistant *Staphylococcus aureus*) of pathogenic microorganism were reported to show susceptibility to the extract.²³ Lastly, the methanol leaf extract *G. braunii* showed antiplasmodial activity against chloroquine-sensitive and resistant strains of *P. berghei*.²⁸ Furthermore, the extract of *G. braunii* leaf growing on *Leucena leucocephala*, was investigated for antimicrobial activity against reference strains (*Escherichia coli*, *Pseudomonas aeruginosa*, *Candida albicans* and Methicillin-resistant *Staphylococcus aureus*) of pathogenic microorganisms. The extract demonstrated positive antimicrobial activity against tested organisms.²³ Lastly, the methanol leaf extract of *G. braunii* exhibited positive antiplasmodial activity against chloroquine-sensitive and resistant strains of *Plasmodium berghei*.²⁸

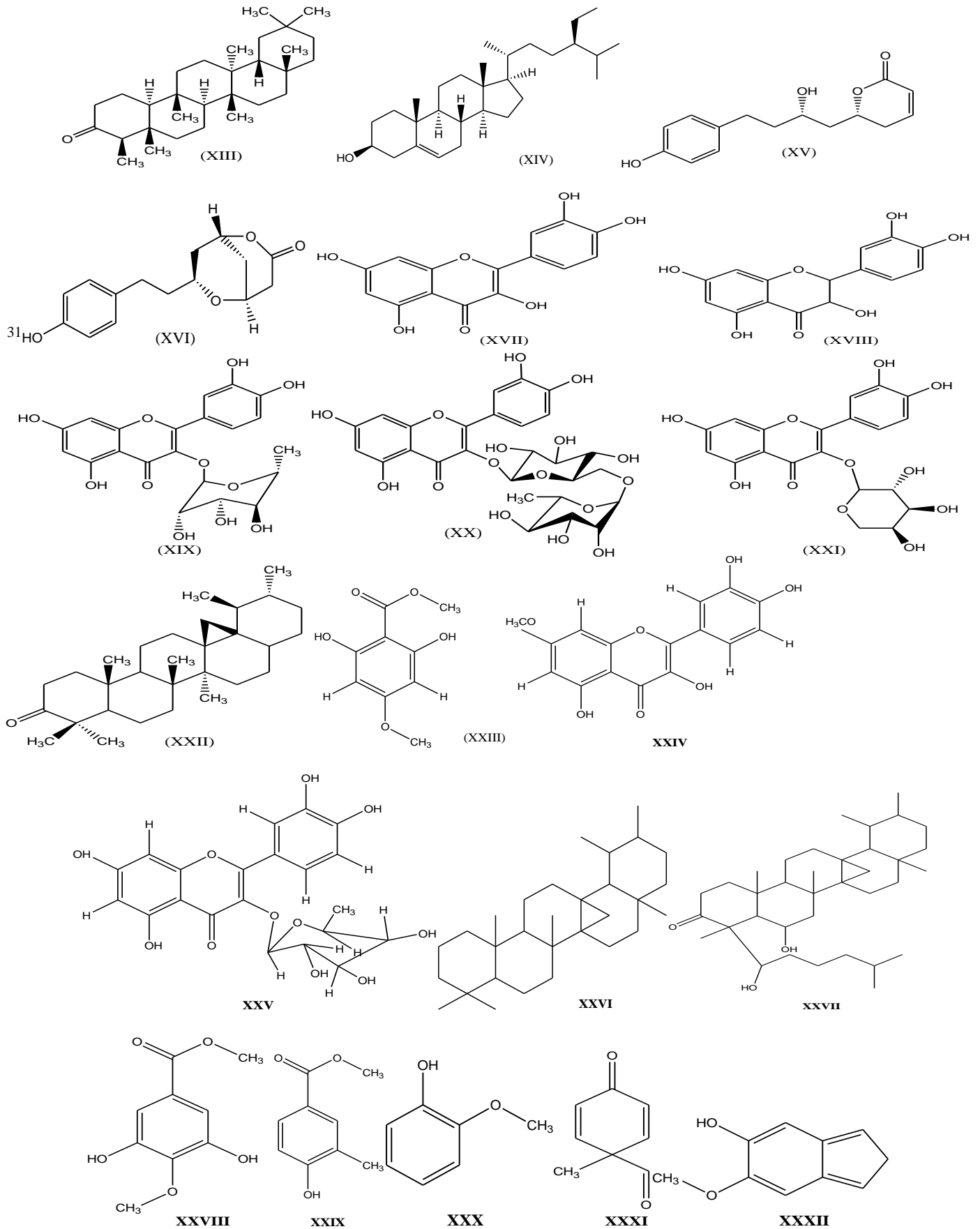
Phytochemistry of *G. braunii*

Two new hydroxyethyloctalactones; 4,6-Dihydroxy-8-[2-(4-hydroxyphenyl)-ethyl]-oxocan-2-one (I) and 6-Hydroxy-8-[2-(4-hydroxyphenyl)-ethyl]-5,6,7,8-tetrahydro-oxocin-2-one (II) were isolated from the ethanol leaf extract of *G. braunii* growing on *Ptilostigma thonningii*.²⁹ Muhammad *et al.*³⁰ reported the isolation of twelve new compounds from the same plant; 15 α -hydroxyl-lup-20(29)-ene-3 β -O-eicosanoate (III), 15 α -hydroxyl-lup-20(29)-ene-3 β -O-docosanoate (IV), 7 α -hydroxyl-lup-20(29)-ene-3 β -O-eicosanoate (V), 7 α ,15 α -epoxy-lup-20(29)-ene-3 β -O-tetracosanoate (VI), 7 α ,15 α -epoxy-lup-20(29)-ene-3 β -O-eicosanoate (VII), 7 α ,15 α -epoxy-lup-20(29)-ene-30-hydroxyl-3 β -O-tetracosanoate (VIII), Lupeol (IX), lupeol palmitate (X), lup-20(29)-en-3 β ,15 α -diol (XI), octacosanoic acid (XII), friedelin (XIII) and β -sitosterol (XIV).³⁰ Similarly, Lupeol (IX) was reported to have been isolated from the n-hexane fraction of the ethanol leaf extract *G. braunii* growing on *Terminalia catappa* for the first time.¹³ Additionally, two lactones and five known flavonoids were isolated from the leaf extract of *G. braunii* growing on *Ptilostigma thonningii*. The compounds are: (R)-6-[(S)-2-hydroxy-4-(4-hydroxyphenyl)butyl]-5,6-dihydropyran-2-one (XV), (1R,5S,7S)-[2-(4-hydroxyphenyl)ethyl]-2,6-dioxabicyclo[3.3.1]nonan-3-one (XVI), quercetin (XVII), (+)-catechin (XVIII), quercitrin (XIX), rutin (XX) and avicularin (XXI).

Table 3: Pharmacological activities of *G. braunii*

Part of the plant used	Solvent phase used	Pharmacological activities	Reference
Leaf	Ethyl acetate	Anticonvulsant activity	[8]
Leaf	Ethanol	Central nervous system	[12]
Leaf	Hexane	Central nervous system depressant activity.	[13]
	aqueous	oxytocic activity	[14]
Leaf	Ethanol	Analgesic, anti-inflammatory and laxative	[15,16]
Leaf	Ethanol, hexane, ethyl acetate	Antidiabetic	[17-19]
Leaf	Ethanol, hexane, ethyl acetate	Hypolipidemic	[11,17,20,21]
Leaf and Stem	ethyl acetate and methanol	Antioxidant activity.	[22-24, 27]
Leaf	Aqueous	anticancer	[25,26]
Leaf	Aqueous, Ethanol, n-hexane, dichloromethane, ethyl acetate and methanol	antibacterial	[9,23,27]
Leaf	Ethyl acetate	Antifungal	[23]
Leaf	Methanol	Antiplasmodial	[28]





Furthermore, two compounds were also isolated from ethanol leaf extract of *G. braunii* growing on *Leucena leucocephala* (Fabaceae); 13, 27-cycloursan-3-one (XXII) and methyl 2, 6-dihydroxy-4-methoxybenzoate (XXIII).²⁹ Additionally, Danladi *et al.*³² reported the isolation of three flavonols; rhamnetin (XXIV), quercetin (XVII) and rhamnetin-3-O- α -L-rhamnoside (XXV) from n-butanol fraction of ethanol leaf extract of *G. braunii* growing on *Terminalia catappa*. A bioactivity-guided study carried out by Oriola *et al.*²⁴ reported the isolation of ursane type triterpenes, phenols and phenol derivatives; 13,27-cycloursane (XXVI), 13, 27-cycloursan-3-one (XXII), globraunone (XXVII), methyl-3,5-dihydroxy-4-methoxybenzoate (XXVIII), methyl-3-methyl-4-hydroxybenzoate (XXIX), guaiacol (XXX), 4-methyl-4-formaldehyde phenome (XXXI), 6-methoxy-2H-inden-5-ol (XXXII) from ethanol leaf fraction of *G. braunii* growing on *Leucena leucocephala*.

Conclusion

Studies have shown that *G. braunii* is used in traditional medicine in the treatment of various illnesses. Additionally, several pharmacological activities of *G. braunii* have been studied and the plant has shown to have promising effects. In addition, many bioactive compounds such as flavonoids, steroids and triterpenoids were isolated and their structures were established. This study documented the ethnomedicinal uses, pharmacological and phytochemical constituents of *G. braunii*.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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