World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 7.409

REVIEW ON THE PHARMACOLOGICAL CHARACTERISTICS, PHYTOCHEMISTRY, AND ETHNOMEDICAL USES OF *LAGGERA AURITA LINN* (ASTERACEAE)

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Article Received on 05/04/2024 **Article Revised on 25/04/2024** **Article Accepted on 15/05/2024**

ABSTRACT
The plant *Laggera aurita* (Asteraceae) is a commonly utilized medicinal plant growing as a weed in African and Asian countries used in the treatment of many diseases. Besides, several phytochemical and pharmacological studies were conducted to check its phytocompounds and therapeutic potentials. However, there is unavailable information on the plant documenting its ethnomedicinal uses and medicinal properties. Therefore, the current article aims to provide updated information on the ethnomedicinal values, phytochemical compounds, and therapeutic potentials of *Laggera aurita* for further studies to develop noble bioactive molecules.

KEYWORDS: Ethnopharmacological uses, *Laggera aurita*, Medicinal plants, Pharmacology, Phytochemistry, Toxicology.

INTRODUCTION

The plants *Laggera aurita* is a widely used shrub among the people in the management of fever in children, other ethno-medicinal uses were also reported among Africans in managing diseases such as connective tissues, inflammatory conditions, sickle cell, pain, fever, anti-convulsant and jaundice, rheumatism. Almost all parts of the plants are used for medicinal purposes. The results of the preliminary phytochemical evaluation of the extractives of the aerial part of *Laggera aurita Linn*. revealed the presence of some of these metabolites (Terpenoids, cardiac glycosides, alkaloids, carbohydrates, flavonoids, saponins, cardiac glycosides and tannins) in the crude, n-hexane, chloroform, ethyl acetate, n-butanol, aqueous portion and the column fractions.

Medicinal plants are readily available sources of a wide range of phytochemical constituents for the prevention and treatment of various medical conditions (Dutra et al. 2016). These secondary metabolites have many biological actions, which give the scientific evidence for utilizing the herbal products in traditional medical practice in various communities (Kaur et al. 2021). About one-fourth of the world's population utilizes traditional treatments using herbs as a source of primary health care (Muhammad et al. 2021). In fact, herbal products are gaining more popularity due to their abundance, afford ability, and presumed safety compared to orthodox medicines (Wada et al. 2019). Currently, there are various documented traditional uses of the plant in the literature. Besides, many scientific investigations were conducted to investigate the bioactive molecules from *L. aurita* for therapeutic reasons. However, summarized information on the traditional values, phytochemical composition, pharmacology, and toxicology on the plant is lacking.

Thus, in order to spur additional research for possible medication development, this review aims to give a thorough summary of the ethnomedicinal benefits, phytochemistry, isolated components, pharmacology, and toxicity of *Laggera aurita.*

Methods

We conducted a thorough search from the plant's inception to April 2024, retrieving information about *Laggera aurita* from academic web databases like PubMed and Google Scholar. *Laggera aurita*, phytochemistry, pharmacological activity, ethnomedicinal applications, and toxicity are some of the search terms that were employed.

RESULTS

Traditional uses

In Nigeria, people with epilepsy use the leaves of *Laggera aurita* (Malami et al. 2016). The essential oils from the plant are used to treat thrombosis, atherosclerosis, and cancer. According to Edris (2007), Guragi et al. (2018), Magaji and Malami (2018), and

Malami et al. (2016), they also have antispasmodic and diuretic properties. In Burkina Faso, Cameroon, and Nigeria, the plant is traditionally used to treat bacterial infections, fever, malaria, stomatitis, pain, asthma, nasal congestion, and bronchitis in children. Cereal grains use it as a preservative (Egharevba et al. 2010). According to Diabala et al. (2014), it has also reportedly been used traditionally to treat rheumatic pain, inflammation, dyspepsia, indigestion, constipation, diarrhoea, and to promote wound healing. Table 1 lists the plant *L. aurita's* documented ethnomedical applications.

Table 1: Reported ethnomedicinal uses of *Laggera aurita.*

Ethnomedicinal Use	Plant Parts	References
Antibacterial	Leaf, whole plant, volatile oil, aerial part	Egharevba et al. (2010), Greff et al. (2006), Magaji and Malami (2018), Shahwar et al. (2012)
Antispasmodic	Not specified	Dantanko and Malann (2020), Singh and Mittal (2015)
Atherosclerosis	Essential oil	Getahun et al. (2019), Olurishe and Mati (2014)
Asthma	Not specified	Guragi et al. (2018), Magaji and Malami (2018)
Bronchitis	Not specified	Magaji and Malami (2018)
Cancer	Essential oil	Edris (2007), Guragi et al. (2018), Magaji and Malami (2018)
Constipation/laxative	Not specified	Dantanko and Malann (2020), Getahun et al. (2019), Olurishe and Mati (2014), Singh and Mittal (2015)
Diuretic	Not specified	(Singh and Mittal, 2015)
Dysentery	Not specified	Dantanko and Malann (2020), Getahun et al. (2019), Olurishe and Mati (2014), Salisu et al. (2014), Singh and Mittal (2015)
Epilepsy	Leaf	Getahun et al. (2019), Guragi et al. (2018), Magaji and Malami (2018), Muhammad and Sani (2018)
Fever	Leaf	Getahun et al. (2019), Magaji and Malami (2018)
Inflammation	Whole plant	Getahun et al. (2019), Olurishe and Mati (2014), Salisu et al. (2015), Shahwar et al. (2012)
Malaria	Leaf, essential oil	Dantanko and Malann (2020), Egharevba et al. (2010)

Phytochemical constituents of *Laggera aurita*

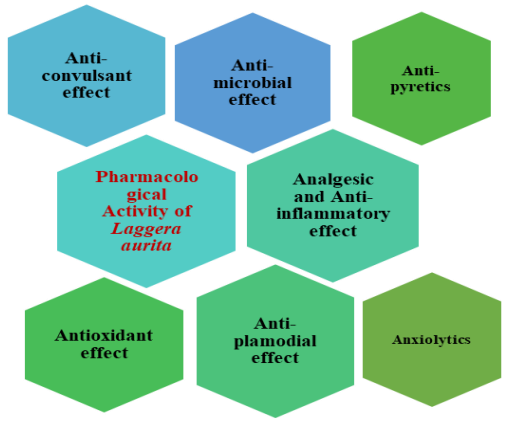
Phytochemical investigation unveiled several monoterpenoids, sesquiterpenoids, and some flavonoids (Xiao et al. 2003). Likewise, compounds such as 2,5-dimethoxy p-cymene, β-caryophyllene, 2,3-dimethoxy-p-cymene, α-humulene, laggerol, m-menth-6-en- 8-ol, α-cadinol, and δ-cadinene were isolated from the whole plant. Hex adecenoic acid α-cadinol, 9,12-octadecadienoic acid were also isolated from the plant's aerial part (Greff et al. 2006; Shahwar et al. 2012). The summary of the documented phytochemical contents from the *L. aurita* is reported in Table 2.

Table 2: Phytochemical constituents of *Laggera aurita.*

Plant Part	Solvent	Phytochemical	Reference
Whole plant, Leaves	Methanol	Carbohydrate	Olurishe and Mati (2014), Salisu et al. (2015)
Whole plant, Leaves	Methanol	Saponins	Olurishe and Mati (2014), Salisu et al. (2015), Shehu et al. (2016)
Whole plant, Leaves	Methanol	Tannins	Olurishe and Mati (2014), Salisu et al. (2015), Shehu et al. (2016)
Whole plant, Leaves	Methanol	Flavonoids	Malami et al. (2016), Salisu et al. (2015), Shehu et al. (2016)
Whole plant, Leaves	Methanol	Alkaloids	Salisu et al. (2015), Shehu et al. (2016)
Whole plant, Leaves	Methanol	Glycosides	Salisu et al. (2015), Shehu et al. (2016)
Whole plant	Methanol	Cardiac glycosides	Shehu et al. (2016)
Whole plant, Leaves	Methanol	Phenols	Salisu et al. (2015), Shehu et al. (2016)

Pharmacological activities of *Laggera aurita*

Research has indicated that various plant parts possess distinct biological activities, including but not limited to antinociceptive, anti-inflammatory, anticonvulsant, antimicrobial, antimalarial, antioxidant, and anxiolytic properties (Egharevba et al. 2010; Salisu et al. 2015; Shahwar et al. 2012; Dalanko and Malann 2020; Singh and Mittal 2015).



Analgesic and anti-inflammatory studies

Pain is a disturbing and unpleasant sensation elicited after the activation of peripheral pain receptors, which is associated with real or possible tissue damage (Fan et al. 2014; Kaliyaperumal et al. 2020). Inflammation is an adaptive physiological response that happens in a particular tissue in response to tissue injury, cell death, cancer, degeneration, and ischemia (Azab et al. 2016). Even though progress has been achieved substantially in treating pain and inflammatory conditions with efficacious drugs, the conditions remain among the highest health burdens in the global healthcare system (Khan et al. 2020). The herbal products' utilization against pain and inflammation has been well reported (Borges et al. 2018; Saleh et al. 2015).

Anticonvulsant properties

Epilepsy is a common serious neurological pathological condition accompanied by recurrent spontaneous seizures due to complicated neurochemical processes involving several neurotransmitters (Almeida et al. 2011). The currently available antiepileptic compounds have adverse effects and limited efficiency, necessitating alternative, potent, clinically efficacious, and safe therapeutic options against the disorder (Fisseha et al. 2021). Several herbal preparations have medicinal use against epilepsy in traditional practice (Aghamiri et al. 2020), including *L. aurita* (Malami et al. 2016). Various herbal products with potential antiepileptic effects have been documented (Zhu et al. 2014). As per the study by Malami et al. (2016), the leaf extract of *L. aurita* at 600 mg/kg produced 40% protection against tonic hind limb extension and a significant decline in the mean recovery time in maximal electro shock (MEST)-elicited seizures.

Antimicrobial properties

Infectious diseases form part of the top 10 causes of global death, disability, and morbidity (Etame et al. 2019; Nair et al. 2017). Even though there has been advancement in antimicrobial therapy, resistance causes serious drawbacks in curtailing infectious diseases (Etame et al. 2019). Natural products, including plants, form a new hub for treating infectious diseases (Blondeau et al. 2020). The crude extract of *L. aurita* and its fractions were reported to have anti-tubercular activity in the broth micro-dilution method (BMM) (Egharevba et al. 2010). The crude extract's minimum inhibitory con centration (MIC) was determined to be 625u/ml compared to several fractions ranging between 1000-3000u/ ml (Egharevba et al. 2010). It was proposed that the observed antimicrobial effect shown by the crude extract might result from several compounds' synergistic action (Egharevba et al. 2010).

Anti-plasmodial properties

Malaria is a disease that causes rampant death and com plications globally, where more than 50% of the population is affected by the disease. The most affected region is sub-Saharan Africa (Habte and Assefa 2020). Besides, the Plasmodium species, notably P. falciparum, have developed resistance to the currently available antimalarial agents, posing obstacles to malaria prevention and treatment (Fenta and Kahaliw 2019). In developing areas, people rely on herbal preparations for treating malaria (Okokon et al. 2017).

Antioxidant properties

Antioxidants moderate the generation of reactive oxygen species (ROS) such as free radicals from various bod ily metabolic activities. However, an irregularity that increases the ROS level and oxidative stress results in many disorders, including cardiovascular diseases, diabetes mellitus, inflammation, and neurodegenerative dis orders associated with oxidative stress (Aldoghaci et al. 2021). Medicinal plants are a great source of antioxidant compounds (Link et al. 2016).

Antipyretic activity

Pyrexia is an elevation in the body temperature beyond the physiological level due to conditions including ovulation, increased thyroid hormone secretion, strenuous exercise, and microbial agents (Sultana et al. 2015). The body's immune is stimulated to remove the microbes in case of infections (Sultana et al. 2015). Various medicinal plants were reported to have antipyretic actions (Nock et al. 2022; Rauf et al. 2014). Another research unveiled a significant ($p < 0.05$) reduction in the Brewers' yeast induced fever model as an indication of the antipyretic effect of the plant (Magaji and Malami 2018).

Anxiolytic activities

Anxiety is a severe psychological situation associated with negative emotional experiences (Mani et al. 2021). This disorder is one of the most common community illnesses affecting about 2–6% of the world population (Mani et al. 2021). Previous studies reported the anxiolytic actions of medicinal plants (Doukkali et al. 2015; El akhal et al. 2021; Lobina et al. 2018). The methanol leaf extract of *L. aurita* (150, 300, and 600 mg/kg) exhibited anxiolytic potentials in the hole-board, elevated plus maze, staircase, beam walk assay, open field, and diazepam-induced sleep models (Guragi et al. 2018).

Toxicological studies

Traditional medicine has been getting attention glob ally with medicinal plant products to treat diseases and improve health (Joung et al. 2019). Because herbal products are obtained from natural sources and utilized for prevention and disease curation, they are generally presumed safe (Abraham and Ahmad 2021). Nevertheless, studies have cautioned about the safety of the herbal preparations, particularly their possible liver and kidney toxicity (Ahmad et al. 2022; Teschke et al. 2014). Therefore, scientific documentation on plant safety information is necessary for drug development (Reduan et al. 2020).

An experiment by Shehu et al. (2016) reported the acute toxicological effects of the *L. aurita* extract at 2000 and 5000 mg/kg (Shehu et al. 2016). The histopathological result showed specific toxicity of the extract on the kidney and liver at 2000 mg/kg. The liver, kidney, spleen, lungs, and stomach were all affected at 5000 mg/kg, except for the heart (Shehu et al. 2016).

CONCLUSIONS

The plant *Laggera aurita* possesses promising therapeutic values. Previous experiments on the plant have established some of its ethnopharmacological indications in traditional medicine as evidence for its potential therapeutic activity against various disorders. However, more research is needed to provide documented proof for many of its traditional uses. The literature has shown that several compounds have been isolated and identified from *Laggera aurita* from different locations, although there are variations in the compounds isolated. Therefore, there is a need to screen the compounds responsible for potential pharmacological effects and toxicities. The toxicological evaluation of *Laggera aurita* has also shown relative safety in sub-chronic administration and signs of toxicity in acute studies. In addition, there is a need for further detailed long-term toxicological evaluation, such as chronic, mutagenic, teratogenic, and genotoxic toxic ity studies of the plant, to establish its safety fully.

Furthermore, there is a need to standardize doses that could be used for subsequent clinical trials in humans. This will further establish safety and efficacy of *Laggera aurita* in the treatment of various diseases.

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