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Comprehensive Analysis of *Senna auriculata* and its Pharmacological Biomedical Applications

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Abstract

Senna auriculata L is well known for a wide range of therapeutic benefits. Leaves, stems, roots, flowers, buds, bark, seeds, and fruit extracts have been used specifically in Ayurvedic, Siddha, and Chinese medical systems to treat ophthalmia and conjunctivitis. S. auriculata, recognized for its healing properties, has long been utilized in Chinese traditional medicine for detoxification, reducing inflammation, and enhancing liver health, highlighting its medicinal potential with antibacterial, antidiabetic, antioxidant, hepatoprotective, and antipyretic applications. The following keywords were used to search the literature from 2008 to 2024. S. auriculata has pharmacological, traditional Chinese medicinal, antidiabetic, anticancer, and hepatoprotective effects. S. auriculata has been used successfully in traditional medicine to treat various illnesses, including type 2 diabetes and skin, eye, liver, and urinary diseases. The databases searched were PubMed, Scopus, Google Scholar, Web of Science, and Science Direct. Based on the research findings, S. auriculata has a wide range of biological actions, including antiviral, antioxidant, and anticancer effects. The pharmacological properties of S. auriculata and its potential therapeutic uses are explored. S. auriculata flowers were used to treat diabetes, nocturnal emissions, urine discharge, and throat irritation. Microbial infectious disorders and antidiabetic, antioxidant, hepatoprotective, antipyretic, antihyperglycemic, anticancer, and antimicrobial properties have all been linked to plants. The study results provide an overview for future research into these important medicinal plants, setting the way for developing new pharmaceuticals and natural therapies.

Keywords: *Anticancer, Antidiabetic, Antimicrobial, Plant-Mediated Nanoparticles, Therapeutic Applications.*

Introduction

Herbal medicines have been used for millennia to cure common illnesses, and many traditional therapies use different plants. The effectiveness of several native plants as medicinal agents for various diseases has been extensively reported by conventional medicine practitioners [1, 2]. *S. auriculata* (*Caesalpiniaceae*) is a shrub of ethnobotanical significance known for its lovely yellow blooms [3]. It is also called “Avaram” in Tamil [4, 5]. Other regional names of *S. auriculata* include Tanner’s Cassia, Tanner’s Senna, Mature Tea Tree (English), Avartaki,

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Pitapuspa, Pitkalika, Manojyna, Pitkala, Charmaranga (Sanskrit), Tarwar, Awal, Tarval (Hindi), Tangedu, Merakatangeeu (Telugu), Arsual, Taravada, and Tarwad (Marathi) [6]. *S. auriculata* is a significant plant in Ayurveda and Siddha medicine and is known for its ethnomedicinal uses. Timoszyk & Grochowalska have recently conducted an extensive analysis of the metabolomic and polyphenolic profiles of *S. auriculata* for the treatment of diabetes and metabolic syndrome [7]. Ayurvedic and other indigenous medical systems usually suggest dietary modifications and traditional plants in India [8]. Natural products are the source of more than 50% of modern medications and are essential to the pharmaceutical industry's drug research initiatives [9].

The plant has a long history of using traditional medicine, and its leaves, roots, bark, flowers, and seeds have all been shown to contain various medicinally active chemicals [10]. The flower contains flavonoids, terpenoids, alkaloids, steroids, reducing sugars, glycosides, phenols, saponins, tannins, and anthraquinone [11]. The leaves contain chemical compounds such as alkaloids, flavonoids, carbohydrates, cardiac glycosides, proteins, phenols, tannins, saponins, and terpenoids. *S. auriculata* bark contains quinoline, phthalate ester, element sesquiterpenoids, alkaloids, monoterpenoids, sesquiterpenes, carbamates, and esters [12]. The phytocompounds present in the roots of *S. auriculata* include flavone glycoside, rutinoside, anthraquinone glycosides, 1,3,8-trihydroxy-6-methoxy-2-methyl-anthraquinone, 7,4-dihydroxy flavone-5-o-beta-d-galactopyranoside, and 1,3-dihydroxy-2-methylantraquinone [13]. The seeds contained several chemical compounds, including glycine, benzoic acid, resorcinol, 2-hydroxy methyl ester, 1-methyl butyl ester, and 4.8% light yellow fatty acid. Some major compounds present in the plant seeds are oleic, linoleic, and palmitic acids. [14].

These compounds have pharmacological qualities that make them useful in the treatment of ailments such as diabetes, asthma, ulcers, conjunctivitis, liver and kidney issues, cancer, and skin disorders [15–18]. The plant's roots, flowers, and buds are some of the parts that are used to cure rheumatism, gonorrhea, diabetes, fever, and gout, among other conditions [19]. Various conditions are used to treat different sections of *S. auriculata*, which is said to have antibacterial, antipyretic, antihelmintic, hepatoprotective, and antihyperlipidemic properties [20–22]. This plant has therapeutic properties that help to treat eye and bladder diseases and includes glucosides [23]. Their traditional use has been validated by their research, and their pharmacological characteristics have shown antioxidant and antibacterial properties [24]. Anthraquinones, which are derivatives of anthracene with the core structure of 9,10-dioxoanthracene, are abundant in *Cassia* plants. These substances have laxative effects and can also have notable antioxidant effects. It is possible to obtain more than 100 anthraquinone derivatives from different *Cassia* species [25, 26]. The findings indicate that *S. auriculata* possesses a diverse range of bioactive compounds, including flavonoids, tannins, alkaloids, glycosides, saponins, and phenolic acids, which contribute to its therapeutic potential. These phytochemicals exhibit significant antioxidant, anti-inflammatory, antimicrobial, antidiabetic, hepatoprotective, nephroprotective, cardioprotective, and anticancer properties making *S. auriculata* a promising candidate for various medical applications. Scientific data regarding the quantification and identification of the chemical composition of *S. auriculata are* rare. Therefore, this study aimed to determine the phytochemicals, pharmacological properties, and biomedical applications of this plant.

Methods

Many databases, including PubMed, Google Scholar, Web of Science, and Scopus, were used to gather all the relevant data from 2008 to 2024. In addition to these databases, information from websites such as *S. auriculata* was found in "Traditional Chinese Medicine," "Pharmacological Activities, "Anticancer," "Anti-diabetes," "Nanotechnology," "Hepatoprotective," and "Anti-inflammatory" throughout the literature search to find pertinent papers published in peer-reviewed journals. Based on their applicability to the study, many papers that were retrieved were chosen for further evaluation. The remaining papers were not included because enough data was collected. The research articles that examined the pharmacological effects of *S. auriculata* and innovative drug delivery methods were the main focus of the investigation.

Pharmacological Activities of S. Auriculata

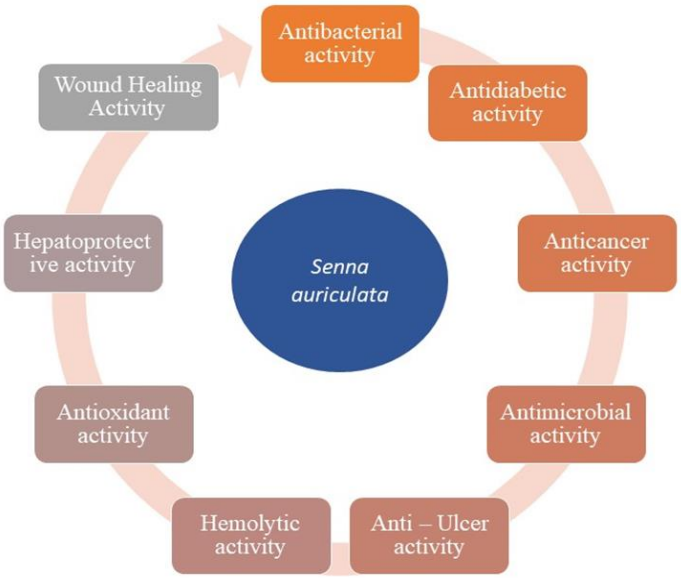

Figure 1. Pharmacological Activities of S. Auriculata Plants

Figure 2. Plant Parts of *S. auriculata*

Antibacterial Activity

Rahman et al. investigated the antibacterial efficacy of crude metabolites and reported that *S. aureus* at 2 mg had a 14 mm zone of inhibition (ZOI). *Pseudomona aeruginosa* and *Candida. Albicans* presented a 12 mm ZOI at the same dosage. For *S. aureus, P. aeruginosa,* and *Enterococcus faecalis,* the minimum inhibitory concentrations (MICs) were 128 µg/mL and 256 µg/mL, respectively. Owing to the presence of phytochemicals with antimicrobial qualities such as phenolics and flavonoids, *S. auriculata* is thought to have antibacterial potential. *S. auriculata* exhibits antimicrobial activity, making it a viable alternative for the synthesis of novel antifungal, antibacterial, and antiviral medicines. It may also be a suitable source for applications involving human red blood cells [25, 27]. Except for *P. aeruginosa*, which had a zone of inhibition of 10 mm, the results showed that the methanol and chloroform leaf extracts exhibited high inhibitory action against all the tested species, *B. cereus, S. aureus, E. coli, K. pneumoniae,* and *P. mirabilis* with zones of inhibition ranging from 12–20 mm. The aqueous leaf extracts showed no inhibition or zones of inhibition ≤12 mm, indicating moderate activity. Using established procedures, phytochemical screening of the extracts revealed the presence of proteins, carbohydrates, steroids, alkaloids, flavonoids, saponins, steroids, saponins, and tannins. The antibacterial activity of these extracts is possibly associated with the presence of flavonoids, steroids, saponins, and tannins [28].

Eshwari et al. compared the ethanolic and ethyl extracts of the leaves of *S. auriculata* and *Perugularia daemia, Achyranthes aspera,* and *Aerva lanata* [29]. The phytochemical analysis confirmed the presence of significant constituents, such as alkaloids, flavonoids, phenols, saponins, terpenoids, tannins, carbohydrates, quinines, Coumarins, steroids, and lactones. The functional groups, such as C-H, C-O, CO-CO, C-X, C-N, and C=O, were identified via FT-IR analysis. These findings can be applied to expand investigations of the production of pharmaceuticals from identified phytoconstituents [30]. Alasady & Thamir, extracted the seeds using methanol and ethanol from the species of *Cassia* (*C. fistula, C. bakeriana, C. glauca, C. siamea,* and *C. alata)* were made at three different concentrations (100 mg/ml, 200 mg/ml, and 400 mg/ml). The investigated *Cassia* species methanolic and ethanolic extracts demonstrated antibacterial activity against the tested bacterial strains such as *E. coli, S. aureus,* and *K. pneumoniae*. Higher doses resulted in greater efficacy than the control (DMSO). However, neither the *C. alata* ethanolic extract nor the *C. fistula* methanolic extract showed any antibacterial action against *K. pneumoniae* at a dosage of 100 mg/ml against *S. aureus*. Notably, the 400 mg/ml *C. siamea* methanolic extract had the strongest antibacterial effect on *E. coli* [31]. The plant parts and their pharmacological activities are illustrated in Figures 1 and 2. Chandrasekaran et al. demonstrated that the ZnO nanoparticles synthesized using *S. auriculata* exhibited notable antibacterial, antifungal, antidiabetic, and anticancer properties. The antibacterial and antifungal efficacy of these nanoparticles was tested against gram-positive bacteria (*S. aureus, B. subtilis*), gram-negative bacteria (*E. coli, Salmonella typhi*), and fungal species (*C. albicans, Aspergillus niger*) [32]. Additionally, their antidiabetic and anticancer potentials were assessed through the α-amylase inhibition assay and the MTT assay, respectively [6]. GC–MS investigations of *S. auriculata* extracts revealed 55 bioactive phytochemical compounds, including AgNPs, with antioxidant capabilities similar to those of ascorbic acid [33, 34]. These AgNPs demonstrated antibacterial activity against gram-negative bacteria and inhibition of DPPH radicals. The FT-IR study demonstrated a reduction in silver ions. These findings show that green-synthesized AgNPs could be useful

therapeutic agents for breast cancer treatment [11].

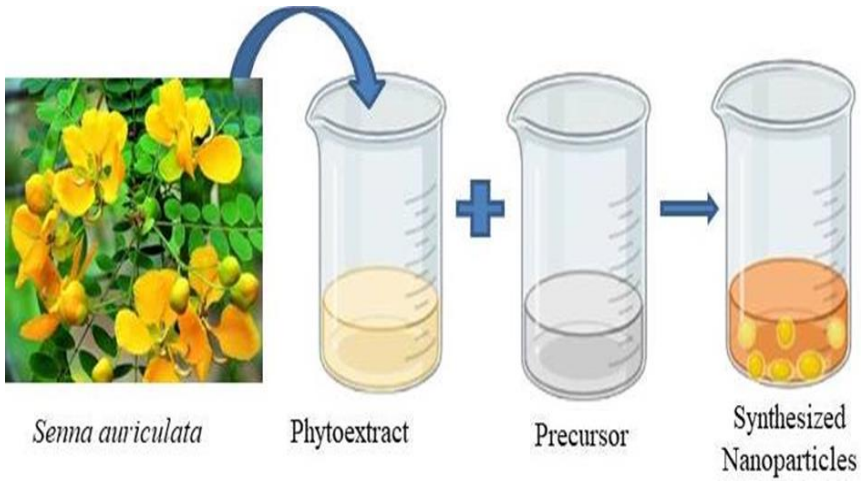

Figure 3. Synthesis of Nanoparticles

The biosynthesized Co_3O_4 nanoparticles exhibited strong antibacterial activity against both gram-positive and gram-negative bacteria, such as *S. aureus*, *Streptococcus mutans*, *Klebsiella pneumoniae*, and *E. coli*, as well as antifungal activity against *Aspergillus flavus* and *A. niger* in in-vitro conditions. The inhibition zones observed for all tested bacteria ranged from 22 ± 0.61 mm to 26 ± 0.81 mm, while for fungi, they ranged from 20 ± 0.42 mm to 33 ± 0.67 mm. The minimum inhibitory concentrations of the *S. auriculata* flower extract-assisted CO_3O_4 nanoparticles against the isolated bacteria ranged from 8 to 20 µg/ml [35].

Antidiabetic Activity

The antidiabetic properties of *S. auriculata* were also examined, revealing its ability to regulate blood glucose levels[36]. The prevalence of diabetes mellitus is rising globally. Many people have both diabetes mellitus and hypertension[37]. The plant's active compounds appear to enhance insulin sensitivity, inhibit key enzymes involved in carbohydrate metabolism, and improve pancreatic beta-cell function. These findings support its traditional use in diabetes management and provide a basis for developing novel antidiabetic formulations. Rats with diabetes caused by streptozotocin (STZ) were used to test the antidiabetic effectiveness of *S. auriculata* bark. When given orally at a dose of 250 mg/kg body weight, various extracts of *S. auriculata* resulted in a gradual decrease in plasma glucose levels. After 90 days of treatment, the glucose levels almost returned to normal, and the most effective treatment was the methanol extract [38]. *S. auriculata* leaf and flower extracts were shown to have hypoglycemic effects on rats whose diabetes was induced by alloxan when dosages of 120 mg/kg were given for 15 days. Their results showed that in rats with alloxan-induced diabetes, these extracts increased beta-cell insulin output [39]. Protein tyrosine phosphatase 1B (PTP 1B) has emerged as a viable therapeutic target, particularly for treating type 2 diabetes [40]. PTP 1B, a negative regulator of insulin signaling, dephosphorylates the insulin receptor in intact cells. The potential to inhibit PTP 1B-type 2 diabetes management has attracted increased attention, prompting an inquiry into the inhibitory action of the hydromethanolic flower extract of *S. auriculata* against PTP1B. The ethyl acetate and n-butanol fractions of the *S. auriculata* flower extracts had IC50 values of 96.27 µg/mL [41]. For 30 days, *S. auriculata* flower extract at doses of 0.15, 0.30, and 0.45

g/kg body weight significantly decreased the high levels of cholesterol and blood glucose in diabetic rats. The 0.45 g/kg dose of *S. auriculata* was as effective as glibenclamide [42].

This study evaluated the efficacy of an herbal tea blend containing fenugreek (*Trigomella foenum-graecum*) and black cumin seeds (*Nigella sativa*) with Aavaram flowers (*S. auriculata*) in lowering blood sugar levels among diabetic patients. In addition to antimicrobial testing against gram-positive, gram-negative, and fungal pathogens, FTIR and XRD were used to evaluate the chemical and crystalline structure of the herbal tea. It revealed that the fenugreek and black cumin seed combination is more effective at decreasing blood sugar levels than the Aavaram flower combination [43, 44]. The potential of *S. auriculata* as a treatment for diabetes and other conditions has been demonstrated by the presence of multiple bioactive components, including polysaccharides, phenolic acids, flavonoids, tannins, saponins, and vitamins A, C, and E, which have antioxidant effects on various proteins. Their study suggested that *S. auriculata*, an ethnobotanical plant, could be a potential diabetes treatment. Increase awareness of its medicinal properties and its potential in managing metabolic syndrome and diabetes. Further research, including chemical analysis and clinical trials, is needed to assess its effectiveness [45]. Research has shown that the *S. auriculata* root methanolic extract has the highest concentrations of flavonoids and polyphenols and compared with other extracts, has the greatest antidiabetic and antioxidant benefits in vitro. The presence of hydroxyl (-OH) groups and coumaric acid is likely the cause of these effects. Furthermore, type 2 diabetic mice were brought back to levels comparable to those of control mice by administering an ethanolic extract of *S. auriculata* root at a concentration of 150 mg/kg body weight. As a result, the pharmaceutical industry may find great use of this extract as a potent antidiabetic and antioxidant [46].

Anticancer Activity

Recent studies have also suggested that *S. auriculata* exhibits anticancer properties. Certain bioactive compounds in the plant have demonstrated cytotoxic effects against cancer cell lines, including Lung, breast, liver, and colorectal cancers [47–50]. The compounds 4-(4-chlorobenzyl)-2,3,4,5,6,7-hexahydra-7-(2-ethoxyphenyl) benzo[h] [1, 4, 7] triazine-8 (1H)-one, which were extracted from *S. auriculata* leaves, showed strong anticancer activity. A dosage of 25 µg/mL efficiently suppressed human colon cancer cells (HCTs) by 50% in less than 48 hours. Lactose dehydrogenase (LDH), an indicator of apoptosis, was found to be significantly released from damaged cell membranes, the high lipophilicity of this compound prevented cancer cells from losing their ability to disintegrate membranes. This compound, which comes from *S. auriculata*, may be able to prevent colon cancer [51]. MDA-MB-231 breast cancer cells showed anticancer effects from *S. auriculata* bark extract in acetone and methanol [52]. The organic compounds in the leaf extract help decrease the amount of silver ions and their capping ability. UV–Vis, SEM, AFM, FTIR, and XRD analyses revealed that the silver nanoparticles were spherical and ranged in size from 30 to 40 nm. UV radiation in the photoreactivation of damaged DNA and, occasionally, its influence demonstrates how UV radiation can coordinate beneficial processes in response to high illumination [53]. The results verified the sample's elemental structure and purity. These silver nanoparticles have been shown to have significant pharmacological effects on diabetes mellitus, arthritis, and cancer [54].

Antioxidant Activity

Hydroalcoholic extracts of *S. auriculata L.* and *Celastrus paniculatus Wild*, two Indian

medicinal herbs, have been shown to have antibacterial and antioxidant properties. There is a significant relationship between phytochemicals and antioxidant capacity, as evidenced by the quantitative evaluations of triphenyl tetrazolium chloride (TTC), total phenolic content (TPC), and total flavonoid content (TFC), which revealed that *S. auriculata L*. and *Celastrus paniculatus Wild* have great antioxidant potential [24]. The high flavonoid and polyphenol content supports its potent free radical scavenging ability, which may play a vital role in preventing oxidative stress-related diseases [55]. Oxidative stress is known to contribute to the pathogenesis of several chronic diseases, including neurodegenerative disorders such as Alzheimer's and Parkinson's disease, as well as cardiovascular diseases [56]. The presence of phenolic compounds enhances the plant's ability to neutralize reactive oxygen species (ROS), potentially reducing cellular damage and delaying disease progression. Additionally, its role in reducing diabetes-related complications, such as nephropathy and neuropathy, requires further investigation.

Hepatoprotective Activity

Previous studies demonstrate its protective effects against liver toxicity, likely mediated through its antioxidant and anti-inflammatory activities [57]. The plant's ability to reduce lipid peroxidation, restore antioxidant enzyme levels, and prevent hepatocellular damage suggests that it could be beneficial for managing conditions such as non-alcoholic fatty diseases (NAFLD) and toxin-induced liver injuries. LCMS analysis facilitated the identification of bioactive compounds in the *S. auriculata* extract, including stigmaterin, kaempferol, quercetin, rutin, luteolin, and other phytochemicals. These compounds are known for their hepatoprotective and antioxidant properties, contributing to the observed pharmacological effects of the plant extract. The correlations between antioxidant activity and phenolic, tannin, and flavonoid contents elucidate the mechanisms underlying the observed pharmacological activities. Their study adds to the increasing amount of data that supports the separation of strong hepatoprotective fractions from medicinal plants such as *S. auriculata* by easy column fractionation guided by the DPPH test [58]. By reducing the levels of TBARS and greatly increasing the levels of antioxidant enzymes such as GST, GPx, SOD, and CAT in blood and liver samples, treatment with *S. auriculata* extract significantly reduced the damage caused by oxidative stress. The findings regarding the efficacy of *S. auriculata* leaf extract revealed its effectiveness against oxidative stress caused by ethanol. The observed hepatoprotective effect was possibly due to the presence of active phytoconstituents such as alkaloids and flavonoids [59, 60]. These findings open new avenues for exploring *S. auriculata* based hepatoprotective drugs, particularly for patients suffering liver disorders induced by toxins or metabolic imbalances.

Anti-Ulcer Activity

The Siddha method provides superior solutions for testing and managing peptic ulcers [61, 62]. These investigations demonstrate the gastroprotective and antiulcer characteristics of the most widely used herbs in Siddha treatment. At the 300 mg/kg dose, the methanolic extract of *S. auriculata* reduced the stomach volume, free and total activity, and ulcerative index to levels comparable to those of the standard medicine famotidine (10 mg/kg). The extract has a protection index of 79.4%, indicating that the methanolic leaf extract of *S. auriculata* has strong antiulcer action [63]. *S. auriculata (L.) Roxb*. Leaf methanolic extract (300 mg/kg body weight) was evaluated for its antiulcer effects on gastric ulcers caused by pylorus ligation, and its effects were contrasted with those of famotidine (10 mg/kg body weight), which is a standard medication. In pyloric-ligated rats, the number of ulcers, gastric volume, free and total

acidity, and ulcerative index were significantly reduced by *S. auriculata (L.) Roxb*. leaf extract, according to previous results [64].

Antimicrobial Activity

The antimicrobial activity of *S. auriculata* against a spectrum of pathogenic bacteria and fungi suggests its application in developing alternative antimicrobial therapies [65]. Given the rising threat of antibiotic resistance, natural plant-based antimicrobial agents are increasingly being explored. The present study highlights the effectiveness of *S. auriculata* extracts inhibiting microbial growth, supporting its traditional use in treating infections. While *S. auriculata* leaf and flower extract showed antifungal efficacy against *Aspergillus niger* or *Candida albicans*, they exhibited broad-spectrum antibacterial activity against common strains of *Staphylococcus aureus, Escherichia coli,* and *Bacillus subtilis*. The minimum bacterial concentration (MBC) and minimum inhibitory concentration (MIC) of *S. auriculata* leaf and flower extract was measured. Their study suggests that the leaves and flowers of *S. auriculata* may be potential sources of natural antibacterial agents. These findings suggest that various extracts of *S. auriculata* flowers contain active chemicals that influence biochemical parameters. The characteristics show how aqueous, methanolic, and petroleum ether extracts of *S. auriculata* flowers compare to paracetamol in terms of serum transaminases, alkaline phosphatase, and total and direct bilirubin levels [66]. UV–vis spectroscopy revealed that the produced nanoparticles had a typical surface plasmon absorption maximum at 420–435 nm, indicating that silver nanoparticles had formed. The X-ray diffraction pattern peaks were consistent with the usual values for the face-centered cubic form of metallic silver. Fourier transform infrared spectroscopy revealed that the polyphenols with aromatic rings and bound amide regions attached to the silver nanoparticles were spherical and polydispersed. The antibacterial activity of the produced nanoparticles was tested against *Serratia marcescens, B. subtilis, Aspergillus niger, E. coli,* and *A. flavus*, with *fungi* showing the highest susceptibility followed by bacteria [67-69]. Further in-depth studies on its mechanism of action, synergy with conventional antibiotics, and clinical effectiveness could enhance its therapeutic potential.

Wound Healing Activity

Wound healing assays have become common as an in vitro approach for studying cell migration and determining the effects of various medications on cell motility and proliferation [29, 70]. The potential of *S. auriculata* leaf extract to stimulate wound healing in L929 murine fibroblast lines was assessed via an in vitro wound healing scratch assay. Compared with the control group, the cell monolayer treated with the methanolic extract resulted in significantly greater wound healing at 8, 16, and 24 hours. Within 24 hours, the wounds of the cells treated with 50 mg/mL of the extract healed completely. Research has shown that the methanolic leaf extract of *S. auriculata* sped up wound healing in comparison with that of control plants and had no negative side effects [71].

Hemolytic Activity

The crude extract metabolites from *S. auriculata* flowers explored the hemolytic activity. The newly collected human blood cells were diluted to 1% and washed three times with PBS, after which 200 µL of each blood sample and 800 µL of PBS solution were combined in each microcentrifuge tube. The absorbance of each sample was measured at 540 nm after the tubes were centrifuged at 3000 rpm. Then the hemolysis properties were calculated. These findings demonstrated that the crude metabolites of *S. auriculata* flowers exhibited dose-dependent hemolytic activity compatible with that of human blood cells [25].

Table 1. Pharmacological Activities of the Plant Extracts S. Auriculata

S. No	Biological Activity	Parts of the Plant	References
1	Antibacterial activity	Flower	[11]
2	Antibacterial activity	Flower	[25]
3	Antibacterial activity	Flower	[32]
4	Antibacterial activity	Flower	[35]
5	Antibacterial activity	Leaf	[27]
6	Antibacterial activity	Leaf	[28]
7	Antibacterial activity	Leaf	[29]
8	Antibacterial activity	Seed	[30]
9	Antibacterial activity	root	[29]
10	Antidiabetic activity	Bark	[38]
11	Antidiabetic activity	Flower, Leaf	[39]
12	Antidiabetic activity	Flower	[41]
13	Antidiabetic activity	Flower	[42, 43, 44]
14	Antidiabetic activity	Root	[46]
15	Anticancer activity	Leaf	[51]
16	Anticancer activity	Bark	[52]
17	Anticancer activity	Leaf	[54]
18	Antioxidant	Leaf	[24]
19	Hepatoprotective activity	Leaf	[58]
20	Hepatoprotective activity	Leaf	[59]
21	Hepatoprotective activity	Leaf	[60]
22	Antiulcer activity	Leaf	[63]
23	Antiulcer activity	Leaf	[64]
27	Antimicrobial activity	Leaf	[65]
28	Antimicrobial activity	Leaf and Flower	[66]
29	Wound Healing Activity	Leaf	[71]
30	Hemolytic activity	Flower	[25]

Limitations

Many therapeutic plants are currently being investigated for a range of pharmacological purposes. Although plants have been utilized for a long time, certain characteristics, such as toxicity and safety concerns, must be highlighted. Therefore, evidence-based verification of the safety and efficacy of herbal therapy is needed. Thorough clinical trials must be conducted to obtain appropriate safety and toxicity data. Many studies have demonstrated

the toxicities resulting from therapeutic plants and their interactions with drugs.

Conclusion and Future Perspectives

For thousands of years, nature has been a rich supply of potent medicines. Many modern drugs have been taken and used from natural sources for traditional applications. Herbal remedies with a lengthy history of use are typically regarded as safer than synthetic medications. Natural products are a significant component of the pharmaceutical businesses' drug discovery processes, accounting for almost half of all recent clinical medications. The present review shows that the herb *S. auriculata* has been studied and shown to have various medicinal properties. Research has effectively established its pharmacological qualities, including anticancer, antibacterial, antimicrobial, hepatoprotective, anti-ulcer, and antidiabetic activities. Investigating its potential in the pharmaceutical and medical sciences is crucial to finding novel and useful applications.

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Declaration of Composing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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