DEEPER INSIGHTS INTO PHARMACOGNOSTIC, PHYTOCHEMICAL, ETHNOBOTANICAL, AND PHARMACOLOGICAL PERSPECTIVES OF JASMINUM AURICULATUM

Simran Aneja[1], Neerupma Dhiman[2]*, Arun Mittal[3], Bhupesh Sharma[4]

Abstract

Jasminum auriculatum Vahl. is a species of jasmine, in the family Oleaceae. It is found in India, Nepal, Sri Lanka, Bhutan and the Andaman Islands. It is commonly known as 'Jasmine'. The plant possess greatest ethnobotanical values such as burning sensation, hyperdesia, ulcers, stomatopathy, cardiopathy, starngury, and dermatopathy. The present study highlights the ethnobotanical examination of morphological characters, pharmacognostic (loss of drying, ash value and extractive value), phytochemicals (alkaloids, carbohydrates, tannins, steroids and glycosides), and pharmacological (antilithiatic, antimicrobial, antioxidant, diuretic, immunostimulatory, larvicidal, and wound healing) aspects. Also miscellaneous aspects such as synthesis of therapeutically active nanoparticles (gold and silver) are also described.

Keywords: *Jasminum auriculatum*, Pharmacognostic, Phytochemistry, Ethnobotanical, Pharmacological, Applications

[1,2*,4]Amity Institute of Pharmacy, Amity University, Noida, Uttar Pradesh, India
[3]Amity Institute of Pharmacy, Amity University, Manesar, Haryana, India

***Corresponding author:**Dr. Neepuma Dhiman
*****Associate Professor,Amity Institute of Pharmacy,Amity University, Noida, Uttar Pradesh, India
E-mail: ndhiman@amity.edu, Phone No: +91-9868014380

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1. Introduction

The term medicinal plants includes various types of plants used in herbalism and played an essential as well as important role in the development of human culture e.g. religions (Hindu, Datura, worship of shiva; Indian hindu god). Most of the natural as well as synthetic based drugs are directly or indirectly derived from medicinal plants. Recently, the demand or requirement of medicinal plants is enormously increasing in both developing and developed countries. As per the World Health Organization (WHO), it is estimated that more than 80% of the population of developing countries is totally rely on traditional medicines derived from plants for their primary health care needs and most of these species of medicinal plants are under threat to become extinct. Recently, number of primary and secondary metabolites extracted from medicinal plants and provides an important source for the discovery of novel pharmacologically active compounds against number of intracellular as well as extracellular infections or diseases. The medicinal plant product i.e. leaves, roots and stem including flowers has its own medicinal importance or its use which is scientifically approved and some of which needs to be proved. The exact criteria or reason or requirement for selecting these medicinal plants showed wide acceptance of herbal products or medicines are being cheaper, lesser side effects and being natural in origin [1].

Medicinal plants contained a wide range of bioactive compounds that are present in plant products (leaves, stem, root, seeds etc.) and used as alternative therapeutic tools for the prevention of many animal and human diseases. Lot of research work related to these medicinal plant products were taken and identified many valuable drugs (e.g. vincristine, vinblastine, taxol etc.) for various immunopharmacological activities e.g. anticancer, anti-inflammatory etc. As per literature, extensive research work is available for isolation and characterization of secondary metabolites especially flavonoids from medicinal plant products. These flavonoids are found in higher concentration in legumes, fruits, seeds, vegetables etc. it is estimated that medicinal plant produces at least hundred thousand secondary metabolites during its growth and development. Out of these, more than 4000 flavonoids are being reported. In this regard, researchers focused only those flavonoids (phenolic compounds i.e. flavonones and chalcones) extracted from medicinal plant products and showed as anti-inflammatory, anti-allergic, anti-viral etc [2,3].

Plants are the good source for the discovery of pharmaceutical compounds and medicines. Natural products could be potential drugs for humans and also these products and analogues can act as intermediates for synthesis of useful drugs. Numerous phytochemicals found in the plant have a range of bioactivities, including anti-inflammatory, anti-cancer, and antioxidant properties (**Figure 1**), it is a medicinal tree widely used in treatment of many ailment in ayurvedic, herbal and folk medicine, commonly known as Juhi. Jasmine is one of the oldest fragrant flowers and is especially appreciated in India. The term jasmine is probably derived from the Persian word 'Yasmin' meaning 'fragrance'. Jasmines are widely grown in warm parts of southern Asia, Europe, Africa and the Pacific regions. Jasmine belongs to the family Oleaceae. Although more than 2,000 species are known, 40 species have been identified in India and 20 are cultivated in South India. The blooms are fragmentary, acrid, bitter, refrigerant, sweet, diurectic, cardiotonic, and depurative in nature, while the roots are helpful for skin conditions, particularly ringworm. They are useful in burning sensation, hyperdesia, ulcers, stomatopathy, cardiopathy, starngury, and dermatopathy [4].

Figure 1. Jasminum auriculatum.

2. Pharmacognostic

Juhi is a stunning flower with a powerful gardenia-like aroma. Despite being a rare species, it demands special attention. It is a beautiful, little, climbing, bushy shrub with simple, oval, tiny, dark green leaves and powdered, satin-white blooms. The leaves are trifoliate or simple, opposite, and ashy-velvety. The core leaflet can be up to 3.5 cm long and 1.5 cm wide, elliptical, and briefly pointed. Lateral leaflets are much smaller, seldom surpassing 4 mm in width. There are hardly many oblique nerves. 4 mm long linear bracts are present. Numerous-flowered cymes of fragrant flowers are present. Up to 5 mm long, the calyx is 3 mm long,

hairy, and has tiny teeth. Flowers are white, tube 1.5 cm long, lobes elliptic, up to 8 mm long. Black, globose, 5 mm-diameter berry. In Hindu religious events, the flower is utilized as a holy offering since it is revered by all manifestations of Goddess Devi [5]. The taxonomy details are provided in **Table 1**.

Table 1. Taxonomical information of *Jasminum auriculatum*.

TAXONOMY	DESCRIPTION
Kingdom	Plantae
Subkingdom	Tracheobionta – Vascular plants
Super division	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Sub class	Asteridae
Order	Scrophulariales
Family	Oleaceae – Olive family
Genus	*Jasminum*– jasmine
Species	*auriculatum* Vahl.

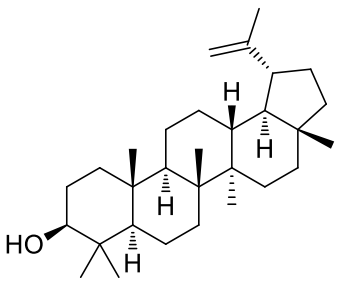
The dorsiventral leaflet has barrel-shaped cells in the top layer of the epidermis. While the upper epidermis lacks stomata and is coated in a very thin cuticle, the lower epidermis does. Both the epidermis has glandular and covering trichomes. Glandular trichomes have 1-2 celled stalks with 4-8 celled head. The covering trichomes are warty, multicellular, uniseriate type. Below the upper epidermis the laminar region has 1-2 layers of palisade cells. These cells have microrosette crystal of calcium oxalate. Palisade is followed by 2-3 layers of spongy parenchyma; some of which have simple starch grains. In the midrib region upper epidermis is followed by 2-4 layers of collenchyma. The vascular tissue is present in the centre. It is shaped like horse shoe and is surrounded by phloem cells; below which are present 3-4 layers of collenchyma cells followed by lower epidermis. Powder of leaf shows numerous simple thick walled warty, uniseriate, multicellular covering trichomes. Many of them were attached to the epidermal cells. The upper and lower epidermis was seen in their surface view. Paracytic stomata are visible in the lower epidermis. In surface view, leaf pieces displaying palisade cells were also discernible. Additionally, there were pieces of vascular tissue [6]. The pharmacognostic details are provided in **Table 2**.

Table 2. Pharmacognostic aspects of Jasminum auriculatum leaves.

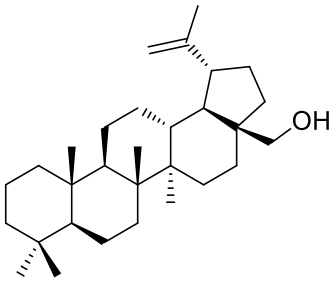
Ash values	**Total ash**		**Acid insolubleash**		**Water soluble ash**
	19%		15%		18%
Extractive values	**Water**	**Ethanol**	**Methanol**		**Acetone**
	9.2%	6.7%	4.3%		2.7%
Moisture content	**Weight of powdered drug**		**Moisture content**		
	2 g		14%		

3. Phytochemistry

The plant contained benzyl acetate, jasmone, resin, glycoside, phenols, salicylic acid, terpenoids, jasminine, tannins, saponins and flavonoids. The leaves yielded lupeol, aliphatic hydrocarbons (C_{20} - C_{34}), aliphatic alcohols (C_{21} - C_{32}), hentriacontane, *n*-tricontanol, fatty acids, jasminol, *D*-mannitol, inositol, sorbitol, xylitol, malvalic acid and jasminine. The flower buds possessed indole, benzyl acetate, and methyl anthranilate. Jasmine flower is a rich source of essential oils, indole, and jasminol. The concretes of the flower volatile oils were composed mainly of 17-pentatriacontene, 22-tricosanoic acid, 1-hexacosene, propyl oleate, 1,54-dibromotetrapentacontane, octadecane, 4-methyl-2-propyl-11-pentanol, 3,5-dimethyl-1-hexene, 3,4-dimethyl-1-hexene, 1-butoxy-2-pentene, and 3,5,5-trimethyl-1-hexene (**Figure 2**). The rhizomes have high amount of (*Z*)-n-dotriacontenyl piperate, 4-pentadecanoxyferulic acid, (*Z*)-8-dehydromelissic acid, β-*D*-xylose, (*Z*)-6- lauroleiyl-β-*D*-tetraglucoside, (*Z*)-6-lauroleiyl-α-*D*-tetraglucoside, etc [7].



lupeol



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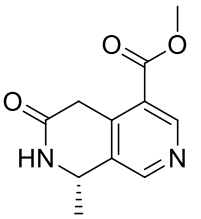
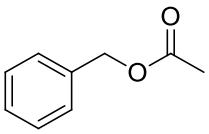
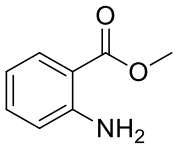

jasminine


benzyl acetate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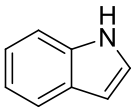
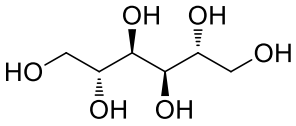

indole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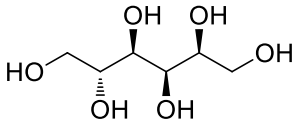
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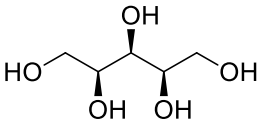
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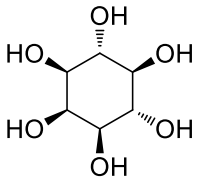
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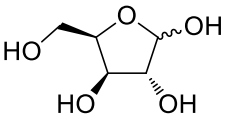
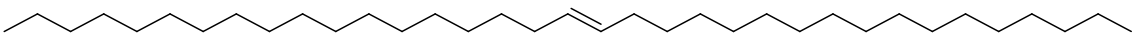
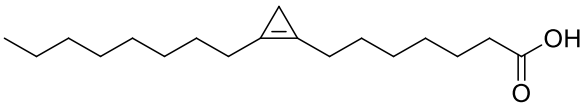

β-*D*-xylose


17-pentatriacontene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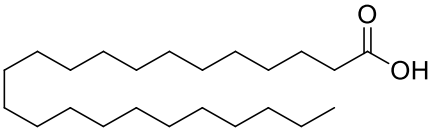
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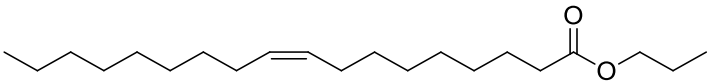
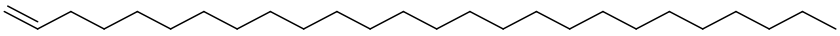
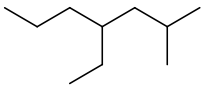

propyl oleate


1-hexacosene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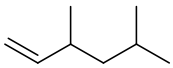
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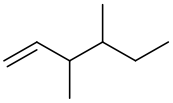
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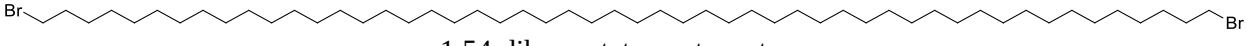
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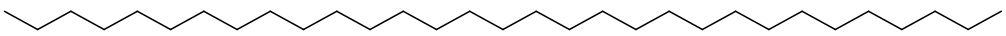
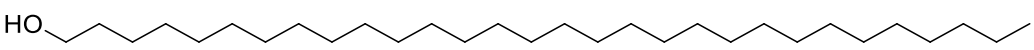

hentriacontane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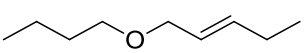
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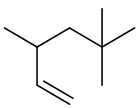
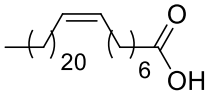

3,5,5-trimethyl-1-hexene


(*Z*)-8-dehydromelissic acid

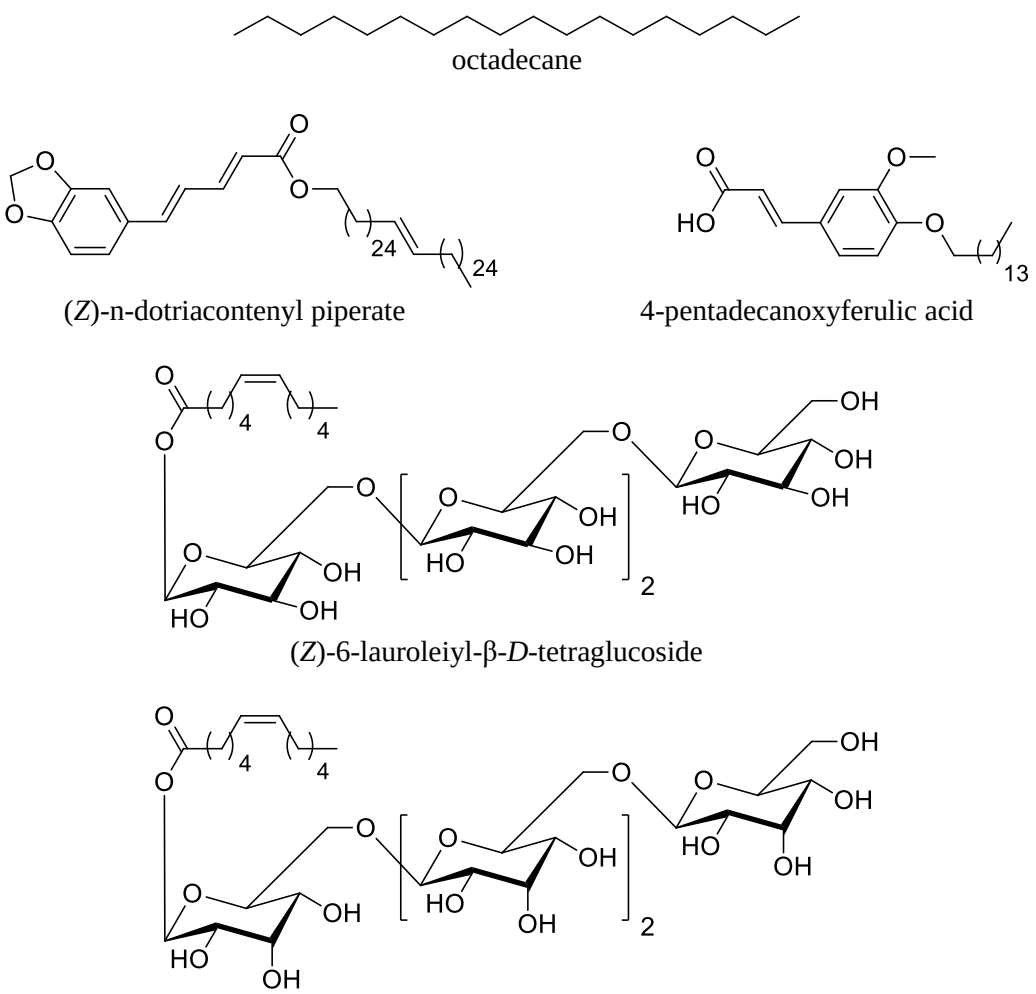


Figure 2. Phytochemicals present in *Jasminum auriculatum*

4. Ethnobotanical uses

Jasminum auriculatum Vahl. is a shrub used in traditional medicines, Ayurveda, Siddha and Unani. Extensive literature survey has reveals that *'Juhi'* has a long history of traditional uses for wide range of diseases. Root, leaves, and flowers of *Jasminum auriculatum* are widely used to cure a number of diseases. The roots are useful in skin diseases especially for ring-worm. Flowers are fragrant but they are useful in burning sensation. Leaves, roots and flower are also useful in stomatopathy, antiseptic, emollient, anthelmintic, ulcers, leprosy, skin diseases, and wounds [8].

5. Therapeutic applications

Jasminum auriculatum Vahl, syn. *J. ovalifolium* Wight, *Mogorium trifoliatum* Lam. (Oleaceae), known as juhi, banamallika and Indian jasmine, is found in India, Nepal, Bhutan, Sri Lanka, Andaman Islands and Thailand. It is a small, evergreen and climbing shrub used as an analgesic, anthelmintic, antidepressant, anti-inflammatory, anti-oxidant, antiseptic, aphrodisiac, astringent, deobstruent, depurative, diuretic, emollient, expectorant, sedative, stomachic and stimulant and to treat bile problems, burning sensation, constipation, flatulence, kidney stones, leprosy, skin diseases, strangury, skin diseases, stomatitis, ulcers and wounds. The leaves are beneficial to cure mouth ulcers. The flowers are effective to relieve tuberculosis. An essential oil of the flowers is utilized in perfumery and to make incense sticks. The roots are useful to cure burning micturition, eye diseases, headache, leprosy, gum and mouth-diseases, pimples, ringworm, scabies, renal calculi and wounds [9].

6. Pharmacological perspectives

6.1. Antilithiatic activity

Male albino rats were used to study the effects of oral administration of aqueous and alcoholic extracts of *J. auriculatum* flowers on calcium oxalate nephrolithiasis. Hypercalcaluria and an increase in calcium and phosphate renal excretion were both brought on by ethanol feeding. The addition of *J. auriculatum* flower extract

dramatically lowered the increased urine oxalate levels, demonstrating a regulatory effect on endogenous oxalate production. Curative and preventative therapy utilizing aqueous and alcohol extracts effectively reduced the elevated deposition of stone-forming components in the kidneys of calculogenic rats. The findings show that *J. auriculatum* flowers possess antiurolithiatic action [10].

6.2. Antimicrobial activity

Shekhar and Prasad studied the antimicrobial perspectives of *J. auriculatum* where the maximum activity was observed by methanol extract against *Pseudomonas* sp. followed by chloroform extract against *Streptococcus mutans* (16 mm). In contrast to it, the minimum activity was observed in propanol extract against *Bacillus subtilis* (8 mm) [11].

Srivastava *et al.* found that various pathogenic microorganisms studied (*S. aureus, E. coli and P. aerugenosa*) by agar well diffusion method were largely inhibited by extracts of dried stem of *J. auriculatum* using reference drug ampicilin [12].

6.3. Antioxidant activity

Srivastava *et al.* evaluated the *in-vitro* study of antioxidant and antibacterial activities of crude extracts (methanol, ethyl acetate, and acetone) of medicinal plant *J. auriculatum* stem. The antioxidant activity of these extracts was determined by using DPPH (1,1-diphenyl-2-picryl hydroxyl) assay. It was found that the crude extract of methanol solvent of *J. auriculatum* stem was significantly highest extract. In a methanol extract of *J. auriculatum* with calculated parameters, reducing power assay substantial results were found. In comparison to ascorbic acid, which was employed as a reference, all the extracts had less antioxidant activity [12].

In vitro antioxidant activity of an isolated chemical from *Jasminum auriculatum* stem extracts is investigated by Srivastava *et al.* DPPH free radical scavenging was used to test the antioxidant activity of different concentrations of isolated compounds [13].

6.4. Diuretic activity

Sterols, flavonoids, glycosides, and tannins were discovered during a preliminary phytochemical analysis of alcoholic and aqueous extracts of *J. auriculatum* flowers. Flowers' potential diuretic properties were examined in alcoholic and aqueous preparations on albino rats. As compared to the reference medicine, frusemide (100 mg/kg body weight), the results demonstrated that both extracts had considerable diuretic effect at a dosage of 250 mg/kg body weight by increasing the volume of urine and concentrations of potassium and sodium salts in urine [14].

6.5. Immunostimulatory activity

Using a flow cytometer, Gupta and Chaphalkar investigate the immunostimulatory activity of leaves from *J. auriculatum* against a particular hepatitis B vaccination antigen. Human whole blood was treated with aqueous extract of *J. auriculatum* at various concentrations (0.5 mg/mL - 30 mg/mL), and the lymphocyte, monocyte, and granulocyte counts, as well as the forward (shape and size) and side scatter (granularity of the cell), were measured using a flow cytometer. The hemolytic activity of the extract was also determined. According to the findings, the *J. auriculatum* leaves aqueous extract increased the number of monocytes and granulocytes count, as shown by the retention and fall in the level of forward and side scatter on human whole blood. Aqueous extract at high dosages, *i.e.* 30 mg/mL have shown hemolytic activity in comparison to control. The findings demonstrated that *J. auriculatum*'s leaves have immunostimulatory effect against a particular vaccination antigen [15]. In a similar manner, the aforementioned research team examined the immunosuppressive activity of varying doses of crude flavonoids (6.25 mg/mL - 100 mg/mL) extracted from the leaves of *J. auriculatum* on human whole blood using a specific antigen (*i.e.*, hepatitis B vaccine surface antigen, 20 μg/mL) in order to estimate blood counts, CD14 monocyte marker, and observe its According to the findings, greater dosages of the crude flavonoids obtained from these three medicinal plants exhibited the greatest suppression of blood counts, CD14 monocyte marker, and cytotoxicity. Overall, the evidence points to the presence of immunosuppressive action against HBsAg in crude flavonoids isolated from *J. auriculatum* [16].

6.6. Larvicidal activity

Culex quinquefasciatus third instar larvae were used as test subjects, and doses ranging from 62.5 mg/L to 8000 mg/L were used. Raveen *et al.* synthesized crude hexane and chloroform flower extracts of *Jasminum auriculatum*. Following 24 and 48 hours, deaths were noted [17].

6.7. Wound healing

By assessing its wound healing potential, along with its antioxidant and antimicrobial properties, Mittal *et al.* tried to validate the ethnotherapeutic

claim of the traditionally used plant *J. auriculatum*) in skin diseases. According to the researchers' observations of a higher rate of wound contraction (83.66% on day 15), a shorter time for epithelialization (17.83 days), higher skin breaking strength (170.71 g), higher collagen content, and favorable histopathological changes, topically applying an ointment containing *J. auriculatum* leaves successively has the most potent wound healing ability when compared to the control group in both models under study. It was discovered that the successive ethanolic extract has a DPPH radical scavenging activity of 33.39 μg/mL. The zone of inhibition for the ethanolic extract against Pseudomonas auregenosa was 16.65 mm, and the lowest inhibitory concentration was 0.78 mg/mL. The results of this investigation show that the leaves' consecutive ethanolic extracts have strong antibacterial, antioxidant, and wound-healing activities. This supports the ethnomedical usage of plants to treat microbial infections and wounds [18].

7. Miscellaneous applications

7.1. Silver Nanoparticles synthesis

Silver nanoparticles (AgNPs) were bio-produced by Balasubramanian *et al*. using stem extracts from *J. auriculatum*. FT-IR and UV-visible spectra were used to establish the presence of AgNPs. SEM-EDAX and XRD techniques were used to confirm the shape and size of silver nanoparticles. By using the disc diffusion method, the antibacterial activity of greenly synthesized AgNPs was evaluated against human pathogens. According to antibacterial research, there are a number of pharmacological uses for green produced AgNPs for the control of fatal human infections [19].

7.2. Gold nanoparticles synthesis

J. auriculatum leaf extract, which functions as a stabilizing and reducing agent was used by Balasubramanian *et al*. to disclose a trouble-free, ecologically friendly method for the biogenic manufacture of gold nanoparticles (AuNPs). The surface plasmon resonance peak at 547 nm in the UV-Visible absorption spectrum provided proof that the AuNPs were produced biologically. The biogenic AuNPs were found to be spherical with an average size of 8 nm–37 nm by TEM and SEM examination. The biogenic AuNPs were shown to be a flexible choice for heterogeneous catalysis by their catalytic reduction activity on *p*-nitrophenol. The pH stability analysis conducted with phosphate buffer solution supported AuNPs' suitability for biological applications. According to research on the cytotoxicity of biogenic AuNPs, the nanoparticles significantly inhibited the growth of a human cervical cancer cell line with an IC_{50} value of 10^4 ng/mL in a dose-dependent manner. The human pathogenic bacteria (*Staphylococcus aureus*, *Klebsiella pneumonia*, *Escherichia coli*, and *Streptococcus pyogenes*) and fungus responded vigorously to the biogenic gold nanoparticles' antibacterial activity (*Candida albicans*, *Aspergillus fumigatus*, *Lecanicillium lecanii*, and *Trichoderma viride*) [20].

8. Conclusion

The article successfully highlighted the essential ethnobotanical characteristics as well as morphological components, vital pharmacognostic aspects (loss of drying, ash value and extractive value), imperative phytochemicals (alkaloids, carbohydrates, tannins, steroids, and glycosides), and most importantly, the pharmacological (antilithiatic, antimicrobial, antioxidant, diuretic, immunostimulatory, larvicidal, and wound healing) aspects. This study will definitely provide sufficient information and motivation to the enthusiastic researchers for further developments of scientific and pharmaceutical interest.

Conflict of interest

No conflict of interest declared.

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