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A review on potency of Oldenlandia auricularia plant extract.

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Abstract: *Oldenlandia auricularia* is a therapeutic plant, belongs to the Rubiaceae family which is begun from South India, Australia, Malaysia, Philippines, and Sri Lanka. It likewise fills in open woodland and bushes. The species contains around 1,300 varieties. There are a few chemical substances in the plant that have pharmacological activities. Alkaloids, anthraquinone, iridoids, sugars, glycosides, coumarin, unsaturated fats, flavonoids, and phenolic compounds are among the phytochemicals tracked down in the plant. It was found that the plant contains therapeutically active substances, for example, *auricularia*, ursolic, alkaloids, and others. The aim is to review the pharmacological properties of *Oldenlandia* species, that have showed anticancer, antidiarrhea, antilipidemic, antioxidant, antidysentery, antifungal, Antihypertensive, antispasmodic, antibacterial, antimalarial, antiplasmonic, and antimutagenic. *Oldenlandia auricularia* shows antihypertensive, antibacterial, antioxidant and anti-inflammatory features and data was gathered about the plant concentration. Many *invitro* and *in vivo* studies have been conducted to exhibit the plant properties.

***Index term- Oldenlandia auricularia*, Anti-inflammatory, Anti-bacterial, Anti-hypertensive, Antioxidants, *Hedyotis*, hematological, diuresis, *Plasmodium falciparum*, Chloroquine.**

INTRODUCTION

Traditional knowledge of herbal remedies to treat human diseases is fast declining in many parts of the world, including India. Even today, tribals and certain local communities in India still practice herbal medicine to cure a variety of diseases and disorders. They collect and preserve locally available, wild, and cultivated plant species. A preliminary survey of villages around Shimoga town of Karnataka, revealed that local communities residing in three villages are still practicing herbal medicine extensively in their primary health care. These villages are located next to Bhadra wildlife sanctuary. There are no previous records of ethnomedical knowledge from the study area. Hence, an attempt has been made to document plant species, medicinal formulations, and treatment of particular diseases by various communities residing in this area (Shimoga) [1].

Oldenlandia species contains mainly more than 50 biological species such as

Table no.1 Different species of *Oldenlandia*

S.no	Species	S.no	Species
1.	*Oldenlandia Auricularia*	26	*Oldenlandia hedyotidea*
2.	*Oldenlandia corymbose*	27	*Oldenlandia rosulata*
3.	*Oldenlandia herbecaea*	28	*Oldenlandia bicornuta*
4.	*Oldenlandia biflora*	29	*Oldenlandia prostata*
5.	*Oldenlandia umbellate*	30	*Oldenlandia marcanii*
6.	*Hedyotits diffusa*	31	*Oldenlandia pumila*
7.	*Oldenlandia erecta*	32	*Oldenlandia goreensis*
8.	*Oldenlandia galioides*	33	*Oldenlandia oxycoccoides*
9.	*Oldenlandia lancifolia*	34	*Oldenlandia sieberi*
10.	*Oldenlandia polyclada*	35	*Oldenlandia pinifolia*
11.	*Oldenlandia brachypoda*	36	*Oldenlandia echinulosa*
12.	*Oldenlandia microtheca*	37	*Oldenlandia lanceolate*

13.	*Oldenlandia capensis*	38	*Oldenlandia saxifragoides*
14.	*Oldenlandia balfouril*	39	*Oldenlandia paniculata*
15.	*Oldenlandia patula*	40	*Oldenlandia acicularis*
16.	*Oldenlandia hygrophila*	41	*Oldenlandia hymenophylla*
17.	*Oldenlandia stocksii*	42	*Oldenlandia crouchiana*
18.	*Oldenlandia trinervia*	43	*Oldenlandia rupicola*
19.	*Oldenlandia salzmannil*	44	*Oldenlandia gibsonii*
20.	*Oldenlandia mitrasacmoides*	45	*Oldenlandia angolensis*
21.	*Oldenlandia intonsa*	46	*Oldenlandia fastigiata*
22.	*Oldenlandia linearifolia*	47	*Oldenlandia cana*
23.	*Oldenlandia stricta*	48	*Oldenlandia pulvinate*
24.	*Oldenlandia adsensionis*	49	*Oldenlandia boscii*
25.	*Hedyotis herbacea*	50	*Scleromitrion diffusum*

Hedyotis diffusa

Hedyotis diffusa Willd. (Rubiaceae), other latin scientific names: *Hedyotis herbacea* Lour., *Oldenlandia diffusa* (Willd.) Roxb., an annual herb distributed in subtropical area in Asia, is known in oriental folk medicines used for the treatment of various diseases including pneumonia in children, pelvitis, hepatitis, tonsillitis, sore throat, appendicitis, urethral infection, contusions, furunculosis, especially for various kinds of tumors, such as tumors of digestive tract, carcinoma of liver, pancreas and urinary bladder, lymphoma, hysteromyoma, in China, Korea, Japan and Malaysia. According to the traditional Chinese medicine theory, *H. diffusa* is sweet and bland in taste, cool in nature, and attributive to lung, liver, urinary bladder, and large intestine channels, possess efficacy of clearing away heat and toxic material, promoting blood circulation and removing blood stasis. Taking into account its extensive clinical applications in cancer and other diseases [2].

CHEMICAL CONSTITUENTS

Anthraquinones, terpenoids, coumarins, flavonoids, steroids, organic acids, and polysaccharides have been isolated from *H. diffusa* and which showed to have various pharmacological activities such as anti-inflammatory, anticancer, antioxidant, neuroprotective, immunomodulatory and hepatoprotective effects.

Anthraquinones

Anthraquinone deriviates, a class of important natural pigments distributed widely in plants, are effective compositions of many herbs. Phytochemical studies revealed 8 anthraquinone compounds existed in the herb of *H. diffusa*. Firstly, the Taiwan scholar Tai isolated three anthraquinones from *H. diffusa* and identified them as 2-methyl-3-hydroxyanthraquinone, 2-methyl-3-methoxy-anthraquinone, and 2-methyl-3-hydroxy-4-methoxyanthraquinone. Subsequently, another anthraquinone compound named as 2,3-dimethoxy-6-methyanthraquinone was isolated from *H. diffisa*). More recently, two 1,4-anthraquinone named as 2-hydroxymethyl-10-hydroxy-1, 4-anthraquinone and 2,3-dimethoxy-9-hydroxy-1,4-anthraquinone were isolated from *Hedyotis herbacea* along with two 9,10-anthraquinone compounds named as 1,4-dihydroxy-2-hydroxymethyl-anthraquinone and 1,4-dihydroxy-2,3-dimethoxy-anthraquinone [3].

Terpenoids

Terpenoids are the biggest class of compounds among various classes of natural substances. So far, 14 terpenoids were found in *H. diffusa*. These compounds were attributed to two basic classes of iridoids and triterpenoids, such as deacetylasperulosidic acid, aspiruloside, candoside, E-6-O-*P*-methoxycinnamoyl scandoside methyl ester, geniposidic acid etc[4].

Steroids

Steroid compounds were most early isolated and identified as β-sitosterol, γ-sitosterol and β-sitosterol-β-D-glucoside from *H. diffusa* by Chinese researchers [5].

Flavonoids

Two flavonol glycosides were first isolated from *H. diffusa* in 1996 and were identified as kaempferol-3-O-arabinopyranoside and kaempferol-3-O-rutinoside.

Others

In addition, 1-cyclobutane derivative, 4,4- dihydroxy-α-truxillic acid, hentriacontane, p-coumaric acid and one oxytocin peptide consisting of 11 amino acid residues were also obtained from *H. diffusa* [6][7].

PHARMACOLOGY

Table no.2 Pharmacology of *Hedyotis diffusa*

Activities	Model	Formulation/ Dosage/Extract	Anticancer activity	References
Colorectal Cancer	HT-29 cell	Ethanol extract	The extract suppressed HT-29 cell growth and induced apoptosis via inactivation of the IL-6/STAT3-signaling pathway	[8]
	HT-29 cells	Ethanol Extract	The extract inhibits colorectal cancer growth *in vivo* via inhibition of SHH-mediated tumor angiogenesis	[9]
	CT-26 cells	Ethanol extract	The extract can inhibit proliferation of CT-26 colon cancer cells from BALB/c mice in a time and dose dependent manner	[10]
Leukemia	CEM cells	Aqueous extract	The extract inhibited Leukemia CEM cells growth in time- and concentration-dependent manners. And the inhibition mechanism has greater correlation with the upregulation of P53 expression.	[11]
	BALB/c mice	Aqueous extract	The extract had anti-leukemia effects on WEHI-3 cell-induced leukemia in vivo.	[12]
	HL-60 cells	*H. diffusa* injection	The extract could induce HL-60 cells differentiation and suppress the expression of the anti-apoptosis-related gene to inhibit the growth of HL-60 cells.	[13]
Liver cancer	H22 mice	Aqueous extract	The extract had an inhibitory effect on the metastasis of hepatocarcinoma in blood.	[14]
	MHCC97-H cells	Total flavones extract	The extract treatment reduced the level of E-cadherin protein and increased the expression of vimentin protein in TGF-β1-induced MHCC97-H.	[15]
Immunomodulatory effect				
	Normal BALB/c mice	Ethanol Extract	The extract has promoted immune responses in normal BALB/c mice.	[16]
	Immunosuppressed mice induced by cyclophospamide	Total flavonoids extract	The extract enhanced specific and non-specific immunity.	[17]
Antioxidant effects				
	LO_2 cells	The extract from methanol, acetone and 80% alcohol	The extraction with 80% alcohol has the strongest antioxidant activity on DPPH assay	[18]
	LO_2 cells	The extract from water, ethanol, acetone, chloroform, ether, petroleum	Acetone extract had the strongest antioxidant effect	[19]

		benzine		
Anti-inflammatory effect				
	Lipopolysaccharide-induced renal inflammation mice	Aqueous extract	The extract protected renal tissues, significantly suppressed the production of TNF-α, IL-1, IL-6 and MCP-1, as well as significantly promoted the production of IL-10 in serum and renal tissues	[20]
Neuroprotective effect				
	Rat cortical cells damaged by L-glutamate	Methanolic extract, five flavonoids and four O-acylated iridoid glycosides	All compounds exhibited significant neuroprotective activity in primary cultures of rat cortical cells damaged by L-glutamate.	[21]

Oldenlandia corymbose

Oldenlandia corymbosa Linn. is a plant of flowering plants groups and it belongs to the family of Rubiaceae. It is widely distributed in the tropical and temperate parts of both the hemispheres. It is also found in the Himalayas at an altitude upto 2000 meters. *Oldenlandia* genus has about 240 different species worldwide. *Oldenlandia corymbosa* is an annual herbaceous medicinal weed, found during monsoon in fields, waste places, lawn and some settled areas in countries like India, Sri Lanka, East Asia, and Java Island and in the Philippines.

The plant is known to remove toxic materials, activate blood circulation, promote diuresis and relieve urinary obstructions. It possesses certain properties that prevent tumors of the digestive tract lymph sarcoma and carcinoma of the liver and larynx. It is also active against diseases like appendicitis, hepatitis, pneumonia, cholecystitis, urinary infection, cellulites, snake bite, skin diseases, ulcers, cough, cold, bronchitis, gynaecologic infections and also deals with pelvic inflammatory diseases[22].In case of the liver diseases, heat burn, vitiated conditions of pitta, hyperdipsia, dyspepsia, flatulence, constipation, helminthiasis, leprosy, skin infections, cold, cough, bronchitis, necrosis, nervous depression caused by abnormal bile and hepatopathy, this plant works as an effective curative agent[23].

TAXONOMICAL CLASSIFICATION

Table no.3 Taxonomical Classification

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Rubiales
Family	Rubiaceae
Genus	*Oldenlandia*
Species	*Oldenlandia corymbose*

CHEMICAL CONSTITUENTS.

A various phytochemical investigation of *Oldenlandia corymbosa* shows the presence of proteins, polysaccharides, polyphenols, tannins, flavonoids, saponins, steroids, triterpene and glycosides. Some of the isolated compounds from the plants are geniposide, iridoid glycosides, 6-alpha hydroxygeniposide, scandoside methyl ester, 10-O-benzoylscandoside methyl ester, asperulosidic acid, asperuloside, deacteyl asperuloside, 10-O-*p*-hydroxy benzoyl scandoside methyl ester, rutinan-lyoniresinol-3-alpha-O-beta glucopyranoside [24].

Studied the total plant pigments through a research investigation of different herbs which are basically Indian traditional medicinal plants. The research study showed that different herbs total plant pigments (chlorophyll-a, chlorophyll-b, total chlorophyll and total carotenoids) concentration may vary with the major environmental or ecological or biogeochemical factors like air pollution and it may vary with different seasonal changes as well. These plant pigments act as anti-oxidants, anti-cancer agents also. They have different kinds of curative properties [25][26][27].

PHARMACOLOGICAL EFFECTS.

Antibacterial Activity

Oldenlandia corymbosa methanol decoctions have antibacterial effects on microorganisms. The powdered plant decoction of the plant was tested for the anti-microbial activities using disc diffusion assay. When applied to immune-suppressed individuals suffering from bacterial or fungal diseases, the plant's extracts from the roots, stems, and leaves significantly inhibited the development of bacteria, demonstrating the presence of the plant's antimicrobial activity. The maximum antibacterial activity was observed against *Klebisiella pneumonae* while maximum antifungal effect was found against *Candida albicans* [28].

Antimalarial Activity

Methanol decoctions of *Oldenlandia corymbosa* was treated *in vitro* on chloroquine sensitive (MRC-pf-20) and resistant (MRC-pf-303) strains of *Plasmodium falciparum* for showing its anti-malarial property. The 50% inhibitory concentration (IC50) of *Oldenlandia corymbosa* was found 10.8µg/ml. In a genuine combination of *Oldenlandia corymbosa* and *Andrographis paniculata* concluded substantial increase in their antimalarial property [29].

Antidiabetic Activity

The research study clearly indicates that the ethanolic extract of the plant have higher inhibition activities towards alpha-glucosidase. The result showed that 90% reduction in alpha-glucosidase activity. From that in vitro study it was concluded that extract of the aerial parts of the plant has significant antidiabetic activity [30].

It is also reviewed that *Oldenlandia corymbose* is having other pharmacological activities like Hepatoprotective Activity, Antioxidant Activity, Abortifacient Activity, Cytotoxic Effect, Acute oral Toxicity Test.

Hedyotis herbacea

Hedyotis herbacea is grown in mild open sunny location. It is grown in very hard soil also. It has tinny white colour flower, and another identifying feature of this plant is its stem are quadrangle, sharp edged four gonodes. It has some small-small leaves. *Hedyotis herbacea* whole plant is useful and its first taste is bitter and second taste is sweet. It also provides cooling sensation, also reduces fever and give anti-inflammatory also stomachache, expectorants it is a tonic herb, tonic means it can be nontoxic and it can be used in small quantity and make some home remedy probably most commonly prepared tea can be made from this. This is mainly used in traditional medicine elephantiasis, fever, lack of appetite, gas issues, blotting, worm infestation, asthma, bronchitis, ulcers and all kind of inflammations [31].

Hedyotis have yielded approximately 50 new chemicals. Alkaloids, anthraquinones, flavonoids, iridoids, triterpenoids, sterols, lignans, and several more chemicals all have incredibly diverse structural makeups. *Hedyotis herbacea* has a tangled, heavily branching stem that is frequently entwined. Small, linear-lanceolate leaves, solitary or in pairs of flowers on long stalks, axillary at the nodes, up to 5 mm in diameter, white or mauve, and small, round capsules are present in the fruits. *Hedyotid herbacea* is said to be anthelmintic, anti-inflammatory, expectorant, stomatic, and tonic throughout. Elephantiasis, fever, dyspepsia, flatulence, colic, asthma, bronchitis, ulcers, and hydrocele can all be treated with it. Either the plant's components or the entire plant can be used to extract the active metabolites [32].

By reviewing this *Hedyotis herbacea* plant articles which possesses the pharmacological activities like Anticancer, Anti mutagenesis, Hepatoprotective activity, Neuroprotective activity, Cytotoxic and other bioactivities, Antibacterial and antifungal activities, and Antioxidats properties.

Oldenlandia auricularia

Oldenlandia auricularia is also known as Indian madder or *Hedyotis auricularia*, or *Exallage auricularia*. *Oldenlandia auricularia* is a member of the family Rubiaceae. It is widely distributed *Oldenlandia* species in India to Southern China and through Malaya to Australia. *Oldenlandia auricularia* is a sub-erect or diffused, prostrate, branched, hairy herb with branches of 15-45 cm long. Leaves are ovate-lanceolate, 2-7.5 cm long, and 0.8-1.5 cm wide. Flowers are white with very short stalks and borne in axillary, very dense cymes. Fruit is crowded, ovoid, about 1.5 mm in diameter and clasped by persistent calyx. Calyx teeth are small, and shorter than the indehiscent fruits [33]. The plant leaf extract was given in Jaundice, used as an emollient, and prescribed for Dysentery, Colitis, and Cholera in India [34]. Around 70 species are available in India. The leaves are used as food in Sikkim, India, where they boil with rice. The herb is widely used in South Karnataka, India, to treat bowel problems along with diarrhoea [35]

TAXONOMICAL CLASSIFICATION

Table no.4 Taxonomical classification

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnolipsida
Order	Gentianales
Family	Rubiaceae
Genus	*Oldenlandia*
Species	*O. auriclaria*

VERNACULAR NAMES

There are different types of names available in different languages. These are mentioned in table.

Table no.5 Vernacular names of *Oldenlandia auricularia.*

S.NO.	Languages Names	Names
1	Kannada	Nela nekare
2	Tamil	Impooral
3	Telugu	Nela adaviaku
4	Malayalam	Erachiketti
5	Sanskrit	Aladana-ghanta
6	Sinhala	Getakola

Fig.no.1 ***Oldenlandia auricularia (H. auricularia or E. Auricularia)***

DISTRIBUTION

World

India, Malaysia, Sri Lanka, Myanmar, Southern China and Australia.

India

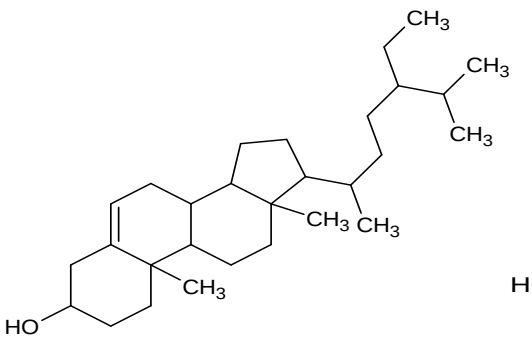
Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, Telangana and Odisha

PLANT PROFILE

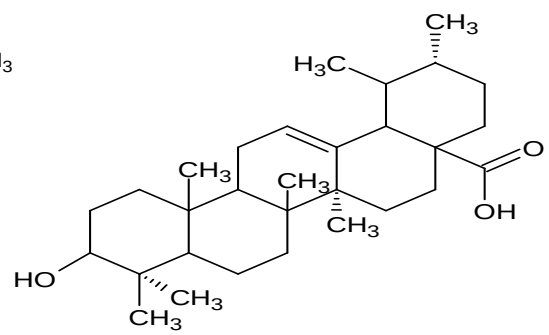
Oldenlandia auricularia is a perennial herbaceous shrub that can reach a length of 40 cm. Round, 2.5 mm in diameter, and smoothie or scantly covered with nanoscopic, uneven hairs that form nodes at the base, are the stems. Along the midvein, above the leaves, hairs that are smooth, hispidulous, or scabrous develop. The leaves are oblong to split, 4–12 centimeters tall, and 5–24 mm wide. The petiole is 4–8 mm long, and the leaves have prominent secondary nerves and a midvein on the underside. Underneath them, there are lateral veins that attenuate at the base and tip. 3 to 9 sporadic scabridulous sets up to 7 mm long and 2-4.5 mm long with short hairs can be found in stipule sheaths. Pedicels are 1-1.5 mm length, axillary, subsessile fascicles with 5-8 flowered inflorescences. The 1.5-2.5 mm long, closely triangular lobes are hispidulous on the outside and curl at the apex. The margins are scabridulous, and collectors may be evident between the lobes [36]. Corolla white, occasionally tinged blue, thinly hispidulous at the outermost portion; tube 1.5-2.5 mm long; lobes linear, 1-2 mm long, upright and reflexed at apex, tiny stiff hairs within at base. Anthers are linear and 0.6 mm long. Staminal filaments are 0.5 mm long and broad, and at the base there are tiny stiff hairs. Stigma bifid, with lobes 0.5-1.0 mm long, puberulous projections on the stipule, a cuneate leaf base, and an acute peak. Style the upper half has stiff, 2.0-3.5 mm long antrorse hairs [37]. The seeds and 'oldenlandioid' characteristics set the individuals apart. (Trilateral seeds with hollow sides). Fruit lacks a beak and is indehiscent, cartilaginous, globose, 1.5–2 mm in diameter, irregularly hispidulous, and has erect calyx lobes. The surface of the 0.4 mm long, flattened, obconic, angular seeds is dark brown, glossy, and reticulate-areol [38].

CHEMICAL CONSTITUENTS

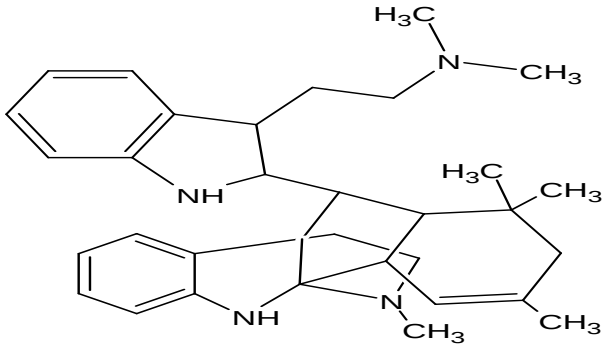
Oldenlandia auricularia has a diverse range of molecular components. There are various pharmacological or biological impacts in every chemical component. The capacity of plant materials to synthesize active compounds, most of which are secondary metabolites, is unique [39]. Since then, lignans, triterpenoids, sterols, coumarins, saponins, indole and carboline alkaloids, anthraquinones, flavonoids and their glycosides, and iridoids and their glycosides have all been studied through phytochemical study on *Oldenlandia auricularia* and other species in the genus [40]. Phytochemical investigation of the plant demonstrated the presence of three glycosides (hydroxy-1- methoxy ethyl glucopyranoside, ursolic acid and oleanolic acid as well as 1'-O-ethyl—D galactopyranoside, 2-formyl-5- hydroxymethyl furan, 5-stigmasta and 22-diene 3-O-D-glucopyranoside) and β-sitosterol. The plant's water-soluble alkaloid auricularine exhibits hypotensive and bronchodilating effects [41]. The pharmacological effects of *Oldenlandia auricularia* have been reviewed in this research [42]. Here I gave some structures in the following figures (A, B, C, D, E and F)



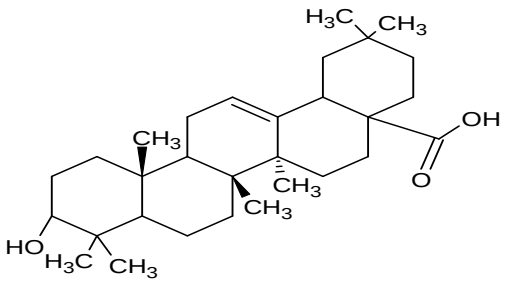
A. β-Sitosterol



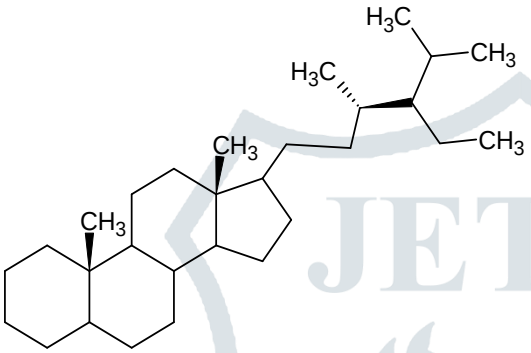
B. Ursolic acid



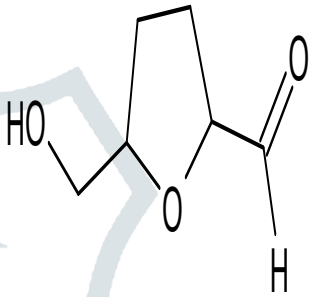
C. Auricularine



D. Oleanoic acid



E. Stigmastane



F. 5-Hydroxy methyl furfural

PHARMACOLOGY

It includes various types of activities of *Oldenlandia auricularia*. Activities are showed in a Figure no. 2

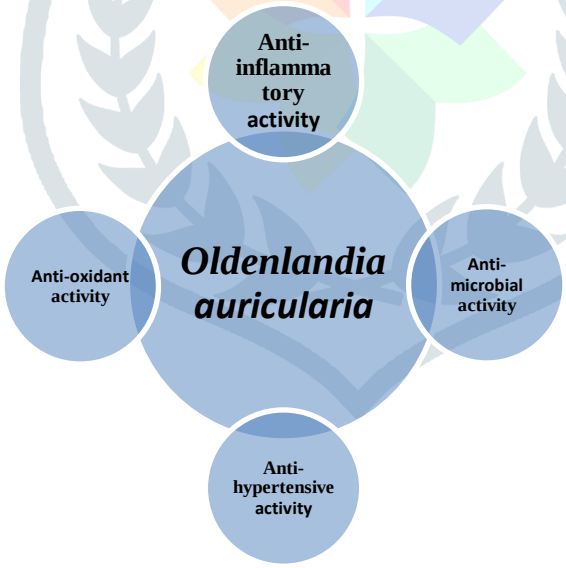


Fig. no. 2 Pharmacological activities of *Oldenlandia auricularia*

Anti-inflammatory activity

Inflammation is a physiological cycle that results from tissue damage induces by microbial pathogen hit, chemical irritants, and wounding [43]. The plants were carefully cleaned, then ground, and then dried in the shade. 100 g of powder were extracted for a day at standard 27°C temperature using one litre of 70% aqueous ethyl alcohol. 3 L of the extract were filtered after the process was repeated twice more. The filtrate was concentrated using a rotary evaporator and vacuum dried in desiccators; the finished product's weight was determined to be 17% [44]. This unprocessed extract, designated *O. auricularia*, was diluted to amounts of 25, 50, and 100 mg/L in aqueous dimethyl sulfoxide (DMSO) solution for in vitro testing. In Dulbecco's modified Eagle's medium (DMEM) with 10% fetal bovine serum (FBS), 100 Uml^{-1} penicillin, and 100 mg/ml^{-1} streptomycin, fresh 264.7 cells, a mouse macrophage cell line, were grown [45]. Lipopolysaccharides (LPS), which are treated with LPS-stimulated cells, were compared to the 0.1% dimethyl sulfoxide as a reference. Standard reference cells were given a treatment injection of 0.1% dimethyl sulfoxide without lipopolysaccharides. In order to address LPS, 0.1% of dimethyl sulfoxide was infused into command-quality cells. All cells were grown for 24 hours at 37°C and 5% carbon dioxide (CO_2) in a humid incubator [46]. The removed culture samples (cells) were given a two-time phosphate-buffer solution washing [47]. In a

0.001L 50 mmol/L potassium phosphate buffer solution with 1 mol/L EDTA, the cells were trypsinized. (pH 7.0). Cell suspensions in Dulbecco's modified Eagle's medium were centrifuged at 10,000 g for 20 minutes at 4°C after being shaken three to four times for five seconds each. Cell supernatants were employed for additional study [48]. Nitrite cytoplasmic, lipoxygenase (LOX), cyclooxygenase (COX), and myeloperoxidase activity were measured. (MPO). The percentages of COX and LOX enzyme inhibition were calculated. On LPS-treated murine macrophages, In this review, study of anti-inflammatory potential of three accessions of *Oldenlandia auricularia* is demonstrated [49].

Antihypertensive activity

A disease known as hypertension (high blood pressure) occurs when the blood presses too hard against the walls of the arteries. High blood pressure is one of the major problems facing public health on a worldwide scale. Numerous illnesses are associated with a high chance, such as retinopathy, chronic liver dysfunction, coronary artery disease, stroke, and heart failure [50]. Decoction was used to extract this herb. Fresh plant aerial parts (60 g) were divided into smaller bits and boiled in distilled water (1500 ml/8 cups) at a low temperature until the volume was decreased to 150 ml. This plant extract was gathered with the toxicological study and subsequent research projects [51]. Blood pressure was estimated at the 0, 7, 15 and 30 days by using Tail cuff method and were conducted with ICR mice to find the approximate lethal dose and to investigate short term toxicological effects (on liver function, kidney function and hematological parameters) or long-term toxicological effects (on liver function, kidney function) of organization of the plant extract [52]. The goal of the research was to investigate the potential of *O. auricularia* for the treatment of hypertension in an animal model. The studies findings demonstrated that *O. auricularia* extract significantly improved blood pressure and tissue histology when compared to the animal group receiving an allopathic medication [53].

Antimicrobial activity

Antimicrobial action is the process of eliminating or obstructing the disease causing microbes. For this reason, various antimicrobial agents are used [54]. Antibacterial, antiviral, and other antimicrobial agents are included. They all work in different ways to stop the illness [55]. *Oldenlandia auricularia's* plant parts (leaves) were removed, dried in the shade for 15 days, and ground into a fine powder. The pulverized substance was then extracted with 500 cc of 70% ethanol and shaken for a day in a flask with a screw closure. After the residue had been centrifuged for 10 minutes at 500 rotations per minute (r.p.m). it was extracted under the same conditions. The filtering process involved filter paper. The 70% ethanol extract was concentrated at a reduced pressure, lyophilized to create powder, and refrigerated at -20°C [56]. The amounts of flavonoids and alkaloids were determined. A modified agar well diffusion method was used to investigate the antibacterial and antimicrobial activities. The dish was inoculated with Gram-positive and Gram-negative microorganisms and kept at 35º–37°C for one to two days. Then, a millimeter scale was used to quantify the inhibition diameter [57]. A portion of leaves made up of the substances unrefined ash, fat, fiber, and carbohydrates [52]. According to the accounts, all extracts produced an inhibitory zone that depended on concentration in both positive and negative bacteria. The plant that has the strongest and most efficient antibacterial activity against pathogenic and human microorganisms. Aqueous and ethanolic extracts were used in this study to demonstrate the antimicrobial activity [58].

Antioxidant activity

An antioxidant that shields a specific compound from oxidative damage. The most important characteristic of an antioxidant is its ability to prevent hydroperoxide from being absorbed. Antioxidant substances like acid of phenol, polyphenols, and flavonoids scavenge free radicals like peroxide(R-O-O-R), hydro-peroxide(R-O-O-H), and lipid-peroxyl, which block the reactive pathways that lead to degenerative conditions [59].

In the past, medicinal plants antioxidant properties were more potent. Separately collected from the *Oldenlandia auricularia* plant were the stalk and leaves. The leaves are dried in the darkness and grounded up using a mechanical size reducer. Using a Soxhlet apparatus and a cold percolation procedure at 55°C for 18 hours, the powdered material (200 g) was successively extracted from ethanol, petroleum ether, and distilled water [60]. The filtrate was then gathered and evaporated at 40°C using a rotary vacuum evaporator, loaded into a sealed container, and kept chilled at 20°C until it was time to use each extract (595 1/2 folded filters, 125 mm) [61]. Using the DPPH technique, which verifies antimicrobial activity. Measurement of DPPH free radical scavenging was done using a modified version of Sreejayan and Rao's (1996) technique [62]. *Oldenlandia auricularia* was given a methanolic solution of DPPH (0.002 L; 100 mol/L) dispersed at doses of 25, 50, 100, 200, and 500 mg/L in 0.0002 L methyl alcohol. Equal amounts of methanol were given to the control group [63]. After 30 minutes, a decline in the fluorescence intensity of DPPH free radicals was observed at 517 nm, which is what caused the absorbance drop. As a standard substance, curcumin was used [64]. This analysis study reported the antioxidant activity of the *O. auricularia* plant [65].

CONCLUSION

This review's pharmacological actions support of *O. auricularia*, significantly greater therapeutic worth. It is clear from this study that *O. auricularia* medicinal plants play a significant role in the treatment of a number of illnesses. The plant has the ability to produce future drugs with high efficacy, as shown by the presence of phytochemical compounds and pharmacological effects. The shrub *Oldenlandia auricularia* is widely available in India, Sri Lanka, and other countries and is used extensively in traditional medicine. Based on this research, we can infer that numerous studies have been carried out to find compounds that have fewer negative effects and more powerful pharmacological effects.

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