



AN ETHNO-PHYTOCHEMICAL AND PHARMACOLOGICAL REVIEW ON SOME UNEXPLORED MEDICINAL PLANTS BELONGS TO NORTH-EAST AND SOUTH-EAST REGION OF CHATTISHGARH

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ABSTRACT

The forests of Chhattisgarh are a large store house of varieties of Medicinal and Aromatic plants and they sustain the lives of large population of forest dependent rural communities through addressing their food, health and livelihood issues. The forests of the state fall under two major forest types, i.e., Tropical Moist Deciduous forest and the Tropical Dry Deciduous forest. The state of Chhattisgarh is

endowed with about 22 varied forest sub-types existing in the state. Total forest area of the state is 59,772 Sq. Km. Out of which, the reserved forest is 25782 Sq. Km. (43.13 %), protected forest is 24036 Sq. Km. (40.22 %) and unclassified forest is 9954 Sq. Km (16.65 %). Medicinal plants of Chhattisgarh state belong to 911 genera and 196 families. These include 14 taxa at subspecies level. The total number of medicinal plant species (taxa) stand at 1525 comprising of climbers (161), herbs (808), shrubs (262) and trees (294). The present review is focus on some unexplored medicinal plants belongs to north-east and south-east region of Chhattisgarh to provide information's on the phytochemicals, ethno medicinal uses and pharmacological activities of plants (*Alangium salviifolium*, *Athyrium falcatum*, *Ipomea reniformis*, *Tamarix aphylla* and *Thespesia lampas*) commonly used in Indian traditional medicine. These plants are known to contain various active principles of therapeutic value and to possess biological activity against a number of diseases.

KEYWORDS: Tropical, phytochemical and therapeutic value.

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INTRODUCTION

Chhattisgarh is a land-locked State in the heart of India. It lies between 17°46" - 24°8" N latitude and 80°15" - 84 ° 24" E longitudes. The average annual rainfall in Chhattisgarh is 1405.3 mm (maximum average annual rainfall up to 1885.1 mm in Jashpur district). The State shares its boundaries with the 6 Indian States i.e. Madhya Pradesh on the north-west, Uttar Pradesh on the north, Jharkhand on the north-east, Orissa on the south-east, Andhra Pradesh on the south and Maharashtra on the south-west.

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The present review is focus on some unexplored medicinal plants belongs to north-east and south-east region of Chhattisgarh to provide information's on the phytochemicals, ethno medicinal uses and pharmacological activities of plants (*Alangium salviifolium*, *Athyrium falcatum*, *Ipomea reniformis*, *Tamarix aphylla* and *Thespesia lampas*) commonly used in Indian traditional medicine. These plants are known to contain various active principles of therapeutic value and to possess biological activity against a number of diseases. No comprehensive accounts on together of these plants are available as a review. NCBI (Pubmed) and Medbioworld databases were used for the collection of pharmacological activities as well as, ethnomedicinal information was extracted from the book on Dictionary of Indian Folk Medicine and Ethnobotany and some related publications which are published on the ethnobotanical aspects.^[5]

1. *Alangium salviifolium*

Alangium salviifolium Linn. is a deciduous, rambling shrub or a tree, up to 10m in height with a maximum girth of 1.2m, which grows wildly in Chhattisgarh and throughout the hotter parts of India. It belongs to Alangiaceae family. It is also found in Western Africa, Madagascar, Southern Asia, Philippines and tropical Australia, and the Pacific Islands^[6]

Vernacular name

Common name

Sage-leaved *Alangium* (English); Angol, Dhera (Hindi); Ankol (sanskrit); Ankolam (Malayalam) Uргу (Telugu); Alangi (Tamil)



Fig.1.Flowers of *Alangium salviifolium*



Fig.2.Leaves of *Alangium salviifolium*

Taxonomy of *Alangium salviifolium* ^[7]

Kingdom: Plantae

Unranked: Angiosperms

Unranked: Eudicots

Unranked: Asterids

Order: Cornales

Family: Cornaceae (Alangiaceae)

Genus: *Alangium*

Species: *salvifolium*

Description: Medium-sized tree or climbing shrub with rough light brown bark. Branchlets grey- or purple-brown, often with strong spines up to 1.2 cm. long, pubescent or glabrous.

- Leaves variable, cuneate or rounded at the base, rounded or acute at the apex, at first pubescent later glabrous, 3–23 cm. long and 1.4–9 cm. wide, petiole up to 1.5 cm. long; lateral nerves 3–9, venation openly reticulate, prominent below.
- Flowers cream with a slight orange tinge, 5–10-merous, 13–31 mm. long, 1–17 in almost sessile inflorescences, pedicels 2–8 mm. long. The pedicels and cylindrical buds are velvety with golden-brown hairs. Calyx tube urceolate 0.75–2.5 mm. long, lobes triangular 0.25–1.5 mm. long. Petals ligulate, densely pubescent outside, internally pubescent or glabrous, 12–28.5 mm. long and 1–2.3 mm. wide. Stamens 10–32, anthers narrow, 5–14 mm. long. Style glabrous, slightly dilated above, stigma capitate or conical, somewhat lobed, 8.5–27.5 mm. long. ^[6-8]

Chemical constituents^[6]: The major phytochemical constituents of the plant are alangine A and B, alangicine, markindine, lamarckinine and emetine.

Uses^[9]: Different parts of this plant are reported to possess acrid, astringent, emollient, anthelmintic, diuretic and purgative properties.

Ethno botanical use

- The root of *Alangium salviifolium* has been used in the Indian system of medicine as an acrid, diuretic, astringent and antidote for several poisons.
- Fruits are sweet, cooling and purgative and used as a poultice for treating burning sensation and haemorrhage.
- The leaves are used as a poultice in rheumatism.
- It is also used externally in acute case of rheumatism, leprosy and inflammation.

Phytochemical profile: Previous phytochemical investigation revealed that the phytochemical constituents of the plant are alangine A and B, lamarckinine, markindine and emetine.

- Ankorine alkaloid was isolated from leaves. It is a rich source of tetrahydroisoquinoline monoterpene glycoside. E.g. alangiside-1 or ipecoside-2 whose structures are closely related to the ipecac alkaloid¹⁰.
- Sterols alangol (m.p. 296°C) and alengol (m. p. 302–307°C) were isolated from seed kernels. ^[11]

- Three new phenolic glycosides, salviifosides A-C, and three known compounds salicin, kaempferol, and kaempferol 3-O-b-D-glucopyranoside were isolated from the leaves of *Alangium salviifolium* (L.f.) Wangerin. [12]

Pharmacological profile

Anti Epileptic activity: The ethanolic and aqueous extracts of leaves of *Alangium salvifolium* proved anticonvulsant activity by delaying the onset of PTZ induced seizures and protecting treated mice from mortality induced by seizures. The phytoconstituents such as tannins, triterpenes and steroids were reported as active substances for antiepileptic activity. [13]

Antioxidant and anti microbial activity: Antioxidant and anti microbial activities of the alcoholic and aqueous extracts from the root of *Alangium salvifolium* wang. were reported due to presence of phenolic compounds and flavanoids in alcoholic and aqueous extracts.

Antimicrobial activity evaluated against Gram positive and Gram negative ATCC (American Type Culture Collection) bacterial isolates, the isolates are: *Bacillus cereus*, *Bacillus pumilus*, *Bacillus subtilis*, *Bordetella*, *Staphylococcus epidermidis*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, and *Enterococcus faecalis*.

The degree of susceptibility of alcoholic extract is in the order

***S. dysenteries* > *S. aureus* > *E. aerogenes* > *S. typhi* > *E. coli*. *B. subtilis*.**

In other hand degree of susceptibility of alcoholic extract is in the order:

***E. aerogenes* > *S. typhi* > *S. dysenteries*. > *S. aureus*.**

The alcoholic extract and aqueous extract showed direct antimicrobial activity against all tested microorganism with minimum inhibitory concentration ranging between 0.130 to 0.520 mg/ml and 0.26 to 2.10 mg/ml, respectively. [14]

Hypoglycemic and Antidiabetic activity: Methanolic extract of *Alangium salvifolium* decreases serum glucose, insulin, triglyceride and total cholesterol concentrations in dexamethasone-administered rats. *Alangium salvifolium* leaves were found to contain flavonoids, terpenoids, alkaloids and steroids which are known to be bioactive antidiabetic principles and its antioxidant properties. [15]

Anti arthritic activity: The anti-arthritic activity of stem barks of *Alangium salviifolium* wang has been reported by Freund's adjuvant induced arthritis model. Petroleum ether, Ethyl acetate, Chloroform, Methanolic extracts of *Alangium salvifolium* have been exhibited significant anti-arthritic activity. All the extracts of *Alangium salviifolium* wang showed potent anti-arthritic activity and the potency of the activity follows the order ^[16]: Chloroform > Ethyl acetate > Aqueous > Petroleum ether > Methanol.

Antibacterial activity: The flowers of *Alangium salviifolium* showed remarkable antibacterial activity against a number of Gram-positive (*Bacillus subtilis*, *Bacillus megatrium*, *Staphylococcus aureus*, *Sarcina lutea*, *Streptococcus b-haemolyticus*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Shigella dysenteriae*, *Shigella flexneri*, *Shigella sonnei*, *Shigella shiga*, *Shigella boydii*, *Salmonella typhi*, *Klebsiella*) bacterial species. 1-Methyl-1H-pyrimidine-2,4-dione and 3-O- β -D-glucopyranosyl-(24 β)-ethylcholesta-5,22,25-triene, isolated from the flowers of *Alangium salviifolium* has shown antibacterial activity. ^[16].

Antifertility activity: Antiprogestogenic activity of the Ethyl acetate, Chloroform and Aqueous extracts of *Alangium salvifolium* wang. has been reported. It has produced abortifacient activity and less anti-implantation activity. It indicates that the herbal drugs may have anti-progesterone effects. Various extracts of the stem bark of *Alangium salvifolium* shown the presence of alkaloids, steroids, saponins and flavonoids, but, tannins and phenolic compounds were noticed only in methanolic extract. ^[18]

Cardiac activity: Epinephrine and nor-epinephrine increases the heart rate and force of contraction. Epinephrine is a hormone, secreted by the adrenal medulla, in response to hypoglycemia. The extract of *Alangium salviifolium* had exhibited the hypoglycemic activity that indicates the release and potentiation of the action of epinephrine. The plant extract drastically increased the oxygen demand and lead to tachycardia. The cardiogenic activity exhibited has positive inotropic and chronotropic effects on an isolated frog's heart probably due to the presence of alkaloids. The characterization of the isolated compound is under progress based on structural studies; moreover, it promises a lot of scope for further envisage on its cardiac activity. ^[19]

Diuretic activity: Diuretic property of Benzene and Ethyl acetate extracts of *Alangium salvifolium* was evaluated against albino rats. For the evaluation of diuretic activity the

method of Lipschitz et al, was employed. The diuretic activity of *Alangium salvifolium* may be due to the presence of flavonoids in both the extracts. ^[20]

Analgesic and anti-inflammatory: Analgesic and anti-inflammatory activities of the Methanolic extract of *Alangium salvifolium* roots has been studied in animal models. The Methanolic extract showed significant dose dependent inhibition of Carrageenan-induced rat paw edema. The extract also produced marked analgesic activity. ^[21]

Anthelmintic activity: Anthelmintic activity of the Aqueous and Alcoholic root extracts of *Alangium salvifolium* subsp. *hexapetalum* were evaluated on adult earthworm, *Pheritima posthuma* (Indian variety) *in vitro*. The alcoholic extract was found to be less effective than the aqueous extract and the activity was comparable with the reference drug, piperazine citrate. ^[22]

Antifungal activity: The antifungal activity of lyophilized aqueous extract of *Alangium salvifolium* subsp. *hexapetalum* has been investigated on Dermatophytes, *Candida albicans*. The inhibitory effect of lyophilized aqueous extract on dermatophytes was not significantly different from that of the reference drug (ketoconazole), but differs against *Candida albicans*. In addition, lyophilized extract has no induction of dermal irritability in rabbits. ^[23]

2. *Ipomea reniformis*: *Ipomea reniformis* Choisy (Convolvulaceae) is a perennial, much branched herb (creeper). It is found widely distributed all over India, especially in damp places in upper Gangetic plain, Gujarat, Bihar, West Bengal, Western Ghats, ascending up to 900m in the hills, Chhattisgarh, Goa, Karnataka in India, Ceylon and Tropical Africa. ^[24-32]

Taxonomy of *Ipomea reniformis* ^[34-35]

Kingdom: Plantae
 Subkingdom: Viridiplantae
 Class: Magnoliopsida
 Subclass: Asteridae
 Order: Solanales
 Family: Convolvulaceae
 Genus: *Ipomea*
 Species: *reniformis*



Fig.3. *Ipomea reniformis* plant

Vernacular name^[30]

Mooshakarni (Sanskrit); Underkani (marathi); Indurkani (Bengali); Underakani (Gujarati); Toinnuatali (Telugu); Chukakani (Urdu); Goromusha (Persian); Mushkani (Hindi); Paerattae-kirae (Tamil).

Description: *Ipomea reniformis* or *salvinia cusculata* (convolvulaceae) is a creeping herb, rooting at nodes. The leaves are up to 1.9 cm long, kidney shaped or ovate-cordate, broader than long and toothed. The flowers are axillary and yellow with hairy sepals. The plant flowers in the rainy season and cold weather. ^[36]

Chemical constituent: Phytochemical investigation of the plant. have showed the presence of resin, glycosides, reducing sugars, starch, caffeic, pcoumaric, ferulic and sinapic acid esters.

Ethno botanical Use: In the Indigenous system of Medicine, *Ipomoea reniformis* has been claimed to be useful for cough, headache, neuralgia, rheumatism, diuretic, inflammation, troubles of nose, fever due to enlargement of liver and also in kidney diseases. Powder of leaves is used as a snuff during epileptic seizures, Juice acts as purgative and the root is having diuretic, laxative, and applied in the disease of the eyes and gums. ^[33]

Phytochemical profile

- Shah et al., have showed the presence of resin, glycosides, reducing sugars and starch while alkaloids are absent. ^[37]
- Petroleum ether extract was reported to contain fats and fixed oil while aqueous extract was reported to contain amino acids, tannins (condensed tannins, pseudo tannins), and starch. ^[35]
- Chemical investigation of *Ipomoea reniformis* shows the presence of caffeic, pcoumaric, ferulic and sinapic acid esters identified in seeds. ^[38]

Pharmacological profile: In the indigenous system of medicine, *Ipomoea reniformis* has been used for treatment of inflammation, epilepsy, diuretic, laxative etc. A little pharmacological investigation has been carried out on this plant. But a lot more can still be explored and utilized.

Anti oxidant and anti obesity activity

Anti oxidant properties of the extracts were studied by DPPH (1, 1-Diphenyl-2-Picrylhydrozyl) radical scavenging activity method. Methanol extract exhibited better anti oxidant activity than other extracts with IC₅₀ of 8.59 µgmL⁻¹ in DPPH radical scavenging method. Methanol and hexane extract exhibited α- amylase inhibitory activity with IC₅₀ of 104.5 and 133.4 µgmL⁻¹, respectively. Ethyl acetate extract showed cytotoxicity with ED₅₀ of 34.29 µgmL⁻¹ in brine shrimp lethality assay. The present study showed that the extracts IB and IC of *Ipomoea reniformis* were found to be showed most promising biological activities. Methanol extract of this plant might be used for anti oxidant and anti obesity activities with minimal toxicity.

Miscellaneous effect

- Sukkawala et al. [28] studied the alcoholic extract of *Ipomoea reniformis*(whole plant) which showed general depressant action in rats, a reversible inhibitory effect on the heart of frog and rabbit and also constriction of the coronary vessels in rabbit heart. The extract also had spasmolytic action on guinea pig ileum but hypotensive effect not influenced by atropine sulphate in cats. The alcoholic extract appeared to be more musculotropic than neurotropic. The effect of aqueous extract however was lower than that of alcoholic extract.
- Aswal et al., [28,40] showed that the 50% ethanolic extract of *Ipomoea reniformis*(whole plant excluding roots) was screened for antiprotozoal, anti viral, diuretic and effects on CVS, CNS and smoothmuscles and was found inactive. The LD₅₀ of extract was found to be >1000mg/kg i.p. in albino mice.

Antihyperglycemic and Antihyperlipidaemic activity: Ethanol and aqueous extracts of *I. reniformis* at doses of 300 and 600 mg/kg b. wt were administered as a single dose per day to diabetes rats for the period of 12 days, respectively. The effect of extracts of *I. reniformis* on blood glucose levels, serum lipid profile (Total cholesterol, triglycerides, phospholipids, low density, very low density and high density lipoprotein) and serum enzymes (ALT, ASP, ALP) were measured in the diabetic rats. The extracts of *I. reniformis* exhibited significant antihyperglycemic and antihyperlipidaemic effects on alloxan induced diabetic rats when compared to the standard drug (Metformin 250 mg/kg)^[41]

Anti-inflammatory activity

Methanolic extract of *Ipomoea reniformis* herb (MEIR) in acute, subacute and chronic models of inflammation was assessed in rats. Administration of MEIR (200, 400 mg/kg, p.o.) exhibited significant anti-inflammatory activity. In acute inflammation as produced by Carrageenan 59.55 % and 64.04 % protection was observed. While in subacute anti-inflammatory models using formaldehyde-induced hind paw edema (after 1.5 h) 38.36 % and 47.95 % and in chronic anti-inflammatory model using cotton pellet granuloma 15.02 % and 19.19 % protection from inflammation was observed. MEIR did not show any sign of toxicity and mortality up to a dose level of 1000 mg/kg, p.o. in rats. The results obtained suggest that the methanolic extract of *Ipomoea reniformis* herb (MEIR) is endowed with effective anti-inflammatory activity mediated via either by inhibition of cyclooxygenase cascade and by blocking the release of vasoactive substances (histamine, serotonin and kinins).^[42]

3. *Tamarix aphylla*: *Tamarix aphylla* is the largest known species of tamarix (height: to 18 metres—60 ft). The species has a variety of common name including Athel pine, Athel tree, Athel tamarisk, and saltcedar. It is an evergreen tree, native across North, East and Central Africa, through the Middle East, and into parts of Western and Southern Asia. It is found in the Middle East and the Arabian Peninsula, east through Iran and into India and Afghanistan.^[43]

Taxonomy of *Tamarix****aphylla*^[44]**

Kingdom: Plantae

Unranked: Angiosperms

Unranked: Eudicots

Order: Caryophyllales

Family: Tamaricaceae

Genus: *Tamarix*Species: *aphylla***Fig.4: branch Of *Tamarix aphylla***

Synonym : Athel tamarisk Athel Pine, Laljhav, Salt Cedar, Tamarisk.

Description^[44,45]: Athel tamarisk is a fast-growing, evergreen tree. It has a rounded or irregular, spreading crown of many heavy, stout branches and long, drooping twigs. It attains a height of 33 to 60 feet (10-18 m) and may attain a diameter of 2.5 feet (0.8 m).

- The leaves are tiny scales 0.06 inch (1.5 mm) long. The twigs are wiry, very slender, and jointed.
- The bark becomes thick and deeply furrowed into long narrow ridges on the trunk and smooth on the branches.
- Stems reddish brown, Slender, curved, and branched with porous Sap wood.
- Flowers Pinkish. Mainly bisexual and stalk less or with a very short stalk.

Phytochemical profile

- The phytochemical screening showed a conspicuous absence of alkaloids in all extracts, then a remarkable presence of tannins in particular hydrolysable tannins. Others metabolites and bioactive compounds were identified such as flavonoids, cardiac glycosides, steroids and terpenoids. ^[46]
- Three new phenolic compound isolated from the gall of *Tamarix aphylla* or *Tamarix articulata* were identified as 3,5-dihydroxy-4-(4'-hydroxybenzoxy) benzoic acid, 3,5-dihydroxy-4-(2',6'-diethyl-4'-hydroxymethylenebenzoxy)benzoic acid, and 3,3'-dimethoxy-4,4'-bis methyleneoxy-trans trans cinnamic acid. ^[47]
- The novel natural polyphenol, 2-O-galloyl-3-O-(3,4,5,6,7-pentahydroxybiphenyl ether-8_a-carboxylic acid-1- carboxyloyl)-4,6-(S)-hexahydroxybiphenol-(α/β)-⁴C₁-glucopyranose, tamarixellagic acid, together with the known dehydrodigallic and dehydrotrigallic acids were isolated from the galls of *Tamarix aphylla*. ^[48]
- The new galloyl glucoses, 2,6-digalloyl glucose and 3,6-digalloyl glucose, were isolated from an aqueous ethanolic gall extract of *Tamarix aphylla*. ^[49]
- The first glycosylated isoferulic acid, isoferulic acid 3-O-beta-glucopyranoside, together with the new phenolics, tamarixetin 3,3'-di-sodium sulphate and dehydrodigallic acid dimethyl ester have been characterized from a flower extract of *Tamarix aphylla*. The structures were established on the basis of spectral data. ^[50]
- The bark of *Tamarix aphylla* contains the new triterpene D-friedoolean-14-en-3 α ,28-diol (isomyricadiol), its 3 β isomer (myricadiol) and its 3-ketone. The structure of isomyricadiol was established by comparing its ¹³C NMR data with those of its 3 β isomer and 3-epibetulinic aldehyde. ^[51]
- A unique diaryloxyfuranofuranlignan, together with a unique biosynthetic transformation product of the known polyphenolic, dehydrodigallic acid, and an unique isoferulylglycerol ester, isolated from the bark of *Tamarix aphylla*, have been

characterized on the basis of chemical and spectroscopic analysis to be (\pm)-2,6-bis-(1-oxy-2,3-dimethoxyphenyl)-3,7-dioxabicyclo-[3,3,0]-octane, decarboxydehydrodigallic acid and 1-isoferulyl-3-pentacosanoyl-glycerol, respectively.^[52]

- A rhamnetinglucuronidetrissulphate isolated from the leaves of *Tamarix aphylla*^[53]
- A new flavanol 3,5-di-o-KSO₃: Kaempferol 7,4'-dimethylether 3,5-di-o-KSO₃ were isolated and identified from the flowers of *Tamarix amplexicaulis*.^[54]

Pharmacological profile

Antifungal activity: In vitro studies of methanolic, pet ether and dichloromethane extract of aerial parts of *Withania coagulans* and *Tamarix aphylla* against seven fungal strains (*Trichoderma viridis*, *Aspergillus flavus*, *Fusarium laterifum*, *Aspergillus fumigatus*, *Candida albicans*, *Trichophyton mentogrophytes* and *Microsporum canis*). Assessment revealed that all extracts of *Withania coagulans* caused significant inhibition in biomass production of all test fungi (0.5 g/ml), while dichloromethane extract of *Tamarix aphylla* showed significant results (1.0 g/ml) against the tested fungal strains only.^[55]

Antimicrobial activity

The ethanol extracts of *Alhagima aurorum* Medic., *Chenopodium murale* L., *Convolvulus fatmensis* G. Kunze., *Conyzadio scoridis*(L.) Desf., *Cynanchum acutum* L., *Diplotaxis acris*(Forssk) Boiss, *Euphorbia cuneata* Vahl., *Origanum syriacum*L., *Solenostemma argel*(Del.) Hayne. and *Tamarix aphylla*L.(Karst) showed significant antimicrobial activity against Gram negative, Gram positive bacteria, unicellular and filamentous fungi. However, *Tamarix aphylla* showed remarkable activity against *Aspergillus flavus* and 16, out of 19, strain of the investigated test organisms.^[56]

Antioxidant activity

Total phenolic content of the aqueous methanol; aqueous ethanol, aqueous acetone and distilled water extracts were determined by Folin Ciocalteu method and their antioxidant activity was assayed through in vitro radical scavenging activity using DPPH· assay. The results showed that mixture water-methanol was better than water-ethanol, water-acetone and water for extraction bioactive compounds in particularly total polyphenols from *Tamarix aphylla* leaves. The average total phenol content of aqueous methanol extract was 262.26 mg GAE/100g dry weight lyophilized extract. However, all extracts were free-radical inhibitors but aqueous acetone extract was more potent than aqueous ethanol extract and two

others extracts. In order of effectiveness (EC50), the potent inhibitors were from water-acetone extract (0.080mg/ml) > water-ethanol extract (0.140mg/ml)>water extract (0.173mg/ml)> Water-methanol (0.911mg/ml)^[57]

Tamarix aphylla, a traditionally used plant in Middle Eastern countries, was screened for its potential antioxidant, anti-inflammatory and wound healing activity. Antioxidant activity of ethanolic extract of Tamarix aphylla leaves was measured by DPPH and hydrogen peroxide free radicals scavenging method. Herbal gel formulations containing 15 and 25% Tamarix aphylla extract in gel base were prepared and evaluated for its anti-inflammatory activity by carrageen induced paw edema model and wound healing activity by excision wound model in Wister rats. The extract show maximum scavenging activity i.e., 80.81 ± 0.29 and 67.76 ± 0.09 at $400 \mu\text{g mL}^{-1}$ by DPPH and hydrogen peroxide free radicals scavenging method respectively. In carrageen induced paw edema model and wound healing activity by excision wound model, formulation showed optimum % inhibition of 53.07 and 89.6% with 25% gel formulation which were comparable to the standard Diclomax and Betadine, respectively. ^[58]

Anti-inflammatory activity

Tamarix aphylla (Tamaricaceae) is recommended for the treatment of tuberculosis in Chifra District. In Arab TMPs of Golan Heights and West Bank region the leaf of the plant is used for the treatment of fever. Both the leaves and seeds are also used as anti-inflammatory. ^[59]

4. Thespesia lampas

Thespesia lampas (Cav.) Dalz & Gibs (T. lampas) belong to the family Malvaceae, vernacularly known as “Ranbhendi”, African chewing gum, azanza, quarters, snot apple, tree hibiscus, wild hibiscus is found as a wild herb growing during monsoon on the hills in a throughout India and also in Eastern Tropical Africa. It is native to east Africa, Indian sub-continent, Indo-China, Malaysia. ^[60,61]

Vernacular names: Assamese: bon kapas; Bengali: ban kapas; Gujarati: junglibhindo, jungle paraspiplo; Hindi: janglibhindi, bankapasi; Kannada: kaadubinde; Konkani: raanbhendi; Malayalam: katthurparathi, katupvarasu; Marathi: janglibhendi, raanbhendi; Oriya: bilokapasiva; Sanskrit: vanakarpasah; Tamil: kattupparutti; Telugu: adavibenda, adavipratti.

Taxonomy of *Thespesia lampas*(synonym: *Azanza lampas*)^[63]

Kingdom: Plantae

Phylum: Magnoliophyta

Class: Angiospermae

Order: Malvales

Family: Malvaceae

Genus: *Thespesia*Species: *Thespesia lampas* or *Azanza lampas***Fig.5. Flower and leaf of *Thespesia lampas*****Description**^[64]

- *Thespesia lampas* is an erect, slightly branched shrub 2-3 meter in height.
- Leaf: lamina up to 20 × 20 cm., suborbicular in outline, palmately 3–5-lobed, stellate-pubescent to nearly glabrous above, stellate-tomentose to stellate-pubescent beneath, apex usually blunt or rounded, margin entire, base cordate and 5–7-nerved, midrib usually with a longitudinal fissure; petiole up to 13 cm. long, stellate-tomentose.
- Stem: straight, erect stout, with smooth texture; reddish brown in colour; having characteristic odour and bitter in taste.
- The flowers are large, and borne in threes in the apex of the branches or at the axils of the leaves. The calyx is green, with 5 pointed lobes united below the middle. The corolla is bell-shaped, 6-8 cm long, yellow, and dark-purple at the centre. The capsules are ovoid, and about 3 cm long, with 4-5 valves.
- Fruits: capsular, dull black, ovoid pointed in shape.
- Seed: glossy, glabrous, dark brown or black in colour.

Chemical constituent: Glycoside, phenolic compound, Tannin, Flavonoid, saponin, carbohydrate, protein.

Medicinal uses: The roots and fruits are employed as a remedy for gonorrhoea and syphilis.

Phytochemical profile

- Preliminary phytochemical analysis reveals the presence of Glycoside, phenolic compound, Tannin, Flavonoid, saponin, carbohydrate, and protein.

- GC-MS analysis show the presence of fatty acids such as dodecanoic acid, tetradecanoic acid, n-hexadecanoic acid, 9-tetradecenal and HPTLC finger printing revealed the presence of β -sitosterol and quercetin in stems of *Thespesia lampas*^[64,65]
- Phytoconstituents like 7-hydroxycadalene (6), thespesenone (7), and dehydrooxoperezinone-6-methyl ether (8) and Several other sesquiterpenemansononeE (4), mansonone F (3), mansonone D (1), mansonone G (9), mansonone M (10), and thespesone (4) quinones were isolated from the heart wood of *Thespesia populnea*.^[66]

Pharmacological profile

Hepatoprotective activity

T. lampas stems extracts at dose of 200 mg/kg body wt. were administered orally once daily for nine days and on seventh day after one hour of drug administration CCl₄ (1ml/kg s.c.) given orally. After 24 h of ninth day, they were sacrifice and their livers were dissected for biochemical and histopathological studies. The extracts showed significant hepatoprotective and antioxidant effect by lowering the serum levels of transaminases (SGOT and SGPT), alkaline phosphatase (ALP), bilirubin, protein, cholesterol and triglyceride as compared to silymarin as a standard hepatoprotective agent.^[67]

Hypolipodaemic activity

The treatment with aqueous extract of T. lampas reduced cholesterol, LDL, VLDL and improved HDL in triton induced rats.^[68]

Anti-diabetic activity

The ethanolic extract of the plant bark (TPBE) and leaf (TPLE) were evaluated for its effect on blood sugar, against the streptozotocin (STZ)–induced diabetic rats and compared it with standard drug glibenclamide. The result of this experimental study indicates that both the ethanolic extract posses' anti-diabetic effect against STZ induced diabetic rats and also showed the possible mechanism due to inhibition of generation of free radical.^[69]

Anthelmintic activity

The aqueous extract of *Thespesia lampas* (Cav.) roots (Ranibhendi) was investigated for anthelmintic activity using earthworms (*Pheretima posthuma*), tapeworms (*Raillietin spiralis*) and roundworms (*Ascaridiagalli*). Various concentrations (10-50 mg/ml) of plant extract were tested in the bioassay. Piperazine citrate (10 mg/ml) was used as reference standard drug whereas distilled water as control. Determination of paralysis time and death

time of the worms were recorded. Extract exhibited significant anthelmintic activity at highest concentration of 50 mg/ml. The result shows that aqueous extract possesses vermifugal activity and found to be effective as an anthelmintic. [70]

Anti-implantation activity

Chromatographic pure principle from PE extract showed significant anti-implantation activity (60%) at the dose of 110 mg/kg, b.w while that from EAc extract showed 48.6 % effect at the same dose. [71]

Antibacterial activity

methanolic extract of *Thespesia populnea* flowers were subjected for antibacterial screening and results show significant antibacterial activity in concentration, 7.2% of methanolic extract were active in the lowest tested concentration of 62.5µg/ml, 5% active in a concentration of 250µg/ml, 75.7% active in a concentration of 500µg/ml, and 92.8% active in a concentration of 1000µg/ml. Ciprofloxacin (10µg) was used as standard drug. [72]

Antioxidant activities and Anti-inflammatory activity

The aqueous extracts of *Thespesia lampas* were evaluated by a 1, 1-diphenyl,2-picrylhydrazyl free radical (DPPH), 2, 2'-Azinobis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and antilipoxygenase assay for the water extraction of *Thespesia lampas* Dalz&Gibs. Ascorbic acid, gallic acid and indomethacin were used as reference standards for DPPH, ABTS and anti-lipoxygenase assays. In both DPPH and ABTS scavenging activities extract showed significant scavenging activity (72.28 µg/ml and 103.4 µg/ml IC for DPPH and ABTS assay). In addition to the antioxidant activity water extract showed anti-lipoxygenase activity (IC₅₀ value is 586.5 µg/ml)[73]

Anti-psoriatic activity

Screening for anti-psoriatic activity was carried out by topical application of different extracts & isolated compounds (TpF-1, TpF-2 & TpS-2) of *Thespesia populnea* bark in the form of a cream using the Perry's scientific mouse tail model. Successive pet-ether extract showed maximum antipsoriatic activity (increased orthokeratotic region by 25%) amongst the extracts tested whereas the compound TpF- 2 exhibited 38% increase in the same. From the above data, it can be said that, the plant *Thespesia populneais* promising for further investigations to prove its anti-psoriatic activity. [74]

Diuretic activity

The extract of *Thespesia populnea* (400 mg/kg) has shown significant increase in the volume of urine, urinary concentration of Na⁺, K⁺ and Cl⁻ with reference to standard Furosemide (100 mg/kg).^[76]

Anti Alzheimer activity: The ethanol extract of *Thespesia populnea* (TPE) was administered orally in three doses (100, 200, and 400 mg=kg) for 7 successive days to different groups of young and aged rats. TPE (200 and 400 mg=kg, p.o.) resulted in significant improvement in memory of young and aged rats. TPE also reversed the amnesia induced by scopolamine (0.4 mg=kg, i.p.) and diazepam (1 mg=kg, i.p.). *Thespesia populnea* bark appears to be a promising candidate for improving memory, and it would be worth while to explore the potential of this plant in the management of Alzheimer patients.^[77]

CONCLUSION

The knowledge of the properties of these unexplored medicinal plants has likely been on to natives by their elders or is based on experience. This recent review can help better on those drugs for their utilization and most effective formulation aspects.

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