**Tamarix gallica: For traditional uses, phytochemical and pharmacological potentials**

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**ABSTRACT**

*Tamarix gallica* belongs to family *Tamaricaceae*, traditionally used in leucoderma, spleen trouble, eye diseases, rheumatis, gingivitis etc. The plant material constituted phytochemical constituents as *tamarixin*, *tamarixetin*, *troupin*, 4- methylcoumarin, 3, 3’-di-0-methylellagic acid and quercetol (methyllic ester)and pharmacological activities reported that the plant material(s) may be used as anti-malarial, laxative, expectorant, antidiarrheal, anthelmintic, antihaemorrhoid, astringent, inhibitor of nephrolithiasis, diuretic, hepatoprotective, antioxidant, anti-hyperlipidemic, antinociceptive, antidiarrhoeal, anticancer, antimicrobial, liver carcinogenesis etc.

**Keywords:** Gingivitis, hepatoprotective, *Tamarix gallica*, antioxidant.

**INTRODUCTION**

Traditional herbal medicines form an important part of the healthcare system of India. Ayurveda, supposed to be the oldest medical system in the world, provides potential leads to find active and therapeutically useful compounds from plants. Plants have always played a key role in the treatment of different ailments human and animals all over the world. In developing country more researchers are working on plant and plant product so recognition of natural product is growing. Herbal medicine is an important part of both traditional and modern system of medicine [1].

*Tamarix gallica* known as Jhau in hindi. There are about 50-60 species of flowering plant in the family *Tamaricaceae*. It is deciduous shrub growing to 4m by 6m at a medium rate and is in flower from june to august. The flowers are hermaphrodite and pollinated by bees [2]. The branchlets and the leaves of the plant are astringent and diuretic, an external compress is applied to wounds to stop bleeding [3,4]. *Tamarix gallica* is traditionally used as expectorant,
laxative, astringent, antidiarrheal and antidysentery [5]. Galls produced by the plant as a result of insect damage contain up to 50% tannin, which is used as dyestuff for fabric [6].

**Vernacular name** [7]: Hindi: Jhau, Jhuv, English: Tamarix, Saltcedar, Sanskrit: Jhavuk, Oriya: Jaula.

**Taxonomy** [8]:
- **Kingdom**: Plantae
- **Phylum**: Spermatophyta
- **Class**: Dicotyledonae
- **Order**: Tamaricales
- **Family**: Tamaricaceae
- **Genus**: Tamarix
- **Species**: gallica

**Distribution**: *Tamarix gallica* is distributed in the coast forests of Bengal, Pakistan, Ceylon, Burma, Malay and Andamans. It is mainly found in the salty regions, between interdunal areas of the desert [4].

**Marketed Formulations**— Many formulations (Liv 52 DS, Liv 52 Vet, Geriforte Aqua, Geriforte Vet, Digyton, Bonnisan, Geriforte) constituted *Tamarix gallica* [9].

**TRADITIONAL USES**
- *Tamarix gallica* used as prophylactic and therapeutic remedies to malaria [10],
- It used as laxative and expectorant [6],
- Rheumatism [11],
- *Tamarix gallica* used as antidiarrheal, anthelmintic, gingivitis and antihaemorrhoid [5],
- Astringent [4],
- Dromedary galls [5],
- It used in leucoderma, spleen trouble and eye diseases [12],
- Diuretic [13],
- Tamarix gallica used as an inhibitor of nephrolithiasis [14],
- Used as hepatoprotective [15].

**CHEMICAL CONSTITUENTS**
*Tamarix gallica* consists of tannin (50%) eg. ellagic acid and gallic acid [15, 16]. Major chemical constituents of tamarix were tamarixin, tamarixetin, troupin, 4-methylcoumarin, 3, 3′-di-0-methylenebolic acid and quercetol (methyllic ester) [17]. The numerous polyphenols were also present in tamarix like anthocyanins, tannins, flavonones, isoflavonones, resveratrol and ellagic acid [18, 19]. It also constituted antioxidants like carotenoids and essential oils [15, 16, 27].

![Tamarixetin](image.png)

(3,5,7-trihydroxy-2-(3-hydroxy-4-methoxyphenyl)-4H-chromen-4-one)
Tamarixin
(5,7-dihydroxy-2-(3-hydroxy-4-methoxyphenyl)-3-(3,4,5-trihydroxy-6-(hydroxymethyl) tetrahydro-2H-pyran-2-yloxy)-4H-chromen-4-one)

3, 3’-di-o-methylellagic acid
(2,7-dihydroxy-3,8-dimethoxychromenochromene-5,10-dione)

4 methylcoumarin
(4-methyl-chromen-2-one)

Ellagic acid
(2,3,7,8-tetrahydroxycromeno-chromene-5,10-dione)

Gallic acid
(3,4,5-trihydroxybenzoic acid)
TOXICITY STUDIES
Methanolic and ethyl acetate extracts of *Tamarix gallica* showed no mortality after acute oral toxicity studies up to the dose of 3000 mg/kg body weight in albino rats [20, 21].

PHARMACOLOGICAL ACTIVITIES

ANTIOXIDANT
Leaves and flowers of *Tamarix gallica* showed antioxidant activity, however flowers showed higher antioxidant activity as compared to leaves. The inhibitory concentration for fifty percent animals (IC 50) values of the flower extracts were 1.3 (β-carotene bleaching) to 19 times (lipid peroxidation inhibition), lower than those for leaves. Flowers extract demonstrated the highest total phenolic content (135.36 mg GAE/g DW). RP-HPLC analysis showed syringic acid, isoquercitin and catechin as the major phenolics [16].

Methanolic and ethyl acetate extracts of *Tamarix gallica* showed antioxidant activity, both extracts led to the isolation of three known phenolic compounds: 3', 3, 5-tri hydroxy 4', 7- diméthoxy flavone, 5-hydroxy 4' ,3,7-triméthoxy flavone and isorhamnetine respectively. The structures of these above compounds were elucidated by mass specroscopy and a series of 1D and 2D NMR analyses. Some extracts and the pure isolated compounds have also been evaluated for their antioxidant activities through different methods: 1,1-diphenyl-2-picrylhydrazyl (DPPH) and cupric-reducing antioxidant capacity (CUPRAC) methods demonstrated important radical scavenging activity with the antiradical power (ARP) of 5 (in DPPH method), and trolox equivalent antioxidant capacity (TEAC) = 1 [22].

ANTI-HYPERLIPIDEMIC
Methanolic and phenolic extract of *Tamarix gallica* showed dose dependent decrease in the levels of cholesterol, triglyceride, LDL-C and VLDL-C level and increase HDL-C at the doses of 400 and 500 mg/kg body weight in triton X-100 induced hyperlipidemic rats. Atorvastatin used as a standard drug. Phenolic extract 500 mg/kg body weight has definite antihyperlipidemic activity [20].

ANTINOCICEPTIVE
Methanolic extract of aerial parts of *Tamarix gallica* showed anti-inflammatory and analgesic activities in rats at doses of 100, 200, and 300 mg/kg p.o. body wt. The extract produced dose dependent inhibition of paw edema due to carragenan and histamine, 10 mg/kg diclofenac used as a standard in the study. Central and peripheral activities of tamarix was also evaluated by tail flick, hot plate and acetic acid induced writhing method on swiss albino mice, *Tamarix gallica* increased in the reaction time and reduction in number of writhes [21].

Methanolic extract of *Tamarix gallica* showed antinociceptive and anti-inflammatory activities. It produced significant inhibition induced by acetic acid and also produced significant inhibitory effect on paw edema induced by carragenan in mice at the doses of 200 and 400 mg/kg body weight [23].

Methanolic extract of *Tamarix gallica* leaves showed antinociceptive, cytotoxic and antidiarrhoel activities in mice. It produced significant writhing inhibition in acetic acid induced writhing in mice at oral dose 500 mg/kg body weight compared to diclofenac sodium 25 mg/kg body weight [24].

Methanolic extract of *Tamarix gallica* barks showed antinociceptive activity in acetic acid induced writhing model in swiss albino mice at doses of 250 and 500 mg/kg body weight, compared to standard drug diclofenac sodium at dose 25 mg/kg body weight [25].
EFFECT ON RENAL CALCULI
The extract of *Tamarix gallica* acted as inhibitor of nephrolithiasis (calcium oxalate). The calcium oxalate formation induced by the addition of oxalate solutions of sodium and calcium chloride. The extract of *Tamarix gallica* acts at the stage of growth, this effectiveness was due to presence of acid [14].

ANTIDIARRHOEAL
Methanolic extract of *Tamarix gallica* leaves showed antidiarrhoeal activity on castor oil induced diarrhoea in mice at dose of 500 mg/kg p.o. body weight, compared to standard drug loperamide at the dose of 50 mg/kg body weight [24].

CYTOTOXIC ACTIVITY
*Tamarix gallica* methanolic show scytotoxic activity, brine shrimps used for cytotoxicity test. 5 mg eggs of *Artemiasalina* were hatched in natural seawater after incubation at about 29°C for 48h. The larvae were allowed another 48 h in seawater to ensure survival and maturity before use. Five doses of plant extract (1, 2, 4, 6, 8 and 10 μg/ml) in 5% DMSO and/or sea water were tested. Each extract preparation was dispensed into clean test tubes in 10 ml volumes and tested in duplicates. The concentration of DMSO in the vials was less than 10 μl/ml. For control, same procedure was followed except test samples. After marking the test tubes properly, 10 living shrimps were added to each of the 20 vials with the help of a Pasteur pipette. The test tube containing the sample and control were then incubated at 29°C for 24 h in a water bath, after which each tube was examined and the surviving nauplii were counted. The percentage of mortality was calculated at each concentration and it was reported that the extract showed lethality against the brine shrimp larvae. *Tamarix gallica* showed dissimilar mortality rate at different concentrations [24].

ANTIMICROBIAL
*Tamarix gallica* leaves and flower shows antimicrobial activity, however flowers extract showed highest antibacterial activity especially against Micrococcus luteus (zi = 25 mm). It also have antifungal activities especially against Candida glabrata (zi = 14.67 mm) and Candida albicans (zi = 14.33). The phytochemical tests demonstrated the presence of five flavonoids in flower extracts including quercetin and kaempferol, leaves showed 6 compounds including quercetin, 3-O-glucuronide [26].

*Tamarix gallica* extracts showed antibacterial properties against human pathogen strains, mean inhibition zone was from 0 to 6.5 mm when concentration increased from 2 to 100 mg/l. The strongest activity was showed against Micrococcus luteus and lowest activity against Escherichia coli [16].

HEPATO PROTECTIVE
*Tamarix gallica* methanolic extracts showed protective effect against thioacetamide induced hepatic oxidative stress and hyperproliferative response in wistar rats. Orally pretreatment of rats with tamarix extract at doses 25 and 50 mg/kg body wt., prevented thioacetamide promoted oxidative stress and toxicity, significantly reduced the susceptibility of the hepatic microsomal membrane for iron-ascorbate induced lipid peroxidation, H2O2 content, glutathione S-transferase and xanthine oxidase activities [15].

EFFECT ON LIVER CARCINOGENESIS
Methanolic extract of *Tamarix gallica* showed inhibitory effects on diethylnitrosamine (DEN) initiated and 2-acetylaminofluorene (2-AAF) promoted liver carcinogenesis in male wistar rats. Pretreatment of *Tamarix gallica* extract at doses of 25 and 50 mg/kg body weight prevented oxidative stress by restoring the levels of antioxidant enzymes and also prevented toxicity at both doses. Protective effect against liver carcinogenesis of *Tamarix gallica* might be mediated by multiple action, include restoration of cellular antioxidant enzymes, detoxifying enzymes, ODC activity and DNA synthesis [27].

CONCLUSION
*Tamarix gallica* constituted a number of phytochemicals, which divulge its uses for various therapeutic purposes. Tamarix can be used for the treatment of various health problems for instance anti-hyperlipidemic, antinociceptive, antidiarrhoeal, antioxidant, anticancer, antimicrobial, inhibitor of nephrolithiasis, liver carcinogenesis, and hepatoprotective. However attempts are required to evaluate the mechanism of actions with therapeutic activity for *Tamarix gallica*.

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