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Review Article

Review Article on Tamarix Dioica Roxb

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ABSTRACT

Tamarix dioica (Tamaricaceae) is also called Ghaz or Khagal. This plant is utilized for antibacterial, antifungal, cytotoxic, antipyretic, antioxidant, anti-inflammatory, acute toxicity, in vitro cytotoxic efficacy, and analgesic activities. Bioactive compounds like flavonoids, phenols, and tannins are found by phytochemical analysis and may contribute to its pharmacological properties. These constituents are associated with various biological activities, including anti-inflammatory, analgesic, antipyretic. Traditionally used to treat hepatic disorders, splenomegaly, and urinary ailments The current review focuses on pharmacognostical characteristics such as scientific categorization, vernacular name, nutritional value, and plant potential in biological activity and review aims to consolidate current knowledge on its phytochemistry, pharmacological aspect, and traditional uses, thereby providing a scientific basis for future research and therapeutic development. Overall, Tamarix dioica holds promise as a valuable natural resource for developing novel treatments targeting inflammation, pain, and organ-related disorders. This review will be more beneficial to student future research.

INTRODUCTION

The vast majority of the worldwide population uses medicinal plants for traditional medicine. (1) A majority of Plants are essential to the world's inhabitants that are medicinal for traditional medicine. In accordance towards the According to the World Health Organization, 80% of people worldwide utilize herbal treatments for primary healthcare.(2-4) Plant components derived from these plants are employed in the pharmaceutical, cosmetic, and medicine industries. (5) Many plants from the Tamarix genus are widely utilized inusing traditional medicine to address a range of illnesses. Higher plants can inhibit the growth and development of specific microorganisms due to existence of biologically active.chemicals likephenolic compounds, flavonoids, and essential oils. (6) Tamarix species like Tamaricaceae There are over 60 species in this genus, many Among

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these are plants that bloom More than 250 various species, including domestic cattle, are fed Tamarix People in Asian and African nations have long utilized Tamarix spp. to cure diabetes, dental issues, and gastrointestinal illnesses. (7) According to WHO (1991), 80% of people in underdeveloped nations are thought to rely on traditional plant-based remedies for their medical needs. Because medicinal plants have the fewest adverse effects, are inexpensive, and have long-lasting restorative properties, many modern medications are even made from their raw components. A wide variety of plant extracts have strong antibacterial properties. (8) T. dioica foliage isused in a carminative manner, a diuretic, and to treat hepatic and splenic irritation; the herb also serves as an astringent. (9,10)

Pharmacognosy

Scientific Classification (11)

Kingdom: The Plantae

Clade: Microorganisms

The Angiosperm Clade

Group: Eudicots

Classification: Caryophyllales

The Tamaricaceae family.

Type: Tamarix

Species: T. dioica

Binomial name: Tamarix dioica Roxb. Ex Roth

Alternatives: Tamarix gallica Wight.

Vernacular name: (12)

Marathi: Jhau, Lal-Jhau

Hindi: Lal jhao, Farash, Lal-jhar

Telugu: Palivela, Ettashirisaru, Ettaverusaru, Farash, Sarru, Lal-jhau

Assamese: Jhau-bon

Sanskrit: Jhavuka, Machika

Nepali: Jhauwa

Tamil: Sivappattushavukku

Urdu: Farash, Gazesurkh

Fig 01: Tamarix Dioica

Description:

Microscopic:

Roots: The root system of Tamarix dioica is deep.

Stems: The stems are globous (smooth), reddish-brown, and heavily branching. The plant has two different kinds of branches: lignified, old-growing branches that are not deciduous and young, green, vegetative branches that are deciduous in the winter.

Leaves: Along the stem, the tiny, scale-like, greyish-green leaves overlay one another.

Flowers: Flowers from male and female plants grow on different plants. Racemes of pink or purple flowers, up to 8 cm long, make up the inflorescences.

Growth Habit: It is a tiny tree or shrub that can reach a maximum height of six meters.

Fruits: Capsule-shaped fruit of Tamarix dioica is specifically defined as trivalved and conic-pyramidal. Fruit Size: 3.5–5 mm is the length of the capsules.

Seed: The sessile coma (tuft of hairs) is 2.75-3 mm long, while the seeds themselves are tiny, about 0.5 mm long.

Distribution: Tamarix dioica is found in saline habitats in western Asia, including India, Pakistan, and Myanmar.

Habit: Twiggy shrub or small tree

Flowering: The flowering and fruiting period is primarily between August and December

Medicinal Part: Bark, galls, twigs, leaves, fruit, flower

Cultivation: Although it can be found in temperate climates, Tamarix dioica grows best in hot, dry regions. These plants are distinguished by their capacity to thrive in alkaline conditions and saline soils, withstanding soluble salt concentrations of up to 15,000 parts per million.

Material and techniques

1.Identifying and harvesting plant material

Fresh and devoid of illness T. dioica leaves are obtained in the Dera Ismail Khan area of KPK Province, Pakistan. A taxonomist from a Department of Pharmacognosy, Faculty of Pharmacy, Gomal University, Dera Ismail Khan, KPK, Pakistan, certified of plant material's taxonomy. T. dioica's voucher herbarium specimen was classified as FP 035. (13)

2.Processing of plant material

After being thoroughly cleaned three times with clean water, T. dioica stems, leaves, blooms, and roots were kept dry in the dark, powdered finely ground, and then kept in a sealed box Containers until analysis.

3. Preparation of Different Extracts with Various Solvents

Each portion of T. dioica, such as the stem, flowers, and leaves, weighing 10 g, was macerated independently for 72 hours using four distinct solvents: methanol, diethyl ether, acetone, and ethyl acetates. Filtration procedures were performed use grade 1 filter paper, and a all filtrates wer a examined for types of microbes (S. aureus and E. coli) and phytochemicals. (14) A creation of water-based extracts Using double-distilled water, 50 g of crushed T. dioica part Leaves, root systems, blooms, and stems are removed one at a time for 72 hours. Making use of Grade 1 filter paper, the extraction was filtered. Phytochemical experiments were performed on the filtrate.

Phytochemistry:

Chemical constituents:

Tamarix dioica's pharmacological action was the focus of the trials, which were intended to scientifically substantiate its traditional uses. HPLC-DAD was used for phytochemical studies, along with a preliminary measurement of the total

flavonoid and phenol content. Tamarix dioica's metabolic extract contained terpenoids, flavonoids, phenols, saponins, and tannins, according to phytochemical analyses. HPLC-DAD analysis of plant extract made in methanol solvent was used to look into the presence of medicinally useful plant components. Flavanone (myricetin), flavones aglycones (aliening and catechins), flavonoid glycosides (rutin and kaempferol), and a phenolic polyhydroxy component (gallic acid) was used to assess Tamarix dioica crude extract. Flavonoids and phenols were identified linked in the past to a number of both oxidation and pharmaceutical processes in biological systems. First Phytochemical Examination According to the preliminary qualitative investigation, TdCr included tannins, phenols, flavonoids, and saponins. (15) Water is a common solvent that is used to extract plant materials. But the main ingredient used by traditional healers is water extract. Eleven The findings from the phytochemical screening of T. dioica's stems, flowers, leaves, and roots indicate that all plant parts include steroids and phobic tannins, while the stems, flowers, and leaves contain terpenoids and saponins, as well as tannins, phenols, and flavonoids. But none of the plant's proteins, alkaloids, glycosides, or amino acids were found. (16) Total Flavonoid Content 36.16 ± 2.36 µg QE/mg extract was the (TFC) in TdCr, according to assay. Total Phenolic Content: 144 ± 0.003 µg GAE/mg extract was found through the assessment of the total phenolic contents in TdCr. (17) Phenolic and flavonoid content: TPC andTFC According to the findings, the portion consisting of ethyl acetate had the greatest TPC and TFC values, followed by chloroform. The fraction containing ethyl acetate had considerably higher TPC and TFC values ($p < 0.05$) compared to the other fractions, based on an ANOVA with a one-way design. The chloroform fraction produced the next-highest TPC and TFC yields, whereas N-hexane gave the lowest yields. (18)

Pharmacological Aspect:

Antibacterial Activity:

T. dioica warrants particular attention owing to its notable biological properties. To evaluate the antibacterial potential of the crude extract and fractionated samples of T. dioica leaves (as detailed in Section 2), agar well diffusion assays were conducted against two Gram-positive and five Gram-negative bacterial strains. (19,20) Chloroform, ethyl acetate, and carbon tetrachloride extracts exhibited minimal antibacterial activity against the standard bacterial strains. However, these extracts demonstrated moderate inhibitory effects against Klebsiella pneumoniae and Pseudomonas aeruginosa, with relative antibacterial activities of 41% and 44.82%, respectively, when compared to the reference antibiotic imipenem. Antibacterial activity was considered significant when the zone of inhibition measured 18 mm or greater. (21)

Antifungal Activity:

According to the findings, which provide a summary of the extracts' antifungal investigations, the crude extract, methanol, and water fractions all shown notable activity against one or more of the tested fungi to varying degrees. Trichophyton rubrum and Candida glabrata were significantly inhibited by the crude extract, while Aspergillus fumigatus was not. Aspergillus fumigatus was not as active against the chloroform fraction as Candida glabrata and Trichophyton rubrum. When it came to Aspergillus fumigatus and Candida glabrata, the methanol fraction exhibited both significant and moderate activity. notable

antifungal efficacy against Trichophyton rubrum, Candida glabrata, along with fumigatus was demonstrated by the water fraction. The crude extract demonstrated 82.75% antifungal activity against Aspergillus fumigatus and 75.86% antifungal activity against Trichophyton rubrum when compared to the common medication amphotericin B. However, the antifungal activity of the water, ethanol, and chloroform fractions against the three fungi mentioned above was 79%, 72%, and 76%, respectively. Two flavones were extracted from Parmar et al.'s study of T. dioica's aerial components. during their study of the phytochemistry of the plant: 5,2',4'-trihydroxy-6,7,8-trimethoxy flavone (Tama done) and 5,7,2'-trihydroxy-6,4'-dimethoxyflavone (tameridone). Evidence 1, gardening 1, 2, 3, and 4, apigenin, and hexanoyl-p-coumarate were all found. Additionally, they reported that gardening 2 exhibited antiviral properties (22)

Cytotoxic activity:

Using dosages of 0.01, 0.1, and 1.00 mg/mL, the deadly nature of brine- shrimp test assessed A cytotoxicity action of different extracts in vitro. No cytotoxicity was seen in any of the extracts. Our current results are consistent with other studies that reported no harmful effects on brine shrimp larvae when Extracts from T. dioica leaves and separated samples were used. Extracts with antibacterial and antifungal properties were further investigated by determining their MIC, MBC, and minimal fungicidal concentration is using a serial 2-fold dilution approach, as specified in NCCLS document M27-A. The crude extract's MICs and MBCs against Pseudomonas aeruginosa and Klebsiella pneumonia in the bacterial examination were 2.5 and 10 mg/mL, respectively, and 1.25 and 5.00 mg/mL. The water-based fraction, methanol, chloroform, and crude extract had MICs and lowest fungicidal concentrations against Candida glabrata of 5.00, 1.25, 5.00, and 0.625 mg/mL and 2.5, 0.625, 2.5, and 0.312 mg/mL, respectively, in the fungal investigation. The considerable fungicidal efficacy of the Four extracts that combat Aspergillus fumigates and Trichophyton rubrum. They were 0.312, 5.00, 0.625, and 0.625 mg/mL and 0.625, 10.00, 1.25, and 1.25 mg/mL, respectively, in terms of their minimal inhibitory limits (MIC). These two studies used Both amphotericin B and imipenem, which are common antimicrobial and anti-fungal medications. (23)

Antipyretic Activity:

The antipyretic effect of various dosages of liquid concentrates of Tamarix dioica and Fagone Bruguier was evaluated in the comparison of positive control sample group that received treatment with a traditional antipyretic in the form of paracetamol and the negative control sample group that received no treatment. Both species' hydro-alcoholic concentrates reduced the feverish rabbits' rectal temperatures to a way that is depending on dosage between 100 and 500 mg/kg body weight. It took two hours for the plant extracts to significantly lower the temperature in comparison to the negative control, regardless of dosage, and the antipyretic effect persisted for at least three hours after that. All three doses (100, 250, and 500 mg/kg) had a strong impact on lowering a animals' rectal temperatures. Most notably, the temperature drop at the conclusion of the fifth hour was more successful than the one brought on by the positive control, 150 mg/kg of paracetamol. The antipyretic effect was, however, very dose-dependent. Compared to animals in both the positive and negative control groups, the 500 mg/kg dose resulted in a larger and longer-lasting decrease in rectal temperature. (24) Tamarix dioica crude methanolic extract's antipyretic

properties were evaluated using Brewer's yeast to induce pyrexia. Data analysis demonstrated considerable ($p<0.05$) antipyretic efficacy at various dosages of the crude extract. During the first hour of therapy, the percentage of antipyretic effect generated At the corresponding values were 0.88, 0.37, and 1.14% for 100, 200, and 300 mg/kg. During the second hour, The temperature of the body decreased to 0.29,1.20, and 1.64% at 100, 200, and 300 mg/kg, accordingly. At the second hour, all test dosages demonstrated statistically significant antipyretic activity ($p<0.05$). At the dose of 300 mg/kg, effects were highly significant ($p<0.01$). All test doses showed a percentage inhibition of 1.87 and 2.44% at the third hour at 200 and 300 milligrams per kilogram. The antipyretic activity at 4 hours was also 1.43, 2.07, and 2.41% for dosages of 100, 200, and 300 mg/kg, respectively. Temperature reductions for test doses at the fifth hour were 1.42, 2.07, and 2.43%, respectively. (25)

Antioxidant Activity:

DPPH radical scavenging outcomes. The T. dioica extract fractions' DPPH radical scavenging IC50 values showed that when it came to scavenging, the ethyl acetate fraction worked best. the free radical, with an IC50 of 87.23 ± 0.70 µg/mL. $P < 0.05$ indicates that this result was considerably higher than all other fractions. Although DPPH scavenging was significant, it was not as high as that of BHT, a pure standard antioxidant. Although it was much less efficient than the ethyl acetate fraction, the chloroform fraction also demonstrated respectable antioxidant activity. Using an IC50 of 114.55 ± 0.81 µg/mL, a n-hexane fraction showed the lowest DPPH activity. (26)

Acute toxicity activity

The chosen plant's crude methanolic extract was found to be safe at all tested intraperitoneal dosages of 500, 1000, and 2000 mg/kg. All of the evaluated animals were confirmed to be normal over the 24-hour evaluation period. Moving, eating, breathing, and other actions didn't substantially change between them saline and test teams. (27)

Anti-inflammatory activity

According to data analysis, at both the 3- and 5-hour stages, the plant being evaluated showed activity utilizing the Paw Edema Caused by Carrageenan Model The findings showed that time and dose both affected the inhibitory activity. At 200 mg/kg, the anti-inflammatory action reached its peak. This dose decreased inflammation by 34.98% at 3 hours and 53.13% at 5 hours. The anti-inflammatory efficacy is 100 mg/kg was 18.34% after three hours and 33.89% after five. Similarly, at 50 mg per kilogram, the inhibiting efficacy was 6.46% at 4 hours and 28.12% at 6 hours. Tamarix dioica doses considerably ($p<0.05$) decreased ear edema caused by xylene. The anti-inflammatory effect was affected by dosage and time. With 200 mg, the greatest anti-inflammatory effects were noted at 15 and 60 minutes. According to the findings, the previously specified dose had an inhibitory effect of 56.99% at 15 minutes and 60.98% at 60 minutes. Likewise, At 15 and 60 minutes, the hindering impact of 100 mg/kg were noteworthy ($p<0.05$), with measurements of 53.65% and 45.29%. The investigated plant exhibited strong inhibitory efficacy even at a modest 50 mg/kg dosage, with At 15 and 60 minutes, the percentages were 32.29 and 45.92, accordingly. (28)

Analgesic activity

The stem bark extract from Tamarix dioica demonstrated a significant ($p<0.05$) analgesic impact whatever examined dose (100, 200, and 400 mg/kg) when tested using the process of writhing caused by acetic acid Examination of the information showed Considering the dose affected the percentage of writhing-inhibiting outcomes. 400 mg/kg produced the greatest analgesic efficacy (64.33%). A dose of 200 mg/kg substantially decreased writhing by 56.60% ($p < 0.05$). A dose of 100 mg/kg blocked 19.18% among the writing. Using the hot plate method, the 200 mg/kg dose demonstrated significant analgesic effectiveness ($p<0.05$) after 120 minutes. 400 mg/kg had a substantial analgesic effect at 30 and 60 minutes ($p<0.05$), although it was significantly more significant at 90 and 120 minutes ($p<0.01$). Activity levels at 200 and 400 mg/kg were 13.32 and 39.50% at 30 minutes, respectively. After 60 minutes, the analgesia reduction percentages regarding the identical doses were 38.09 and 39.02%, respectively. The nociceptive signals answer to 200 and 400 mg/kg at 90 minutes were 52.64% and 36.52 percent, respectively. 400 mg/kg reduced activity by 48.05% after two hours. (29)

In Vitro Phytotoxic Efficacy:

The phytotoxic effects of Tamarix dioica were tested on seeds of Vigna radiata, Echinochloa crus-galli, Zea mays, and Balanites ramosa. The study used methanol extracts at levels of 1000, 600, and 200 µg/ml. A strongest inhibition occurred at 1000 µg/ml across all species.T. dioica extract significantly suppressed plant growth compared to the control.By the fifth day, both fresh and dry weights showed a marked reduction ($P<0.05$).Shoot growth inhibition was highest in B. ramosa (50.97%) and lowest in V. radiata (37.52%).Root growth inhibition was highest in E. crus-galli (54.99%) and lowest in V. radiata (43.54%).Fresh weights decreased from 2.2 g to 1.86 g; dry weights from 0.70 g to 0.60 g.This suggests the presence of bioactive allelochemicals such as essential oils and phenol A. mays showed significant decline in fresh and dry weight, confirming extract potency. A sandwich method was also used to support phytotoxicity through lettuce seed tests.Findings matched those reported by Fujii and Aziz (2005).E. crus-galli was notably affected at all concentrations of T. dioica extract. Overall, the extract affected all four plant species significantly. dioica showed 43.34% inhibition in B. ramose, and 34.93% in V. radiata.At the shoot level, highest resistance was in E. crus-galli (50.97%), lowest in V. radiata (43.52%).At the root level, E. crus-galli again showed highest inhibition (54.49%), Z. mays the lowest (24.54%).The study aligns with earlier findings by Jamil (2008).T. dioica contains effective phytotoxins suitable for weed control.It is recommended as a natural herbicidal agent for sustainable agriculture .(30)

CONCLUSION

Tamarix dioica Roxb, which has been used in the treatment of different diseases and found to have antimicrobial, antioxidant, anti-inflammatory, analgesic, antibacterial, antipyretic, acute toxicity, and cytotoxic activities, was determined based on a study of the current studies. Traditional medicines have recently gained increased attention and evaluation for their efficacy, and they are generally safe for human beings. Many phytochemical and pharmacological research have been undertaken on various sections of Tamarix dioica. Further research into the therapeutic effects of particular phytochemicals and their mechanisms of action is encouraged.

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