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THESPESIA POPULNEA LINN.: A REVIEW

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ABSTRACT: *Thepesia populnea* Linn. (Family- Malvaceae) is one of the important drugs used in Herbal medicines. It is known by the name Paras-pipal. It is often cultivated for ornament and shade, and it blooms throughout the year in the tropics. Various parts of this plant are found to possess useful medicinal properties, such as antifertility, antibacterial, anti-inflammatory, antioxidant, purgative, and hepatoprotective activities. The yellow juice of fruits is employed in treating certain hepatic diseases. A decoction of the bark is given internally in the diseases of the skin and that of the fruits as an antidote for poisoning. The seed possesses purgative properties. The plant is useful in malaria. A wide range of biologically active compounds such as flavonoids, sesquiterpenoids, tannin, saponins, alkanes, essential oil, sugars, fatty acids, and antioxidants are present in the plant. This contribution provides a comprehensive review of its ethnomedicinal uses, chemical constituents and pharmacological profile as a medicinal plant.

INTRODUCTION: *Thepesia populnea* Linn. (Family- Malvaceae) is an is a small evergreen tree averaging 6–10 m (20–33 ft) in height, with a short, often crooked stem and a broad, dense crown. It has glossy green, heart-shaped leaves and yellow hibiscus-type flowers. The tree grows well along warm coastal areas from the east coast of Africa and South and Southeast Asia to Melanesia, Micronesia, and Polynesia. It is currently naturalized in tropical climates throughout the world from the Caribbean to Africa. The tree is valuable as a coastal windbreak because it is highly resistant to wind and salt spray and grows well in sandy, saline soils [1]. It propagates easily and grows rapidly. It naturalizes easily and has become a weed in some areas, so it should not be planted in areas where it is not already present.

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The tree grows best under full sunlight and tolerates drought conditions. The heartwood is resistant to dry wood termites. Milo has many uses including coastal protection, animal fodder, windbreaks, and living fences. The most common use in the Pacific today is probably as an ornamental tree, despite its valuable timber [2].

It has a short, straight or crooked trunk and a dense crown with thick lower horizontal branches. The bark is grey and smooth to highly fissured and dark brown in larger trees. Flowers are a typical hibiscus shape in appearance: bell-shaped, 4–7 cm (1.5–2.5 in) in length, with five over-lapping, broad, rounded petals. Colour is pale yellow with a maroon spot at the base of each petal and with star-shaped hairs on the outer surface. Flowers open and close on the same day, and the yellow flowers turn dark red, purple, or pink as the day progresses. The alternate leaves are glossy green above and paler green below. Leaf blades are heart-shaped, Leaf stalks are long. Fruits are brittle, dry, woody or papery seed capsules, rounded and flattened, containing five cells and several seeds.

The brown, hairy seeds are about 1 cm long and 0.6 cm broad. Seeds are blown short distances by wind but are more likely to be dispersed by water. Both the lightweight fruits and seeds can float from one island to another on ocean currents [3].

Various parts of this plant are found to possess useful medicinal properties, such as anti-fertility, antibacterial, anti-inflammatory, antioxidant, purgative, and hepatoprotective activities. The bark, leaves, flowers, and fruits are reported to be useful in cutaneous affections, such as scabies, psoriasis, ringworm, guinea worm, and eczema. The yellow juice of fruits is employed in treating certain hepatic diseases. A decoction of the bark is given internally in the diseases of the skin and that of the fruits as an antidote for poisoning. Various parts of the plants have high tannin contents, and plant extracts have been shown to have anti-bacterial and anti-viral activity. The compound oil of bark and capsule is useful in arthritis and gonorrhea. The seed possesses purgative properties. The plant is effective in malaria [4].

Phytochemical Constituents: Air-dried flowers of *T. populnea* contain kaempferol, β-sitosterol, gossypetin, quercetin, and a mixture of kaempferol 3-glucoside, quercetin 3-glucoside, kaempferol 5-glucoside separated, rutin, kaempferol 3-rutinoside, and kaempferol 7-glucoside [5]. Dextro-Rotatory gossypol has recently been isolated from flowers, fruits, and bark. The gossypol content in different parts of the tree is a seed (3.14%), flower buds (3.37%), leaves (1.66%), roots (2.11%), stem (1.43%). Presence of herbecetin and thespesin has been reported from fruits [6].

Heartwood is reported to contain sesquiterpenoids, named populene A-H (1-8) [7]. It also contains 6 sesquiterpenoid quinones of the mansonone group containing the cadalene skeleton. Four were identified as mansonones C, D, E, and F. The other 2 are new natural products belonging to this group and are named thespesone I and thespone II. Based on spectral studies and chemical properties, their structures are assigned as 1,2,6,9-tetrahydro-7-hydroxy-1,5,8-trimethylnaphtho[2, 1-b]furan-6, 9-dione and 6,7-dihydro-1,5,8-trimethylnaphtho[2, 1-b]furan-6,7-dione, resp. Mansonone-D has been converted into both thespesone and thespone under oxidation conditions [7].

A new mansonone, 7 hydroxy-2,3,5,6-tetrahydro-3,6,9 trimethylnaphtho [1,8-b,c]pyran-4,8-dione, in addition to mansonones D, E and F were isolated from the heartwood of *Thespesia populnea* [8].

A new sesquiterpene quinones Thespesenone and Dehydrooxoperezinone-6-methyl Ether were isolated from *Thespesia populnea* [9]. Stem bark contains alkaloids, carbohydrates, protein, tannins, phenols, flavonoids, gums and mucilage, saponins and terpenes [10] of *Thespesia populnea* are reported to containβ-sitosterol-3-O- β-D-glucopyranoside-6'-O-stearate, β-sitosterol, daucosterol, kaempferol, 1-hentriacontanol, stearic acid, betulin [11]. Leaves of *T. populnea* contain lupeol, β-sitosterol as the major constituents it also contain the presence of lupenone, alkanes [12].

Pharmacological Activities:

Anti-Inflammatory, Analgesic and Antipyretic: Oral administration of seed extract significantly reduced carrageenan-induced paw edema and brewer's yeast-induced pyrexia. In tail immersion method also showed significant analgesic activity. GC–MS analyses showed the presence of fourteen fatty acids, predominant fatty acids were palmitic and stearic acid [13].

The ethanolic extract of *Thespesia populnea* bark (TPE) was investigated for anti-inflammatory and analgesic activity for evaluation of inflammation carrageenan-, histamine- and serotonin-induced paw edema served as acute models, and formaldehyde-induced arthritis served as a chronic model in rats. The acetic acid-induced writhing response and formalin-induced paw licking time in the early and late phases of mice were used to assess analgesic activity. Furthermore, phytochemical studies indicated that the ethanolic extract of bark contains alkaloids, carbohydrates, protein, tannins, phenols, flavonoids, gums and mucilage, saponins and terpenes [14].

Anti-Diarrheal: From the aqueous extract fractions namely methanolic fraction (MF) and residue fraction (RF) were made and studied for anti-diarrheal activity in castor oil induced diarrhea model, the RF and MF have significantly reduced the cumulative wet fecal mass, whereas the, RF was found to be more potent than MF. RF had shown significant inhibition of PG-E_2 induced

secretions (anti-secretory) and decreased the movement of charcoal in the charcoal meal test indicating its anti-motility activity. Furthermore, RF has shown significant inhibition of acetyl-choline, histamine, and $BaCl_2$ induced contractions on rat colon, guinea pig ileum and rabbit jejunum with EC_{50} values of 241.7, 303.1 and 286.1 µg/mL, respectively indicating the anti-motility effect of RF. The phytochemical analysis of RF showed the presence of gums and mucilage and the possible mechanism might be the combined inhibition of elevated prostaglandin biosynthesis and reduced propulsive movement of the intestine [15].

Hepatoprotective: Leaf, flower and stem bark of *T. populnea* showed varying levels of protective action against CCl_4-induced liver damage as evidenced from a significant reduction in the activities of serum marker enzymes for liver damage (alanine transaminase, aspartate transaminase, and alkaline phosphatase), and bilirubin levels when compared with CCl_4-intoxicated control rats. The stem bark suspension showed maximum hepatoprotection compared with leaf and flower. An ethanol extract of the stem bark was more active than n-hexane, and water extracts, the hepatoprotective effect of this extract was almost comparable to that of silymarin (100 mg/kg), a reference herbal drug. Thus, the present study indicates that ethanol extract of *T. populnea* stem bark is promising for further studies leading to hepatoprotective drug development [16].

Thespesia populnea (Malvaceae) bark was extracted with methanol and water. The extracts were vacuum dried to yield the resp. Methanol (MET) and aq. ext. (AET). The extracts were evaluated for hepatoprotective activity against carbon tetrachloride (CCl4) induced liver damage at 2 dose levels (250 and 500 mg/kg). The biochemical parameters observed in serum were total bilirubin, an alkaloid. phosphatase (ALP), serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT) levels and total protein. Aspartate transaminase (AST), alanine transaminase (ALT) and total protein levels in the liver were also evaluated. Histopathology study on the liver tissue was also performed. The extracts exhibited a dose-dependent reduction in total bilirubin, ALP, SGOT, SGPT, AST, ALT and increase in total protein (serum and liver) levels. The extracts also exhibited only mild hepatocytic damage compared to the the CCl_4 treated group. MET was found to exhibit higher hepatoprotection than AET [17].

Memory Enhancing Activity: Vasudevan *et al*., [11] reported the effects of *T. populnea* bark on cognitive functions, total cholesterol levels and cholinesterase activity in mice. The learning and memory parameters were assessed using elevated plus maze and passive avoidance apparatus. Furthermore, TPE reduced significantly the central (brain) cholinesterase activity in mice. TPE exhibited remarkable cholesterol lowering property comparable to simvastatin (a standard drug) in the present study. Furthermore, we observed that *T. populnea* bark possessed a powerful memory enhancing activit**y** in mice. Since diminished cholinergic transmission and increased cholesterol levels appear to be responsible for the development of amyloid plaques and dementia in Alzheimer patients. Therefore, *T. populnea* bark appears to be a promising candidate for improving memory and it would be worthwhile to explore the potential of this plant in the management of Alzheimer patients [18].

The Hypoglycemic and Antihyperglycemic Effects: The hypoglycemic and antihyperglycemic effects of an alcoholic extract of the fruit of *Thespesia populnea* was investigated in both normal and alloxan-induced diabetes in rabbits. The present study indicated a significant anti-diabetic activity of the fruit of *T. populnea* and supports the traditional usage of fruits by the Ayurvedic physicians for the control of diabetes [19].

Anti-Implantation Activity: *Thespesia populnea* was tested for possible anti-implantation activity in Sprague-Dawley female rats of normal estrus cycle after overnight cohabitation with males of proven fertility. The day when spermatozoa were detected in vaginal smear was treated as the 1st day of pregnancy. The compounds were administered to female rats from the 1st day to the 7th day of pregnancy. On the 10^{th} day, the rats were laparotomized under light anesthesia, and the numbers of implantation sites and corpora lutea were noted. The result showed significant anti-implantation activity, and they were found to be a mixture of two groups of long-chain fatty acids from GLC [20].

Antioxidant: Antioxidant activity of the aqueous (AET) and methanolic extracts (MET) of the *Thespesia populnea* bark was investigated in rats by inducing liver injury with carbon tetrachloride: olive oil (1:1). The extracts exhibited significant antioxidant activity showing increased levels of glutathione peroxidase (GPX), glutathione S-transferase (GST), glutathione reductase (GRD), superoxide dismutase (SOD) and catalase (CAT) and decreased the level of lipid peroxidation (LPO) [21].

Antioxidant potential of the plant is evaluated against superoxide anion, hydroxyl radical and reducing power. The title plant exhibited concentration-dependent antioxidant activity. Phytochemical studies indicated the presence of flavonoids and phenols in the tested extracts, which might have contributed to antioxidant activity. Further studies are in progress to isolate the antioxidant moiety of the tested extracts [22].

Wound Healing Activity: The aqueous extract of *T. populnea* fruit showed significant wound healing activity in the excision wound, and incision wound models in rats following topical and oral administration, respectively [23].

Immunomodulatory: Methanolic ext. of leaves of *Thespesia populnea* (Family: Malvaceae). The methanolic extract of *T. populnea* (METP) The measurement of the immunomodulatory property was carried out by Delayed Type Hypersensitivity (DTH), Humoral antibody (HA) titer response to SRBC and Cyclophosphamide induced myelosuppression. Phytochemical screening suggests the presence of flavonoids, triterpenoids, proteins, amino acids, phenolic and steroidal compounds the immunomodulatory activity of plant may be attributed to these phytoconstituents [24].

CONCLUSION: The extensive literature survey revealed that *Thespesia populnea* is essential medicinal plant with diverse pharmacological spectrum. The plant shows the presence of many chemical constituents which are responsible for the different pharmacological and therapeutic property. The evaluation needs to be carried out on *Thespesia populnea* in order to uses and formulation of the plant in their practical clinical applications, which can be used for the welfare of humanity.

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CONFLICT OF INTEREST: Nil

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