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Review Article

REVIEW ON PHARMACOLOGICAL STUDIES OF *THESPESIA POPULNEA LINN.*

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ABSTRACT

Now a day's focus on plant research has been increased throughout the world and data have collected to show the immense potential of plants used in various traditional systems. The objective of present review is to provide advance information includes traditional uses, photochemistry and pharmacology of *T. populnea* for the drug discovery research, which contains wide range of active chemical constituents in it. The Plant shows various pharmacological activities like Dermatitis, Anti-hepatoprotective activity, Antisteroidogenic activity, Cytotoxicity and superoxide anion generation by some Naturally occurring quinines, Wound healing activity, Antioxidant activity, anti-implantation activity, Alzheimer's disease, Antinociceptive and anti-inflammatory, Anti-inflammatory, analgesic and antipyretic properties, Antioxidant, Anti-diabetic activity, Anti-Psoriatic, Synergistic activity, Antibacterial Activity, antiulcer activity, Immunomodulatory Activity, α-Amylase Inhibitory.

Keywords: *T. Populnea*, Chemical constituents, Pharmacological study.

INTRODUCTION

T. populnea (L.) Linn. (Fam. Malvaceae), a fast growing, medium-sized evergreen tree, up to 10 m tall with yellow, cup-shaped flowers having maroon centre and distributed throughout coastal forests of India and also largely grown as a roadside tree[1]**.** It has heart-shaped leaves glossy green in colour and yellow hibiscus-type flowers. *T. populnea* is small evergreen tree with average height 6–10 m (20–33 ft), a short, often crooked stem and a broad, dense crown. It is currently place naturalized in tropical climates throughout the world. The tree well grows under full sunlight and tolerates drought conditions. The tree is valuable as coastal windbreak because it is it highly resistant to wind. It propagates easily and grows rapidly. In the present study the plant profile and its ethno pharmacology were focused.

PLANT PROFILE

1. Plant Information

Botanical name: *T. populnea* Linn.

Family: Malvaceae

Author: Linn.

Year: 2006

2. Taxonomy

Kingdom: Planate

Division: Magnoliophyla

Class: Magnoliopsida

Order: Malvale

Family: Malvaceae

Genus: *Thespesia*

Species: *T. populnea* Linn.

3. Vernacular names:

Sanskrit: Parisah, Kapitana, Phalisah, Gardabhandah.

Marathi: Parasa pimpala.

Bengali: Gajashundi, Paraasapipula.

English: Portia tree, Umbrella tree.

Gujarati: Paraspipalo.

Hindi: Paraspipal.

Kannada: Huvarasi.

4. Common names: Seaside mahoe, Portia tree.

5. Distribution: Coastal forests if India and also largely grown as road side tree.

6. Parts used: Root, Fruits, leaves, Bark, Flowers, seeds.

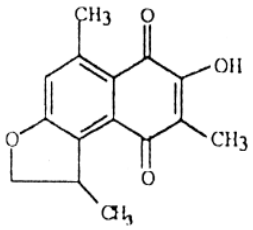
7. Traditional claims

- Bark and fruits posses more curative properties. The plant is astringent, cooling, depurative, anti-inflammatory, haemostatic, anti-diarrhoeal and anti-bacterial. It is useful in dematopathy such as scabies, psoriasis, ringworm, leprosy, arthritis, haemorrhages wounds, ulcer, cholera, diabetes, as cites, dispsia, cough, asthma, catarrh**[2]**.
- The Ayurvedic Pharmacopoeia of India recommends the ***Prameha****, Raktapitta, Raktavikra, Yoniroga,daha, Trsa, Vrana, Sotha, Balavisarpa, Pama, Khandu, Dadru, Medoroga* **[1]**
- It is useful in dysentery, piles, diabetes, haemorrhoids. It cures ulcers, itching; scabies and other skin diseases and urinary disorders bark is astringent given internally as an alternative. In the form of hot poultice leaves are beneficial in painful joints. Fruits leaves are applied externally to scabies, psoriasis and other skin diseases. Parts use mainly were Root, leaves, flowers, fruits, bark **[3]**.
- Kirtikar and Basu and Dymock, Warden, and Hooper report that leaves are applied to inflamed and swollen joints. Kirtikar and Basu say that in the Konkan, the flowers are employed in the cure of itches**[4]**.
- The bark, fruits, leaves; flowers are reported to be useful in coetaneous infection such as scabies, psoriasis, and ringworm. The juice of fruits employed in treating certain diseases herpetic diseases. The fruits contain a principal which is active against gram-positive and Gram-negative bacteria and is for curing the intestinal diseases. Seed yields a deep red, thick fatty oil which is also use in coetaneous diseases. A compound oil of bark and capsule is useful in urithrites and gonorrhoea. The astringent bark, root and fruits are stated to be used in dysentery, cholera, haemorrhoids; the mashed bark is employed as a politice or hot fomentation for wounds **[5].**

8. Chemical constituents

The various chemical constituents were isolated from the *T. populnea are* Gossypol [6], 7 Hydroxy-2,3,5,6-tetrahydro-3,6,9-

Trimethylnaphto [1,8-B,C] Pyran-4,8-Dione[7], Kaempferol, Quercetin [8], Kaempferol 3-glucoside, Quercetin 3-glucoside, rutin[9], Nonacosane, lupenone, myricyl alcohol, lupeol, β-sitosterol and β-sitosterol-β-D-glucoside[10], 5, 8-dihydroxy-7-methoxyflavone, 7-1ydroxyisoflavone and Thespone [11]·Mansonones D E and F Populneol, Thespesin[12].



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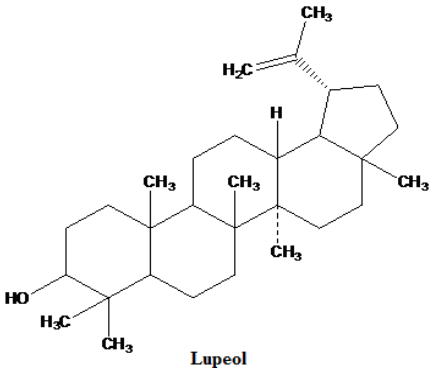

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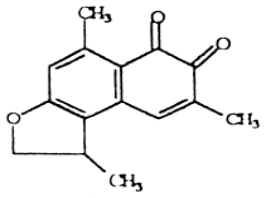

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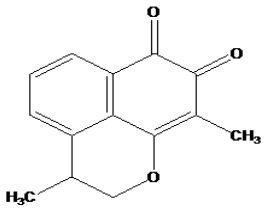

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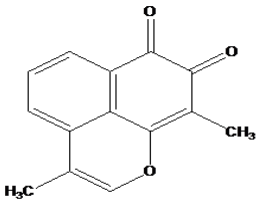
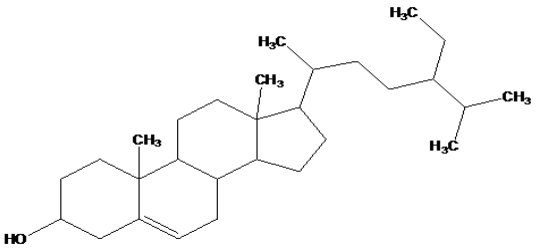
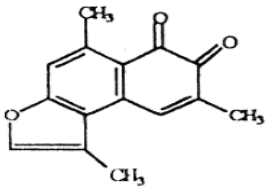


Mansonone F



β-Sitosterol



Thespone

9. Strength as per Ayurvedic pharmacopoeia of India

- Total Ash: Not more than 13 per cent,
- Acid-insoluble ash: Not more than 2 per cent,
- Foreign matter: Not more than 2 per cent,
- Alcohol-soluble extractive: Not less than 3 per cent,
- Water-soluble extractive: Not less than 2 per cent,

PHARMACOLOGICAL ACTIVITY

Literature reveals that *T. populnea* has been explored for its pharmacological activity.

1. Dermatitis

The allergenic property of *T. populnea* has not been known before. A patient suffered from allergic contact dermatitis. So, wood shavings were extracted, the constituents were isolated, purified, and identified and the activity was determined experimentally in guinea pigs. The main chemical component was identified as new mansion: 7-hydroxy-2, 3, 5, 6-tetrahydro-3, 6, 9-trimethylnaphtho [I, 8 BC] pyran-4, 8-dione. In sensitizing experiments, it showed to be moderate sensitizer[13].

2. Anti-hepatoprotective activity

The ethanol extract fraction of *T. populnea* administered orally to different groups of rats was evaluated using CCl_4 the model of liver injury showed significant activity[14].

3. Antisteroidogenic activity

The various extract of *T. populnea* was screened in albino mice it was observed that the weight of the uterus and ovaries were reduced significantly. The cholesterol and ascorbic acid content in ovaries were significantly elevated. The significant inhibition of 3-beta hydroxyl steroidal dehydrogenise and glucose 6 phosphate dehydrogenase[15].

4. Cytotoxicity and superoxide anion generation by some naturally occurring quinines

The quinines, mansonone-D, mansonone-H, thespone and thespesone isolated from the heartwood of *T. populnea* tested for their cytotoxic action by aerobic incubation with human breast adenocarcinoma cells. The red ox cycling of these quinines produce superoxide anion radical (O2 •2) and H2O2 on aerobic incubation with NADH: cytochrome c reductase. Generation of superoxide radical during enzymatic reduction of quinines was confirmed by EPR spin trapping experiment using 5, 5-dimethyl-1-pyrroline-*N*-oxide (DMPO) as a spin trap[16].

5. Wound healing activity

The aqueous extract of *T. populnea* fruit at a dose level of 200 mg/kg showed significant activity in the excision wound and incision wound models in rats following topical and oral administration, respectively[17].

6. Antioxidant activity

The aqueous and methanol extracts of the *T. populnea* bark at a dose level of 500 mg/kg showed significant antioxidant activity was investigated in rats. The extracts exhibited significant activity when induce liver injury with carbon tetrachloridev: olive oil (1:1) showing increased levels of glutathione peroxidise glutathione S-transferees, glutathione reductase, superoxide dismutase and catalyse. And decreased level of lipid peroxidation[18].

7. Anti-implantation activity

The successive extracts of petroleum-ether and ethyl acetate and subsequent crude alcoholic extract of seeds of *T. populnea* in female albino rats. The Graded doses of active principles and the crude alcoholic extract (in 1%gum acacia suspension) were tested for possible anti-implantation activity in rats of normal oestrus cycle after overnight cohabitation with males of proven fertility. The 1st day of pregnancy was a day when a spermatozoon was detected in vaginal smear. The compounds were administered from the 1st day to the 7th day of pregnancy to female rats and on 10th day, the rats were laparotomized under light anaesthesia and the numbers of implantation sites and corpora lutea were noted. The isolated principle from PE extract at the dose of 110 mg/kg, showed significant anti-implantation activity (60 %), while that from Each extract showed 48.6 % effect at the same dose. In contrast, the final alcoholic extract showed no such significant action[19].

8. Alzheimer's disease

The effects of *T. populnea* bark on cognitive functions, total cholesterol levels and cholinesterase activity in mice. A total of 312 mice divided into 52 different groups were employed in this investigation. The ethanolic extract of *T. populnea* was administered orally in three doses (100, 200 and 400 mg/kg) for 7 successive days to different groups of young and aged mice and the learning and memory parameters were assessed using elevated plus maze and passive avoidance apparatus. Plant extract (200 and 400 mg/kg, p.o.) showed significant improvement in memory of young and aged mice. Plant extract also reversed the amnesia induced by scopolamine (0.4 mg/kg, i.p.) and diazepam (1 mg/kg, i.p.). Furthermore, Plant extract reduced significantly the central (brain) cholinesterase activity in mice. Plant extract exhibited a 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 activity in mice. Since diminished cholinergic transmission and increased cholesterol levels appear to be responsible for development of amyloid plaques and dementia in Alzheimer patients, Plant extract may prove to be a useful medicine on account of its multifarious beneficial effects, such as memory improving property, cholesterol lowering, ant cholinesterase and anti-inflammatory activity[20].

9. Antinociceptive and anti-inflammatory

The ethanolic extract of *T. populnea* bark (TPE) at the doses (p.o.) of 100, 200 and 400 mg/kg body weight for evaluation of inflammation carrageenan-, histamine- and serotonin-induced paw enema served as acute models and formaldehyde-induced arthritis served as a chronic model in rats were studied. The analgesic activity was assessed using to acetic acid-induced writhing response and formalin-induced paw licking time in the early and late phases of mice. The higher doses of Plant extract (200 and 400 mg/kg, p.o.) were inhibiting carrageenan, histamine and serotonin-induced paw enema as well as formaldehyde-induced arthritis successfully. In addition, Plant extract (200 and 400 mg/kg, p.o.) significantly attenuated the writhing responses induced by an intraperitoneal injection of acetic acid and late phase of pain response induced by an sub plantar injection of formalin in mice. Furthermore, the ethanolic extract of bark contains alkaloids, carbohydrates, protein, tannins, phenols, flavonoids, gums and mucilage, spooning and terrenes. From acute oral toxicity studies (OECD-423 guidelines), no mortality was observed even at highest dose of Plant extract (2000 mg/kg, p.o.)[21].

10. Anti-inflammatory, analgesic and antipyretic properties

T. populnea seeds were successively extracted by using petroleum ether (40–60 ◦ C) and ethanol. Unsaponifiable matter and fatty acids were separated from seed oil. Ethanolic extract was fractionated using CHCl3, EtOAc, n-BuOH and H2O solvent. Acute arthritis was induced by sub-plantar injection of carrageenan into the left hind paw of rats and the paw volume was measured using plethysmometer. Analgesic activity assessed by heat induced pains (tail immersion model) and antipyretic activity assessed using brewer's yeast-induced pyrexia model. Oral administration of TPO and Plant extract at 200 and 400 mg/kg b.w. and tested fractions at 200 mg/kg significantly reduced carrageenan induced paw enema and brewer's yeast-induced pyrexia. In tail immersion method also extracts and fractions showed significant analgesic activity. Amongst all fractions EtOAc showed most significant results. Unsaponifiable matter showed significant anti-inflammatory and analgesic activity. GC–MS analyses showed the presence of fourteen fatty acids, predominant fatty acids were palm tic and static acid[22].

11. Antioxidant and Anti Inflammatory

The nitric oxide method reveals that the standard drug i. e. ascorbic acid shows good results when compared to ethanolic extract of *T. populnea*. Antioxidants help to neutralize free radicals, which are unstable molecules that are linked to the development of a number of degenerative diseases such as cancer, cardiovascular diseases, cognitive impairment immune dysfunction, cataract and muscular degeneration[23].

12. Anti-diabetic activity

The ethanolic extract of the plant *T. populnea* bark and leaf were evaluated for blood sugar, against the streptozotocin (STZ)–induced diabetic rats and compared it with standard drug glibenclamide. The result showed that both the extract posses' anti-diabetic effect against STZ induced diabetic rats and also showed the possible mechanism due to inhibition of generation of free radical[24].

13. Anti-Psoriatic

Three compounds TpF-1, TpF-2 & TpS-2 were isolated from the bark powder and an attempt was made to characterize them by physical, chemical and spectral data. The screening for anti-psoriatic activity was carried out by topical application of different extracts and isolated compounds. *The* successive pet-ether extract showed maximum anti-psoriatic activity (increased orthokeratotic region by 25%) amongst the extracts tested where as the compound TpF-2 exhibited 38% increase in the same. From the above data, it is can be said that, the plant *T. populnea* is promising for further investigations to prove its anti-psoriatic activity[25].

14. Antibacterial Activity

Flavonoids reported as having many pharmacological activities like antimicrobial, antioxidant, cytotoxic, chemoprevention activities and they possess strong anti-proliferative effects related to inhibition of cell cycle progression and apoptosis induction. The phytochemical studies indicated that methanolic extract of *T. populnea* flowers contains alkaloids, tannins, flavonoids, and anthroquinone glycosides. Moreover the individual components were identified by

thin layer chromatography and Rf value was compared with standard flavonoid quercetin. The total phenolic and flavonoid content studies were carried out. The bacteria used for antibacterial study were *Shigella flexneri (*NCIM 4924), *Rhodococcus terrae* (NCIM 5126), *Klebsiella pneumoniae* (ATCC 13883*), Escherichia coli (*ATCC 11775*), Brevibacterium luteum* (NCIM 2923*), Streptococcus faecalis (*NCIB 2406), *Proteus mirabilis* (NCIB 8268*), Bacillus licheniformis (*NCIM 2468*), Micrococcus luteus* (ATCC 2984*), Shigella sonei* (ATCC 29930), *Shigella boydii* (ATCC 8700), *Micrococcus flavum* (NCIM 2376*), Flavobacterium devorans* (NCIM 2581*), and Shigella dysentriae* (ATCC 13313). According to results in the lowest tested concentration the 92.8% active at the concentration of 1000µg/ml, 75.7% active in the concentration of 500µg/ml 5% active in the concentration of 250µg/ml, 7.2% of the plant extract were active in concentration of 62.5µg/ml and 125µg/ml and in a dose dependent manner[26].

15. Synergistic activity

The methanolic extract of *T. populnea* (Malvaceae) showed the minimum inhibitory concentration of in combination with oxytetracycline using 12 different Gram positive and Gram negative bacteria was found to be around (62.5 µg/mL to 1000 µg/mL). The synergistic activity was verified using Kirby and Bauer techniques. 83.3% shows synergistic activity against all 12 different bacteria both Gram positive and Gram negative species. The highest synergism rate was attained against *Shigella boydii* (ATCC8700)[27].

16. Antiulcer activity

The *T. populnea* (L.) used for the treatment of ulcer, in the folk medicine of different cultures. The present study was undertaken to determine the anti-ulcer potential of the terpenoid fraction from the leaves of *T. populnea*. The terpenoid fraction of leaves of *T. populnea* were tested orally at the doses of 50, 100 and 200 mg/kg, on gastric ulcerations experimentally induced by pylorus ligation, aspirin induced ulcer, aspirin induced ulcerogenesis in pylorus legated rats and analysed for ulcer index, gastric volume, pH, free and total acidity, sodium and potassium ion output. The bio-chemical estimations like total proteins, total hexodes, hexosamine, fucose, sialic acid were also made. Terpenoid fraction decrease ulcer index in dose dependent manner. The aggressive factors like gastric volume, free and total acidity decreases showing the anti-secretary mechanism. Increase in pH and K + ion output. The terpenoid fraction significantly decreased the protein level and increased the total carbohydrate (TC). Mucin activity (TC: P) significantly increased at the tested dose level 200mg/kg. Terpenoid fraction from *T. populnea* leaves showed significant antiulcer activity in experimentally induced ulcer in rat model by decreasing the gastric secretions and by enhancing glycoprotein levels[28].

17. Immunomodulatory Activity

The methanolic extract of *T. populnea* (METP) was given at doses of 100, 200, and 400 mg/kg b.w; p.o. Levamisole (50 mg/kg b.w, p.o) was used as a standard immunomodulatory drug whereas Cyclophosphamide (30 mg/kg b.w, p.o) was used as a standard immunosuppressant drug. The measurement of immunomodulatory property was carried out by Delayed Type Hypersensitivity (DTH), Humoral antibody (HA) titre response to SRBC, and Cyclophosphamide induced myelosuppression. Results of present study clearly indicate that Methanolic extract has shown potentiation of DTH response at 400 mg/kg b.w, p.o ($P<0.01$). The increasing doses of methanolic extract have shown the augmentation of antibody titre. Cyclophosphamide induced immunosuppression was counteracted by METP, i.e. WBC counts have reached to normal values at a dose of 200 mg/kg b.w, p.o ($P<0.001$). Phytochemical screening suggest the presence of flavonoids, triterpenoids, Proteins, Amino acids, phenolic and steroidal compounds. The immunomodulatory activity of plant may be attributed to these phytoconstituents[29].

18. *α*-Amylase Inhibitory

Postprandial hyperglycaemia is a prime characteristic of diabetes mellitus and has been a focus in the therapy for diabetes. One of the therapeutic approaches which involve decreasing hyperglycaemia aims at inhibiting the enzyme *α*-amylase. The leaves of *T. populnea* were studied for the presence of amylase inhibitors. The fractions obtained by successive fractionation using solvents of varying polarity was studied for the presence of primary and secondary metabolites. The total phenolic content of the different fractions was determined by HPLC and was correlated with their amylase inhibitory potential. Similarly, the protein content of the extracts was also estimated to understand the nature of the inhibitor present. This study shows that the leaves of *T. populnea* were effective in inhibiting *α*-amylase, thereby proving to be potential hyperglycaemic agents[30].

19. Memory-Enhancing Activity:

The Elevated plus-maze and Hebb-Williams maze served as the exteroceptive behavioural models for testing memory. Diazepam-, scopolamine-, and ageing-induced amnesia served as the interceptive behavioural models. The ethanol extract of *T. populnea* was administered orally in three doses (100, 200, and 400 mg=kg) for 7 successive days to different groups of young and aged rats. Plant extract (200 and 400 mg=kg, p.o.) resulted in significant improvement in memory of young and aged rats. Plant extract also reversed the amnesia induced by scopolamine (0.4 mg=kg, i.p.) and diazepam (1 mg=kg, i.p.). Cholesterol- lowering, anticholinesterase, anti-inflammatory, and antioxidant properties of *T. populnea* may favourably contribute to its memory-enhancement effect. 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[31].

20. Hypoglycaemic, anti-diabetic and anti-ulcer:

The extraction is done with alcohol and water then extracts were dried to get the powder. The extracts were screened for hypoglycaemic, anti-diabetic and antiulcer activities at the dose level of 500 mg/kg by standard method. The extracts exhibited significant response for anti-diabetic and antiulcer activities[32].

CONCLUSION

This review gives some phytochemicals as well as the detailed pharmacological information of *T. populnea*. The main focus on the pharmacological potentials of *T. populnea,* which is very helpful to researcher to add more about this valuable plant. Apart from this still there are few options to investigate the unexplored potential of plant based on its uses. The active constituent needs to be isolate and should be considered for further *in-vivo* or *in-vitro* studies to confirm the traditional claims and to explore the potential of development of drug.

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