



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Article

Comprehensive Review On Pharmacological Activities Of *Thespesia Populnea* Soland And *Pongamia Pinnata* Linn

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ARTICLE INFO

Received: 30 July 2024
Accepted: 03 Aug 2024
Published: 07 Aug 2024

Keywords:

Thespesia populnea,
Pongamia pinnata,
phytochemical constituents,
pharmacological activity.

DOI:

10.5281/zenodo.13255293

ABSTRACT

In the global context, herbs and herbal medicines are often associated with nutraceuticals and are extensively utilized for treating a wide range of ailments. This review emphasizes on various Phyto-constituents and pharmacological action of *Thespesia populnea* Soland (Malvaceae) and *Pongamia pinnata* Linn (Fabaceae). Both plants, which originated in India, exhibit a diverse array of phytochemical compounds in their different parts, including alkaloids, flavonoids, glycosides, tannins, terpenes, saponins, phenols, phytosterols, steroids, and proteins, showcasing multiple therapeutic activities such as anti-bacterial, anti-inflammatory, anti-oxidant, anti-ulcer, wound healing, analgesic, anti-convulsant, anti-malarial, anti-diabetic, and anthelmintic effects. The primary aim of this analysis is to evaluate the utilization of distinct plant parts for various curative purposes.

INTRODUCTION

According to WHO, herbal medicine and phytonutrients are referred as nutraceuticals, which are becoming more prevalent worldwide with numerous people using these products in various national healthcare systems to treat a wide range of ailments¹. An herb is a plant having medicinal, aromatic and palatable properties. Herbal medicines comprised of parts of plants or crude plant extracts consisting of various chemical constituents, which exert synergistic effect in combination. Any part of the plant like leaves

bark, flower, fruit, root and seeds can be used for their therapeutic value². As per WHO, around seventy-eighty % of the world populace, especially in developing nations, people prefer non- conventional medication as their primary healthcare³. There are many benefits of herbs, few of them are mentioned below in fig 1. Herbal formulations containing combination of multiple-plant extracts are preferred over single plant extracts as drugs in the indigenous system of medicine. These formulations are used to treat diversity of sickness. Since plants are tangled

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



combinations of many compounds, no one compound can have the desired effect. To ensure that the final formulation has a concentrated intended activity, multiple plants with similar desired activities are chosen⁴. In ayurvedic medicine formulation, two methodologies are employed, polyherbalism and single-drug usage. Polyherbalism is the practice of combining many

medicinal plants to increase the efficacy of treatment. This method is extensively employed throughout the world for its therapeutic uses, exhibiting strong efficacy at safe dosages in broad scope of health issues. Synergism in polyherbal compositions emphasizes how the combined plants complement each other's qualities⁵.

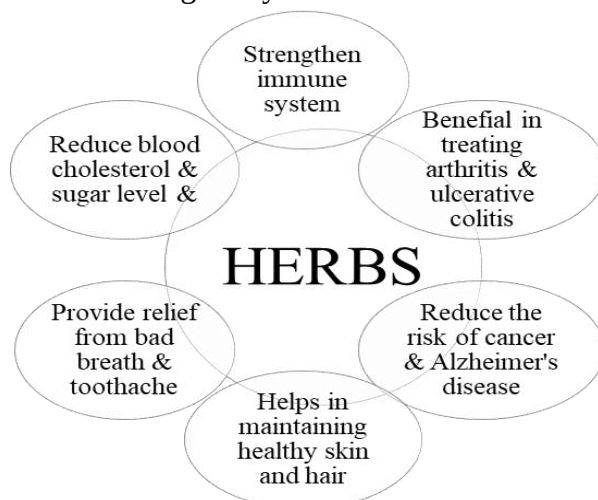


Fig 1: Various benefits of herbs.

Table 1. Phytochemical description & Pharmacological activities of *Thespesia populnea*.

Sl No.	Plant Parts	Extraction Solvent	Active Constituents	Activity
1.	Leaf 	Water Acetone Chloroform Methanol Ethyl acetate Petroleum ether Ethanol	Alkaloids Phytosterols Oils& Fats Saponins Phenols Steroids Flavonoids Terpenoids & terpenes Reducing sugars Tannins Carbohydrates Anthocyanins Glycosides Sterols Coumarins Anthraquinones Resins Quinines Proteins Gums	Anti-microbial ⁶ , Anti-psoriatic ⁷ , Antiproliferative & Anti inflammatory ⁸ , Anti-malarial ^{9,10} , Wound healing ¹¹ , Analgesic & Anti- inflammatory ¹² , Anti-diabetic ¹³ activities
2.	Root 	Ethanol Chloroform Petroleum ether Ethyl acetate Methanol	Flavonoids Tannins Gossypol Beta sitosterol Alkaloids Glycosides Carbohydrates Phenols Thiols Steroids Gums Phytosterols Mucilage Terpenes Resins Proteins	Anti-microbial ¹⁴ Anthelmintic ¹⁵ Anti-diabetic ¹⁶

3.	Bark 	Ethanol Petroleum ether Aqueous Methylene chloride Ethyl acetate Chloroform Methanol Alcohol	Alkaloids Carbazole Carbohydrates Protein Terpenes Tannins Flavonoids Phenols Gums Saponins Mucilage Steroids Glycosides Amino acid Triterpenoids	Anti-inflammatory & Antinociceptive ¹⁷ Anti oxidative ^{18,19} Anti diabetic ¹³ Anti diarrheal ^{20,21} Anti ulcer ²² Antimicrobial ²³ wound healing ²⁴ Hepato-toxicity ²⁵ Diuretic ²⁶ Anthelminitic ²⁷ Memory enhancing activity ²⁸
4.	Flower 	Water Ethanol Methanol Chloroform Petroleum ether Ethyl acetate Dimethyl oxide	Alkaloids Flavonoids Tannins Anthraquinone glycosides Phenols Flavonoids Carbohydrates Steroids Proteins Gums Saponins Terpenes	Anti-bacterial ²⁹ Anti-oxidant & Anti-inflammatory ^{30,31} Anti-microbial ³²
5.	Fruit 	Aqueous Chloroform Dichloromethane Ethanol Ethyl Acetate Hydro Alcohol	Alkaloids Flavonoids Carbohydrates Phenols Steroids Glycosides Tannins Saponins	Would Healing ³³ Anti-Cancer ³⁴ Anti-Microbial ³⁵
6.	Seed 	Hexane Methanol Ethyl acetate Ethanol(70%v/v) Petroleum ether Alcohol	Phytosterols Alkaloids Phenols Triterpenes Glycosides Tannin Carbohydrates Quinones Flavonoids Long-chain fatty acids & mixture of fatty acids	Anti-Oxidant ³⁶ , Anti-implantation ³⁷ activities

Table 2: Phytochemical description & Pharmacological activities of Pongamia pinnata.

Sl No.	Plant Parts	Extraction Solvent	Active Constituents	Activity
1.	Leaf 	Petroleum ether Chloroform Ethyl acetate Methanol Water Ethanol (70%) Hydro alcohol (70%) Acetone	Alkaloids Flavones & flavonoids Glycosides & cardiac glycosides Saponins Carbohydrates Tannins Triterpenoids Steroids Phytosterols Proteins Amino acids Phenolic compounds Sterols Karanjin	Antibacterial ³⁸ , Antidiabetic ³⁹ , Anti-oxidant ⁴⁰ , Anti-viral ⁴¹ , Anti-plasmodial ⁴² , Anti-inflammatory ⁴³ , Anti-ulcer ⁴⁴ , Anticonvulsant ⁴⁵ , Antihyperammonemic effect ⁴⁶ & Anti-lice ⁴⁷ Antinociceptive & antipyretic ⁴⁸ and Wound healing activities ⁴⁹

2.	Root 	Methanol Petroleum ether Dichloromethane Ethyl acetate	Fixed oils Flavonoids & flavones Chalcones β -diketone Karanjin Ponganones Ovilitin B	Anti-ulcer activity ⁵⁰ Anti-oxidant & Anti-microbial ⁵¹
3.	Bark/Stem 	Petroleum ether Ethanol Aqueous Methanol	Alkaloids, Glycosides, Flavonoids, Tannins, Phenolic compounds, Steroids, Triterpenes, Terpenoids, Volatile oils Carbohydrates	Anti-microbial ⁵² Cardio protectivity ⁵³ Anti-convulsant ⁵⁴ Anti-inflammatory and analgesic ⁵⁵ Anti diabetic ⁵⁶
4.	Flower 	Acetone Petroleum ether	Flavonoids Fixed oils	Antibacterial activity ⁵⁷ Anti-hyperglycaemic & Anti- lipid peroxidative ⁵⁸ Activity
5.	Fruit 	Hexane Chloroform Water Butanol	Tannins Alkaloids Quercetin Saponin β sitosterol Guggulipid Pinnatin Kanugin Kanjone Kangugin Karanjin Pongamol Pongamin	Anti-dyslipidemia & Antioxidant ⁵⁹ Anti-hyperglycemic ⁶⁰ activity
6.	Seed 	Acetone Chloroform Ethanol Methanol Petroleum Ether Aqueous-methanol	Alkaloids Terpenoids Glycosides Flavonoids Saponins Sterols Steroids Phenols	Anti-Microbial ⁶¹ Anti-Inflammatory ⁶² Anti-Gastro duodenal ulcer ⁶³ Anti-oxident ⁶⁴ Anti-Arthritic ⁶⁵

Exploring the various pharmacological activities of *Thespesia populnea* & *Pongamia pinnata*:

1) *Thespesia Populnea*:

1. Anti-microbial activity by Agar cup method:

Thespesia populnea (L) leaf ethanol extract with DMSO was tested in vitro against clinical isolates of *P. aeruginosa*, *E. coli*, *Candida albicans*, and *Aspergillus niger* using the agar cup method to evaluate its antibacterial and antifungal qualities.

At greater doses, the leaf extract's antibacterial activity against *P. aeruginosa* and *E. coli* was at its peak; at lower quantities, it was not effective. Also, no antifungal activity against *C. albicans* and *A. niger* was seen at any of the tested doses. The study revealed that *T. populnea* has potent antibacterial properties. This is as a result of the extract's phenolics, flavonoids, essential oils, and terpenoids. This shows how crucial *T. populnea* is in preventing bacterial infections⁶. Alike root¹⁴,

bark²³, flower³², fruit³⁵ extracts also exhibit anti-microbial activity.

2.Anti-psoriatic activity by Perry scientific mouse tail model:

Following using the extract, the extract-treated skin revealed significant improvements in psoriasis-related skin changes, such as reduced epidermal thickness overall and stratum granulosum retention. Based on histopathological research, there has been improvement in skin health, as seen by a rise in the amount of Ortho keratotic regions. Additionally, the extract was found to have a 1.2-fold increase in E2A gene expression in Wistar rat skin samples, suggesting a potential function in controlling inflammatory and immunological reactions linked to psoriasis. These results show the need for more investigation into the underlying mechanisms for action of *Thespesia populnea* extract and highlight its therapeutic potential in treating psoriasis.⁷

3.Anti-malarial using mice model infected with P. berghei:

This study examined the effects of chloroquine and *Thespesia populnea* extract on parasitemia and anaemia in mice infected with *Plasmodium berghei* ANKA (PbA). While parasitemia levels remained unchanged, a noticeable change took place between the fourth and sixth days. In comparison to the control group, chloroquine treatment resulted in a decrease in parasitemia levels. The flavonoids found in *Thespesia populnea* extract subtly affect the parasite activity by helping in the prevention of deterioration of haemoglobin. The group that received both the extract and chloroquine had lower parasitemia, maybe as a result of a flavonoid-chloroquine interaction. Furthermore, the antioxidant qualities of the extract might have raised haemoglobin levels, thereby reducing anaemia. However, for greatest effectiveness, the right dosage could be required. *Thespesia populnea* extract and chloroquine together show promise in treating

malaria, demonstrating the potential of complementary therapies in anti-malarial activity.¹⁰

4.Wound healing activity using excision wound & restricted incision wound model:

Alcohol, aqueous, and petroleum ether extracts from *T. populnea* leaves were tested for acute toxicity, showing no fatality up to 2000 mg/kg doses. For wound healing evaluation, a dosage of 200 mg/kg was chosen. Treatment with these extracts significantly reduced epithelization time in excision wound models, evidenced by shorter eschar fall ($P < 0.001$). Moreover, they notably increased wound contraction rate on the twelfth day compared to controls ($P < 0.001$). In incision wound model, the extracts notably enhanced skin tensile strength by the tenth day post-wounding ($P < 0.001$). These findings highlight the significant wound healing properties of *T. populnea* leaf extracts, improving epithelization, wound contraction, and skin tensile strength. Such effects suggest their potential therapeutic application in wound treatment¹¹. Alike bark²⁴ & fruit³³ extracts also exhibits wound healing activity.

5.Analgesic & anti-inflammatory activity by Acetic acid-induced writhing, Tail clip test, Tail immersion & Carrageenan induced pedal method:

Rats and mice were utilized in the study to compare analgesic and anti-inflammatory properties of *Thespesia populnea* leaf extracts in aqueous (AE) and ethanolic (EE) extracts. In tail clip, immersion and acetic acid-induced tests, both extracts demonstrated dose-dependent decreases in writhing and analgesic effects, with EE demonstrating higher efficacy. Only the highest dose of EE markedly accelerated reaction time in the tail immersion test. Both extracts showed anti-inflammatory effects in the rat paw oedema model, but EE shown better reduction, especially at higher dosages, similar to phenylbutazone. All things considered, *Thespesia populnea* leaf extracts



showed encouraging analgesic and anti-inflammatory qualities, with EE often having greater benefits than AE in a variety of scenarios. These results point to possible medicinal uses for the control of pain and inflammation, which may be related to the phytochemical composition of the plant¹². Even bark¹⁷ and flower³⁰ extracts show promising anti-inflammatory activities.

6. Anti-diabetic activity using streptozotocin-induced diabetic rat model:

The ethanolic extracts of *Thespesia populnea* bark and leaves display potential antidiabetic activity. In the streptozotocin-induced diabetic rats, significant reductions in blood sugar levels were observed following oral administration of extracts at a dose of 400 mg/kg body weight over 10 to 15 days. These outcomes were similar to those of glibenclamide, the standard drug. The mechanism of action likely involves stimulation of pancreatic β -cells for insulin secretion or increased peripheral glucose uptake. These findings suggest the therapeutic potential of *Thespesia populnea* extracts in managing diabetes¹³. Alike bark¹³ & root¹⁶ also has anti-diabetic activity.

7. Anthelmintic activity using earthworm assay:

An experiment on anthelmintic efficacy explored the effectiveness of several drugs against human intestinal roundworm parasites, *Pheretima posthuma* and *Ascaris lumbricoides*, utilizing earthworms as substitutes. Different treatments, including piperazine citrate and various extracts, were administered to distinct worm groups over a four-hour period. Significant reductions in paralysis and death were observed with methanol, chloroform, and ethyl acetate extracts compared to the standard for *Pheretima posthuma*. In *Ascaris lumbricoides*, ethyl acetate and chloroform extracts exhibited notable efficacy in paralysis and death reduction, with methanol extract also demonstrating effectiveness in paralysis reduction. These results highlight the potential anthelmintic properties of the tested extracts against both

roundworm species¹⁵. While bark extract has anthelmintic activity against only *Pheretima posthuma* species.²⁷

8. Antioxidant activity by superoxide radical scavenging and DPPH activity

The bark of *Thespesia populnea* possesses strong antioxidant properties, demonstrated by significant scavenging activity in opposite to DPPH and superoxide radicals in concentration-dependent method. Thin-layer chromatography revealed various substances with antiradical action, likely phenolic compounds. Additionally, the extract exhibited significant reducing power, indicating its ability to convert Fe^{3+} to Fe^{2+} ¹⁹. Previous research has shown that *T. populnea* bark enhances the body's natural antioxidant defences and protects against CCl_4 -induced liver toxicity in rats, suggesting its potential therapeutic application in conditions related to oxidative stress¹⁸. Even flower^{30,31} & seed³⁶ extracts has antioxidant activity.

9. Anti-diarrheal activity by castor oil-induced diarrhoea, prostaglandin E2-induced diarrhoea model and charcoal meal test:

The bark extracts of *T. populnea* demonstrate promising antidiarrheal activity, as revealed through various experimental models. Both aqueous and alcoholic extracts exhibit significant reductions in faecal weight in castor oil-induced diarrhoea tests, with the aqueous extract showing stronger effects. Similarly, in prostaglandin E2-induced diarrhoea assessments, both extracts effectively inhibit enter pooling compared to controls. Moreover, in the charcoal meal test, both extracts notably decrease the amount of charcoal meal that passes through the gastrointestinal tract, with the aqueous extract displaying superior inhibitory properties. These suggests the promising therapeutic use of *T. populnea* bark extracts in regulating diarrhoea, indicating their importance in treating gastrointestinal disorders.^{20,21}



10. Anti-ulcer activity by Pylorus Ligation Induced Ulcers in rats:

The ethanolic extract derived from *Thespesia populnea* bark exhibits gastroprotective effects, as proven in two ulcer models: ethanol-induced ulcers and pylorus ligation-induced ulcers. In correlation to control groups, treatment with varying the doses of extract (100 mg/kg, 200 mg/kg, and 400 mg/kg) remarkable decrease in gastric juice volume, increases gastric pH, and lowers acidity levels. Furthermore, in the model of ethanol-induced ulcers, the extract significantly reduces lesions on the gastric mucosa. The extent of inhibition of mucosal lesions rises with increasing doses of the extract, eventually reaching levels matches to the standard drug omeprazole (OMZ) at 20 mg/kg. These findings indicate that *Thespesia populnea* extract has potential as a gastroprotective agent, offering significant protection against gastric ulceration.²²

11. Hepatotoxicity by carbon tetrachloride-induced liver toxicity in rats:

Methanol and water were used to extract the bark of *Thespesia populnea* for the Hepatoprotective investigation. For this investigation, Wistar albino rats of any sex were employed. The extract's ability to prevent liver damage brought on by carbon tetrachloride was evaluated. The present investigation demonstrates noteworthy hepatoprotective effect of both the aqueous and methanolic extract against carbon tetrachloride-induced liver injury. *Thespesia populnea* bark methanolic extract exhibits more hepatoprotective properties than aqueous extract.²⁵

12. Diuretic activity using metabolic cage method:

Albino rats were utilized in study to evaluate the diuretic efficacy of various *T. populnea* (Linn.) Soland bark extracts, including ethanol, ethyl acetate, water and petroleum ether. The study's parameters included urine volume and the concentrations of K⁺, Na⁺ and Cl⁻ ions in the

urine. Furosemide dosage: 100 mg/kg used as a standard. Amount of urine and the content of K⁺, Na⁺, and Cl⁻ in the urine have significantly increased in response to the different extract (400 mg/kg). Based on the current investigation, it can be inferred that *T. populnea* (Linn.) Soland is a plant that has notable diuretic action.²⁶

13. Memory enhancing activity using Hebb-William's maze model:

Ethanol extract of *Thespesia populnea* bark. Hebb-William's maze was used to evaluate memory-enhancing activities boosted plus maze. In comparison to the control group, *Thespesia populnea* mice of all ages have lower cholesterol levels. In the current investigation, *Thespesia populnea* extract shown strong cholesterol-lowering properties equivalent to the nootropic medication Piracetam. Furthermore, we found that *Thespesia populnea* bark significantly improves mice's memory. It might demonstrate that *Thespesia populnea* is also utilized as an anti-Alzheimer medication due to its memory-improving properties.²⁸

14. Anti-cancer activity by using MTT assay:

K562, HeLa cells lines were treated with extract in different concentration ranges and incubated for 48 hrs. Phosphate buffer solution was used to wash the cells in the well twice before MTT staining solution was added and incubated at 37°C. *Thespesia populnea* hydro-alcoholic fruit extract reduced all cell viability, despite of varying degrees, according to the MTT experiment results. The extract's cytotoxic action is more similar to that of several chemotherapeutic cancer treatments, resulting in cell shrinkage and morphological alterations that ultimately kill cell lines. Result showed that Paclitaxel, a standard chemotherapy drug, demonstrated potent activity in opposite to both K562 and HeLa cell lines, that has IC₅₀ values of 0.29 µM & 0.23 µM, respectively. Additionally, an extract from the *Thespesia populnea* plant exhibited significant



anti-cancer effects, with IC₅₀ values of 2283 µg (K562) and 2886 µg (HeLa). Furthermore, the mean cell viability of HeLa and K562 cells was assessed at various concentrations of the plant extract, revealing a dose-dependent improvement in cell viability. The negative control maintained full cell viability (100%).³⁴

15. Anti-implantation activity by Khanna and Chowdhury method:

Using female rats, the anti-implantation activity of compounds C-1 and C-2 as well as an alcoholic extract was assessed. Both C-1 and C-2 showed dose-dependent suppression of uterine horn implantation sites, however C-1 was more effective than C-2 at 110 mg/kg. At concentrations as high as 110 mg/kg, the alcoholic extract, however, failed to exhibit any appreciable anti-implantation efficacy. The composition of C-1 and C-2 differed, as shown by fatty acid analysis, with C-2 having more unsaturated fatty acids than C-1. This points to a possible relationship between anti-implantation action and the content of fatty acids. The study sheds light on the chemical properties and dose-response relationship affecting the effectiveness of investigated chemicals in suppressing implantation.³⁷

2) Pongamia Pinnata

1. Anti-bacterial activity agar well diffusion method:

The study looked at *P. pinnata*'s crude floral pigment extract's antibacterial capabilities against a range of harmful microorganisms. Significant suppression of *B. cereus*, *E. Coli*, *K. pneumoniae*, *B. subtilis*, *E. aerogenes* and *S. aureus* was seen, according to the results. Maximum inhibition, similar to that of the antibiotic streptomycin, was seen against *B. cereus* and *S. aureus*. The inhibitory activity of floral extracts was higher than that of bark extracts. The study suggests more investigation into the chemical components of *P. pinnata* floral extract in order to find potential antibacterial agents against a range of pathogenic

bacterial illnesses. Recognition was awarded to the people and organizations that helped with the research⁵⁷. Alike leaf extract has also exhibited the anti-bacterial activity³⁸ & root⁵¹, bark⁵², seed⁶¹ extracts has shown the anti-microbial activity.

2. Antidiabetic activity by Alloxan-induced diabetic model & Oral glucose tolerance test:

P. pinnata leaf extracts failed to exhibit any lethality at a dosage of 5000 mg/kg in acute toxicity testing. This dosage's limited yield and possible toxicity at larger levels led to the selection of a tenth of it for efficacy testing. Using models of alloxan-induced diabetes and glucose tolerance, the antidiabetic potential was assessed. Every extract lowered blood sugar levels, but the effects of the petroleum ether and ethanolic extracts were particularly strong and were on the same level with those of the prescription medication glibenclamide. Furthermore, after 14 days of treatment, these extracts reduced irregular lipid levels and urine sugar in diabetic rats and increased body weight, suggesting potential benefits for glycaemic management and insulin secretion³⁹. Alike bark extract also shown promising anti-diabetic activity⁵⁶.

3. Anti-oxidant activity by DPPH scavenging test:

The antioxidant activity of *Pongamia pinnata* ethanolic & acetate leaf extracts was assessed using the DPPH scavenging test technique at doses ranging from 25 µg/ml to 125 µg/ml. Ascorbic acid is used as the reference standard for comparison of the results. The DPPH radicals were significantly inhibited by both extracts; however, the ethanolic extract was more active than the ethyl acetate extract. Ethanolic extract had the maximum inhibitory percentage of 89% at 125 µg/ml concentration, which was quite similar to ascorbic acid's value. Conversely, at a concentration of 150 µg/ml, the ethyl acetate extract exhibited 87.7% inhibition. Overall, ethanolic leaf extract outperformed ethyl acetate extract in terms of



DPPH scavenging activity. This implies that *Pongamia pinnata* may have antioxidant properties, especially in the ethanolic component⁴⁰. Even root⁵¹, fruit⁵⁹, seed⁶⁴ extracts also exhibits the anti-oxidant activity.

4.Anti-viral activity against White Spot Syndrome Virus (WSSV) in shrimp:

Penaeus monodon showed notable antiviral activity in opposite to White Spot Syndrome Virus (WSSV) when fed an ethanolic extract of *P. pinnata*, that has survival rates of 40% and 80% at 200 & 300 g/g of body weight/day, respectively, even 15 days after infection. Furthermore, the leaf extract's PTLC fractions exhibited antiviral properties; the second fraction, at various doses, showed higher survival rates (10–60%) than the first and third fractions. After six days post-infection, control groups devoid of the extract exhibited 0% survival rate. These results point to the possibility of using *P. pinnata* extracts to treat shrimp infected with WSSV.⁴¹

5.Anti-plasmodial activity by Plasmodium falciparum Growth Inhibition Assay:

RPMI 1640 was replaced with a medium from Cranmer et al., 1997 in order to improve parasite growth in the experiment, which was first reported by Chen et al., 1994. 96-well microtiter plates were treated with extracts at four different doses, containing 3% parasitized erythrocytes at a density of 5×10^8 cells/ml. Nucleic acid incorporation was assessed after 48 hours of incubation at 37°C in a controlled environment with the addition of L-[2,3,4,5,6-3H] phenylalanine. A formula based on counts of radioactivity was used to determine inhibition. With IC₅₀ values established, *Pongamia pinnata* leaf extracts displayed differing levels of inhibition. An IC₅₀ of roughly 30 ng/ml was found for chloroquine-diphosphate. The antiparasitic action of plant extracts can be better understood using this method; *Pongamia pinnata*, for example, has been shown to have promising

inhibitory effects on the integration of plasmodial nucleic acids.⁴²

6.Anti-inflammatory activity by Bradykinin-induced paw oedema method

Bradykinin-induced paw oedema was most effectively prevented by straight ethanolic extracts, which demonstrated a strong anti-inflammatory activity. The site of anti-inflammatory activity of various extract, which are more polar in nature, is likely to be found at the membranes of inflammatory cells, such as leucocytes or mediator target cells. Thus, in general, the polar components seem to block eicosanoid processes in inflammation by blocking the prolonged late stages of inflammation. The most effective extract of chloroform was found against carrageenin and PGE₂, while it was least effective against bradykinin⁶². Alike leaves^{43a} and bark⁵⁵ extract has shown anti-inflammatory activity.

7.Anti-ulcer activity by Aspirin induced method:

Pongamia pinnata root methanolic extract showed a strong protective effect against aspirin-induced ulcers, but not against ethanol-induced ones. After ten days of treatment, there appeared to be a decrease in ulcers caused by acetic acid. Increasing cell proliferation, mucosal cell glycoproteins, mucosal cells and avoidance of lipid peroxidation were found to have an ulcer-protective impact, instead of an unpleasant effect on acid pepsin secretion⁵⁰. Even leaf extract reported the anti-ulcer activity⁴⁴.

8.Anti-convulsant activity by Pentylene-tetrazol (PTZ) & maximal electroshock (MES)-induced seizures:

The effectiveness of *Pongamia pinnata* stem bark-petroleum ether extract (PPSB-PEE) on mice behaviour and seizures was evaluated. PPSB-PEE showed dose-dependent changes in behaviour, with higher doses causing writhing, reduced activity, and altered vital signs. In tests inducing

convulsions, PPSB-PEE demonstrated anticonvulsant activity in opposite to maximal electroshock (MES) and pentylenetetrazol (PTZ)-induced seizures. However, it was ineffective against picrotoxin and isoniazid-induced seizures. In electrical kindling seizures, PPSB-PEE significantly reduced seizure severity. Additionally, PPSB-PEE fractions exhibited varied anticonvulsant effects, with some fractions increasing latency to clonic convulsions and reducing mortality. Diazepam, used as a reference, consistently delayed seizure onset and reduced mortality. These findings suggest potential anticonvulsant properties of PPSB-PEE, particularly against PTZ- and MES-induced seizures, highlighting its relevance in seizure management⁵⁴. Alike leaf extract also exhibited anti-convulsant activity⁴⁵.

9. Anti-hyperammonemic effect by inducing hyperammonaemia in Waister rats:

Rats given ammonium chloride had higher body weights than those in the control group. In comparison to control and ammonium chloride-treated groups, animals treated with PPEt alone and with both ammonium chloride and PPEt demonstrated fewer notable variations in body weight. The rats treated with ammonium chloride, the concentrations of circulatory uric acid, ammonia, urea, non-protein nitrogen, and creatinine increased considerably. Rats given PPEt in addition to ammonium chloride, on the other hand, exhibited noticeably reduced levels of these parameters in comparison to ammonium chloride group. When compared to control rats, rats treated with PPEt alone did not show any appreciable variations in these levels. The study shows that PPEt can help reduce the negative effects that rats treated with ammonium chloride can have.⁴⁶

10. Anti-lice activity using filter paper diffusion method:

Chloroform, Petroleum ether, chloroform and methanol extracts were utilised to test the anti-lice

activity of *Pongamia pinnata* extracts at concentrations of 5%, 10%, and 20%. The filter paper diffusion method was used to test these extracts against both adult lice and nymphs. The extracts with the highest mortality rates were petroleum ether, methanol, and chloroform, while the extracts with the least activity were water. The extracts' ovicidal activity was determined by applying it to eggs. The petroleum ether extract delayed and prevented nymph development, exhibiting significant ovicidal effects. The methanol and chloroform extracts somewhat postponed the emergence of nymphs, while the water extract exhibited no ovicidal activity. These results suggest that *P. pinnata* petroleum ether extract has potential ovicidal and anti-lice properties, making it a good candidate to continue lice control studies.⁴⁷

11. Antinociceptive & antipyretic activities by hot plate, acetic acid-induced & tail flick writhing tests:

Pain suppressing effects, including the hot plate, acetic acid-induced and tail flick writhing tests were performed, the study found that the 70% ethanol extract derived from *Pongamia pinnata* leaves (PLE), administered at doses of 100, 300, and 1000 mg/kg, showed potential responses and remarkable pain-alleviating properties, based on study findings. Furthermore, rats experience discomfort induced by Brewer's yeast. PLE increases the threshold for pain. Additionally, PLE demonstrates antipyretic properties in cases of Brewer's yeast-induced fever. Morphine typically exhibits stronger antinociceptive effects than PLE, notwithstanding latter's primary effects. Furthermore, compared to PLE, acetylsalicylic acid (ASA) has a greater antipyretic effect. As per the result, PLE possesses valuable natural analgesic and antipyretic properties. Yet its efficacy is not up to that of conventional medications like morphine and ASA in some situations.⁴⁸



12.Wound healing activity using Excision and incision wound healing models:

The study demonstrates the effective wound-healing properties of the *P. pinnata* leaf extract. The *P. pinnata* therapy significantly accelerates wound closure in compared to controls, causing a detectable reduction in wound area by the sixteenth day after surgery. Histological analysis reveals that those treated with *P. pinnata* saw fewer scars and enhanced tissue regeneration. Furthermore, animals treated with *P. pinnata* have improved breaking and tensile strengths of the healed tissue in comparison to controls and standard treatments. Furthermore, the extract affects TNF-alpha production, a pro-inflammatory cytokine, with a significant decrease observed on the eighth day after surgery. *P. pinnata* therapy also increases the anti-inflammatory cytokine IL-10 levels, which promote recovery. Groups treated with *P. pinnata* have substantially more hydroxyproline and hexosamine, which show enhanced wound healing and needed for the production of extracellular matrix. *P. pinnata* has encouraging possibilities for wound healing overall.⁴⁹

13.Cardioprotectivity using Streptozotocin-Nicotinamide induced diabetic rats:

The study analyses PPSB-PEE's beneficial effects for rat diabetic cardiomyopathy. When compared to normal rats, diabetic rats had higher blood glucose levels and cardiac abnormalities, which were considerably reduced by PPSB-PEE treatment. The normalization of ECG parameters, such as the QRS, QT, and QTc intervals, suggests improved heart function. PPSB-PEE therapy also enhanced LV contractile function, serum cardiac markers, and hemodynamic parameters, indicating cardioprotective benefits. Furthermore, by lowering oxidative stress markers and lessening histological alterations in heart tissue, PPSB-PEE showed antioxidative qualities. As a treatment for diabetic cardiomyopathy, PPSB-PEE appears to be

promising overall because it improves oxidative stress, hemodynamic, glucose regulation, cardiac function, and histological changes in rats.⁵³

14.Anti-hyperglycaemic and Anti-lipid peroxidative Activity uses both in-vivo &in-vitro assays:

It has been shown that in diabetic rats induced with alloxan, oral administration of *P. pinnata* flower ethanolic extract considerably decreases hyperglycemia, inhibits lipid peroxidative effects, and strengthens the antioxidant defense system. Based on these findings, *P. pinnata* extract treatment may be an appropriate substitute for anti-hyperglycemic medications in diabetic patients⁵⁸. Alike fruit extract has shown the anti-hyperglycaemic activity⁶⁰.

15.Anti-Gastro duodenal ulcer using cold restraint stress, aspirin, pylorus-ligated, ethanol induced gastric ulcer & cysteamine induced duodenal ulcer in rats:

During a four-hour treatment period, three substances: PPSM, SFT, and OMZ were discovered to exhibit anti-ulcer effects on gastric duodenal mucosal glycoproteins and rat cell proliferation. PPSM and SFT have different effects on glycoprotein components in the gastric mucosa in comparison to the control group. SFT is associated with a considerable rise in total carbs, while PPSM is associated with significant increases in sialic acid and hexosamine levels. Notable increases in total carbs and hexosamine are also observed after OMZ therapy. On the other hand, SFT and OMZ therapies cause a considerable drop in protein levels. SFT exhibits a notable increase in cell proliferation in comparison to the control and PPSM groups, while OMZ exhibits a possible increase in cell proliferation—the precise relevance of which is unknown. These results collectively imply that the substances have a variety of impacts on the makeup of the stomach mucosa.⁶³



16. Anti-arthritis by Inhibition of protein denaturation model:

The effects of Pongamia pinnata ethanolic extract (EEPP) against protein denaturation at various concentrations ($\mu\text{g/ml}$), measured in terms of % inhibition and viscosity (Cps). At lower concentrations, EEPP demonstrate increasing % inhibition of protein denaturation. For instance, at 10 $\mu\text{g/ml}$, EEPP inhibits protein denaturation by 22.12%. This trend continues as the concentration increases, with consistently exhibiting higher % inhibition compared to EEPP. Regarding viscosity, extracts show a decrease in viscosity with increasing concentrations, indicating their ability to prevent protein denaturation. Generally, exhibits slightly lower viscosity compared to EEPP at each concentration, they suggest a potentially stronger inhibitory effect on protein denaturation. Overall, the results suggest that both EEPP possess inhibitory effects against protein denaturation.⁶⁵

CONCLUSION:

The detailed review of Thespesia populnea and Pongamia pinnata is discussed in this article. Each part of the plant is analysed, and its uses for various diseases are addressed. Various Phyto-constituents are reported from various parts of this plants which are responsible for exhibiting respective pharmacological activities like anti-microbial, analgesic, anti-inflammatory and extend to complex activities like anti-cancer, cardio-protectant, anti-psoriatic etc., which can be verified by in-vitro and in-vivo studies. Every part of Thespesia populnea and Pongamia pinnata has a wide range of therapeutic activities, which have been proven and reviewed in this article.

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HOW TO CITE: Chaithra K.*, Pallavi S., Preethu K., Rakshitha S., Sadaf Farooq, Sahana H. S., Comprehensive Review On Pharmacological Activities Of *Thespesia Populnea* Soland And *Pongamia Pinnata* Linn, *Int. J. of Pharm. Sci.*, 2024, Vol 2, Issue 8, 2707-2722. <https://doi.org/10.5281/zenodo.13255293>

