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REVIEW ON *TEPHROSIA PURPUREA*

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ABSTRACT

Tephrosia purpurea(Fabaceae) commonly known in sanskrit as 'sharapunkha' is higjly branched, herbaceous, superect, perennial herb widely grown in india. Whole plant and various parts of the plant are useful as ayurvedic medicines.Medicinal uses of drugs are tonic,laxative, diuretic, bronchitis,bilious febrile attack, boils, pimples, diarrhea, gonorrhea, rhumatism and cures disease of heart, spleen and blood.The pharmacological studies haves shown that *Tephrosia purpurea* posses following biologica activity such as antiulcer,anitmicrobial,antibacterial, antiviral, antiasthmatic, hepatoprotective, antihyperglycemic and antihyperlipidemia, immunomodulatory activity, antioxidant, wound healing propertu, antiallergic activity. A wide variety of phytochemicals are isolated from the plant T*ephrosia purpurea* which has concerned with their medicinal uses.The present review high lights the mainly phytochemistry and pharmacological activity of the plant.

KEYWORDS: Tephrosia Purpurea, Phytochemistry, Pharmacological Activities.

INTRODUCTION

A large number of herbal drugs are reputed to have excellent medicinal value, and are in use for the treatment of several ailments. In folk medicine, various indigenous drugs are used, in single and/or in combined forms, for treating different types of inflammatory and arthritic conditions, with considerable success. Although the use of these drugs has a sound tradition, and their medicinal uses and general safety are well known to native peoples, their place has yet to be rationalized in therapeutics, using the current methodology. Scientific studies are therefore required to judge their efficacy and some of the medicinal properties popularly

claimed, as well as other limitations to widen the scope of these drugs. Chronic inflammatory diseases remain one of the world's major health problems.[1-2] Inflammation is the response of living tissues to injury. It involves a complex array of enzyme activation, mediator release, and extravasations of fluid, cell migration, tissue breakdown and repair.[3-4] Inflammation has become the focus of global scientific research because of its implication in virtually all human and animal diseases. *Tephrosia purpurea* L. (Leguminosae), commonly known in Sanskrit as Sharapunkha, is a copiously branched, sub-erect, herbaceous perennial which occurs through out the Indian.[5] whole plant has been used to cure tumours, ulcers, leprosy, allergic and inflammatory conditions such as rheumatism, asthma and bronchitis.[6]

Common Names[7,8]

English: Fish poison, Wild indigo

Hindi: Sarphonk, Sarpunkha

Hawaiian: Auhuhu, Auhola, Hola

Gujarati: Unnali

Rajasthani: Masa

Punjabi: Jhojro

Marathi: Untoali

Malayalam: Kattamari, Kozhinjil

Taxonomic classification[9]

Kingdom - Plantae (Plants)

Division - Magnoliophyta

Class - Magnoliopsida

Order - Fabales

Family – Fabaceae

Genus - *Tephrosia*

Species – *purpurea*

Synonyms: *Cracca purpurea, Tephrosia piscatorial*

Botanic Description

Tephrosia purpurea is an erect or spreading annual or short-lived perennial herb, sometimes bushy, 40-80 cm tall, rarely up to 1.5 m; indumentum sericeous, strigose or velutinous; stem slender, erect or decumbent at base. Leaves imparipinnate; stipules narrowly triangular, 1.5-9 mm x 0.1-1.5 mm; rachis up to 14.5 cm long, including the petiole of up to 1 cm; petiolule 1-

3 mm long; leaflets 5-25, obovate to narrowly elliptical, terminal leaflet 7-28 mm x 2-11 mm, lateral leaflets 5-30 mm x 2-11 mm, acute at base, apex rounded to emarginate, venation usually distinct on both surfaces. Inflorescence an axillary or leaf-opposed pseudo-raceme, (1.5-)10-15(-25) cm long, sometimes with basal leaf-like bracts; flowers in fascicles of 4-6; bracts to fascicles and to flowers small, bracteoles usually absent; pedicel 2-6 mm long; flower 4-8.5 mm long, purplish to white; calyx campanulate, persistent, cup 1.4-2.3 mm x 1.5-3.2 mm, unequally 4-toothed, teeth pubescent inside; standard broadly ovate, 3.5-7.3 mm x 5-10 mm, clawed; wings 2.5-6 mm x 1.5-3.8 mm, auricled on vexillary side, clawed; keel 2.2- 4.5 mm x 2-3 mm, auricled on vexillary side, clawed; stamens 10, staminal tube 4-6 mm long, filaments alternately longer and shorter, free part up to 3.5 mm long, vexillary filament free at base, connate halfway, 5-8 mm long; style up to 4.5 mm long, upper half glabrous, stigma penicillate at base.

Fig. 1: Whole plant of *Tephrosia purpurea.* Fig. 2: Flower of *Tephrosia purpurea.*

Fig. 3: Fruit of *Tephrosia purpurea.* Fig. 4: Leaf of *Tephrosia purpurea.*

Pod flat, linear, 2-4.5 cm x 3-5 mm, somewhat up-curved towards the end, convex around the seeds, flattened between, margins thickened, dehiscent with twisted valves, 2-8(-10)-seeded. Seed rectangular to transversely ellipsoid, 2.5-5 mm x 1.8-3 mm, light to dark brown to black, sometimes mottled. *T. purpurea* is a very variable species and many subclassifications

exist. Most characteristic is the shape of its pod: convex around the seeds with a distinctive flat area in between. The name *T. purpurea* is often erroneously applied to the cultivated *T. noctiflora* Bojer ex Baker which has longer inflorescences, a very long carinal calyx tooth and reticulately ridged seeds.

For South-East Asia *T. purpurea* is subclassified as follows; (a) subsp. barbigera Bosman & de Haas: vexillary filament and staminal tube velutinous; occurring in the Philippines, New Guinea and Australia. Based on flower and inflorescence lengths, further subdivided into 2 varieties: var. barbigera (flower 7-8 mm long, longest inflorescence 11-19.5 cm long) and var. rufescens Benth. (flower 5-6 mm long, longest inflorescence 4.5-11 cm long). (b) subsp. purpurea : characteristics and distribution as described for the species; vexillary filament and staminal tube glabrous.

Phytochemistry

Parts	Constituents	Traditional uses
Roots	Tephrosin, diguelin, isotephrosin, rotenone(rotenoid), tannins, phytosterols, glycosides, purpurin, isolonchocarpin	Diuretic, enriches the blood, useful in bronchitis, wounds, boils, pimples, liver and spleen diseases, asthma, inflammation, hepatoprotective, used in poisoning due to snakebite, useful in enlargement of spleen, antidiarrhoeal. Given in tympanitis, dyspepsia and chronic diarrhea. In French Guiana it is used as fish poison.
Seeds	Tephrosin, diguelin, quercetin	Used in poisoning due to rat bite
Leaves	Osyritin, 2% glycoside, Rutin, rotenone(rotenoid), Tephrosin, Pongaglabol, Semiglabrin	Useful in Diseases of lungs and of the chest, tonic to intestines, improves the appetite, good in piles, syphilis, gonorrhoea
Whole plant	β sitisterol, ursolic acid, spinosterol, epoxyflavon, pongamol, tetratriacontane, rotenone(rotenoid), Tephrosin, Butelinic acid, 12-α-hydroxy rotenone, Dimethylglabranin.	Digestible, Anthelmintic, Alexeteric, Antipyretic, Cures diseases of liver, spleen, heart, blood, cures tumors, ulcers, leprosy, asthma, bronchitis, piles,caries of the teeth, laxative, blood purifier.

Pharmacological Activities

Hepatoprotective Activity[10]

The ethyl acetate fraction of an ethanol extract of the roots of *T. purpurea* was evaluated for its efficacy in rats by inducing hepatotoxicity with CCl4. Serum levels of aspartate

aminotransferase, alanine transaminase, alkaline phosphatase, bilirubin, and triglycerides were used as biochemical markers of hepatotoxicity. The results showed that oral administration of *T. purpurea* resulted in a significant reduction in aspartate aminotransferase, alanine transaminase, alkaline phosphatase and total bilirubin, when compared with CCl4-damaged rats. A comparative histopathological study of liver from the test group exhibited almost normal architecture, as compared to the CCl4-treated group. The results are comparable to that of Silymarin. Hepatoprotective activity of *T. purpurea* exhibited better effectiveness than Silymarin in certain parameters. In vitro studies revealed that the alcoholic extract, exerted a significant hydroxyl radical scavenging activity. It prevents cellular leakage and loss of functional integrity of the liver cell membranes caused by various hepatotoxic agents.

Anti-Inflammatory Activity[11]

Analgesic activity of *T. purpurea* was carried out using acetic acid-induced writhing in mice and the tail flick test in rats. The anti-inflammatory activity was evaluated using car- rageenan-induced rat paw edema and cotton pellet granuloma formulation in rats. The effects of the administration of refer- ence standard (Ibuprofen and Hydrocortisone) were also evaluated. *T. purpurea* were found to be more effective in preventing carrageenan-induced rat paw edema, cotton pellet granuloma formation, and acetic acid-induced rat paw edema.

Antimicrobial Activity

A novel oleanene type tri-terpenoid glycoside was iso- lated from the butanolic extract of the seeds of *T. purpurea*. Its structure was elucidated as 3-O-{β-D-glucopyranosyl-(1→6)-[α-L-rhamnopyranosyl-(1→2)]-β-D-glucopyranosyl-(1→4)- [β-D-glucopyranosyl-(1→2)]-β-D-xylopyranosyl}-2, 1-dihydroxy- 23, 29-dihydroxymethylolean-11, 13(18)-diene-28-oic acid. The isolated saponin was tested for its antimicrobial activity. Maximum inhibition was recorded against the Gram-positive bacterium Streptococcus pneumoniae, and complete inhibi- tion was observed on the growth of the fungus Alternaria alternata. The potency of the extract was quantitatively as- sessed by determining the minimum inhibitory concentration values against selected bacteria.[12] In another research study, the petroleum ether extract, alcoholic extract and aqueous extract of seeds of *T. purpurea* were found to have antibacte- rial activity against Bacillus subtilis, Escherichia coli and Pseudomonas aeruginosa.[13]

Antiulcer Activity

Antiulcer activity of *T. purpurea* extract was studied in rats in which gastric ulcers were induced by oral administra- tion of ethanol, or 0.6 mol·L−1 HCl, or indomethacin, or by pyloric ligation, and duodenal ulcers were induced by oral administration of cysteamine HCl. Omeprazole was used as a reference drug. The ulcer index in the *T. Purpurea* treated animals was found to be significantly less in all the models compared to vehicle control animals. The antiulcer property was more prominent in animals in which ulcers were induced by HCl, indomethacin, and by pyloric ligation. Omeprazole produced a significant gastric and duodenal ulcer protective effect when compared with the control group. The anti-ulcer activity of *T. purpurea* was however, less than that of ome- prazole. Results suggest that *T. purpurea* possesses signifi- cant antiulcer property which could be either due to cyto-protective action or by strengthening of gastric and duodenal mucosa, and thus enhancing mucosal defense.[14] The aqueous root extracts of *T. purpurea* (100 and 200 mg·kg−1) were screened for ulcerative colitis using the method of acetic acid-induced ulcerative colitis in mice. Macroscopical study of the colon, level of myeloperoxidase in colon, and histopathology of the colon tissue were studied for the as- sessment of activity. Results showed that the aqueous extract was effective in the treatment of ulcerative colitis at a dose of 200 mg·kg−1.[15]

Antidiabetic Activity[16]

Studies revealed that an aqueous seed extract of *T. pur purea* resulted in a decrease in the blood glucose concentra- tion, and also increased insulin level, which could be due to the stimulation of insulin secretion from remnant pancreatic β-cells which in turn enhance glucose utilization by periph- eral tissues. Hyperglycemia is associated with an altered hexokinase and glucose-6-phosphatase activities, elevated lipid peroxidation, disturbed enzymatic superoxide dismutase, catalase, glutathione peroxidase and non-enzymatic glutathione, vitamin C and vitamin E. Antioxidant status was observed in streptozotocin-induced diabetic rats. There is decreased hemoglobin and increased glycosy- lated hemoglobin levels in diabetic rats. Increased hemoglo- bin in *T. purpurea*-treated diabetic rats indicated decreased blood glucose level and glycosylated hemoglobin. Oral administration of *T. purpurea* to diabetic animals significantly improved hexokinase and glucose-6-phosphatase activities.

Anxiolytic Activity[17]

Anxiety disorders are among the most common mental disorders besides depressive disorders, and approximately affect one eighth of the world population at some point in their life. Anxiolytic activity of a hydroalcoholic extract of *T. purpurea* was studied in mice using the elevated plus-maze, ele- vated zero-maze, y-maze, and hole-board models. Furthermore, the anxiolytic effects of the hydroalcoholic extract at the dose 200 and 400 mg·kg−1 orally was compared to a known active anxiolytic drug, diazepam. The extract administered orally in two different doses, was able to increase the time spent and the number of arm entries in the open arms of the elevated plus-maze and elevated zero-maze, as well as decrease the visits by mice in the Y-maze, it also significantly increased nose poking, line crossing, and rearing in the hole-board assay. This effect was comparable to that of the diazepam, indicating that the extract of *T. purpurea* is an effective anxiolytic agent at the dose of at the dose 200 and 400 mg·kg−1.

Mast Cell Stabilizing Potential (Anti Allergic) Activity[18]

Mast cell stabilizing potential of *T. purpurea* was evalu- ated for the management of asthma using experimental ani mal models. An extract of the aerial part of *T. purpurea* was prepared, and the mast cell stabilizing potential evaluated against clonidine-induced mast cell degranulation, in adult Wistar albino rats, the result revealed that the ethanolic ex- tract of the aerial parts of *T. purpurea* showed a dose-dependent, significant reduction in mast cell degranula- tion as compared to the clonidine-treated animals, however its effect was less than dexomethasone and disodium cromoglycate, which are potent mass cell stabilizers, thus *T. purpurea* possesses good mast cell stabilizing properties, and hence can be a candidate of asthma management.

Anti-Tuberculosis Activity[19]

Mammalian host defense against the pathogen involves restricting access of the organism to iron. *In vitro* growth studies using standard culture media indicate that siderophore mediated iron acquisition plays a critical role in the growth and metabolism of *Mycobacterium tuberculosis*. In response to iron starvation, mycobacteria produce siderophores, iron-storage proteins or receptors. However, exochelins (siderophores) of *M. tuberculosis* are capable of removing iron from the transferrin and lactoferrin, and transferring it to the cell wall of *Mycobacterium*. Recently a compound was isolated from a root extract of *T. purpurea* that solubilizes the compound rock iron [Fe (OH)3] and helps in plant metabolism. This

compound is also capable of inhibiting the growth of *M. tuberculosis* under *In vitro* conditions. The mechanism of action of this compound is through competition with the bacteria for iron in the environment.

Antioxidant Activity[20-21]

The therapeutic effects of tannins and flavonoids can be largely attributed to their antioxidant properties. The results of antioxidant activity of *T. purpurea* revealed that the leaves of this plant have antioxidant potential. Antioxidant activity of ethanol extract and ethyl extract of *T. purpurea* were stud- ied for CCl4–induced lipid peroxidation and superoxide gen- eration. Results indicate that ethyl acetate extract has improved antioxidant activity as compared to ethanol extract.

Cytotoxic Activity[22-24]

The chlorofom extract of the powdered root of *T. purpurea* were subjected to preliminary chemical screening, and brine shrimp hatchability and lethality testing. The investigation was extrapolated to animal cell lines, Daltons lymphoma ascities and Erhlich ascites carcinoma. The Trypan blue exclusion method was used for this screening and confirmed the potent cytotoxic activity of *T. purpurea*.The chemopreventive potential of *T. purpurea* extract was assessed in N-nitrosodiethylamine-induced hepatocellular carcinoma in *Wistar rats*. Hepatocellular carcinoma was induced by a single intraperitoneal injection of N-nitrosodiet- hylamine (200 mg·kg−1) followed by subcutaneous injections of CCl4 (3 mL·kg−1 per week) for six weeks. After admini- stration of the carcinogen, 200 and 400 mg·kg−1 *T. Purpurea* extract were administered orally once a day throughout the study. The levels of liver cancer markers, including α-fetoprotein and carcinoembryonic antigen, were substantially increased by N-nitrosodiethylamine treatment. *T. purpurea* extract treatment significantly reduced liver injury and restored the entire liver cancer markers. Additionally, *T. purpurea* extract normalized the activity of antioxidant enzymes, namely lipid peroxidation, reduced glutathione, catalase, superoxide dismutase, glutathione peroxidase, and glu- tathione-S-transferase in the liver of N-nitrosodiethylamine treated rats. Treatment with *T. purpurea* significantly reduced the nodule incidence and multiplicity in the carcino- gen-bearing rats. Histological observations of the liver tissues correlated with the biochemical observations. Cytotoxic activity of different fractions of *T. purpurea* was tested in the human MCF-7 cancer cell line by trypan blue exclusion method. Two fractions of *T. purpurea* showed IC50 values of 152.4 and 158.71 µmol·L−1.

Antiviral Activity[25]

The methanol extract of *T. purpurea* flowers was studied for antiviral activity by using virus cultures namely, HEL cell cultures, HeLa cell cultures and Vero cell cultures. The results indicate good antiviral activity of the flowers extract of *T. purpurea*.

Spasmolytic Activity[26]

Investigation revealed the spasmolytic activity of the ethanol extract of the leaves of *T. purpurea* on *guinea pig* trachea. The results showed the spasmolytic activity of the drug. Preliminary phytochemical investigation showed that the presence of glycosides and saponins may be responsible for this activity.

Antiepileptic Activity[27]

Research revealed the anti-epileptic activity of *T. pur purea* in status epilepticus induced in rats by administration of pilocarpine after lithium chloride. The results of the lithium-pilocarpine-induced status epilepticus model demonstrated that the ethanolic extract of *T. purpurea* has signifi- cant ability in reducing the severity of status epilepticus, and also possesses both *In vitro* and *In vivo* antioxidant activity.

Nephroprotective Activity

Studies revealed nephroprotective activity of the alcohol extract of *T. purpurea* in gentamicin-induced kidney cell damage and in vitro hydroxyl radical scavenging activity. The hydroxyl radical scavenging effect of the extract was enhanced with increases in drug concentration, suggesting the role of free radical scavengers in minimizing gentamicin-induced kidney cell damage.[28] An investigation was conducted of the chemopreventive efficacy of *T. purpurea* against N-diethylnitrosamine-initiated and potassium bromate-mediated oxidative stress and toxicity in rat kidney. The data indicate that *T. purpurea* is a potent chemopreventive agent against renal oxidative stress and carcinogenesis induced by N-diethylnitrosamine and KBrO3 by reducing lipid peroxidation and xanthine oxidase activities and enhancing antioxidant enzyme activity.[29] In another study, aqueous extract of *T. purpurea* roots was examined for its antilithiatic activity in two models of urolithiasis. The aqueous extract of *T. purpurea* was found to be effective in reducing the formation of, and dissolving existing, calcium oxalate (gentamicin and 5% ammonium oxalate) and magnesium ammonium phosphate stones (zinc discs).[30]

Antimalarial Activity[31]

The stem extract of *T. purpurea* showed antiplasmodial activity against the D6 (chloroquine-sensitive) and W2 (chloroquine-resistant) strains of *Plasmodium falciparum* with IC50 values of (10.47 ± 2.22) and (12.06 ± 2.54) μg·mL−1, respectively. A new prenylated flavone, terpurinflavone, isolated from *T. purpurea* extract showed antiplasmodial activity with IC50 values of (3.12 ± 0.28) μmol·L−1 (D6) and (6.26 ± 2.66) μmol·L−1 (W2).

Author Contributions

All the authors have contributed equally.

Conflict Of Interest

All authors are hereby declaring there is no conflict of interest with respect to the manuscript.

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