A REVIEW ON PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES OF TEPHROSIA PURPUREA (LINN.)

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ABSTRACT

Tephrosia purpurica (L.) Pers. is a well-known plant in Ayurveda and named “Sarwa wranvishapaka” for its property to heal wounds. Tephrosia purpurea is a wild herb belongs to the family fabaceae and commonly known as sharpunkha. It is distributed among India, Australia, China, Sri Lanka up to 400 m to 1300 m altitude. Phytochemical investigations indicate the presence of semiglabrin, pongamole, lanceolatins A and B, rutin, lupeol, and β-sitosterol. Flavonoids including (+)-tephrorin A and B, (+)-tephrosone, an isoflavone, 7, 4‘-dihydroxy-3’, 5’-dimethoxyisoflavone and a chalcone, (+)-tephropurpurin, carbohydrates, protein, gums and mucilage, fixed oils, fats, amino acids, glycosides, alkaloids, saponins, lipids, flavonoids, tannins, phenolics, and phytosterols. Whole plant may be used for its rich flavonoid and polyphenol content were isolated from the whole plant. Pharmacological activities of different parts of the plant reported include Antioxidant, Anti-Inflammatory And Analgesic, Antimicrobial, Wound Healing Potential, Antiulcer, Spasmolytic, Diuretic, Anti-Diabetic, Anti-Hyperlipidemic, Anticarcinogenic, Antidiarrheal, Antiviral, Hepatoprotective, Immunomodulatory, Antiepileptic, Antituberculosis, Antimalarial, Anthelmintic, Anti-Fungal have all been described. In the present review, the literature on the phytochemical and pharmacological investigations of Tephrosia purpurea (L.).

KEYWORDS: Review, Tephrosia purpurea; Phytoconstituents, Pharmacological activities.
INTRODUCTION

The generic name Tephrosia purpurea (L.) Pers. Is derived from the Greek word tephros, meaning "ash-colored," referring to the grayish tint given to the leaves. Tephrosia is a genus of flowering plants in the pea family, Fabaceae (Leguminosae) and subfamily Papilionaceae, comprising more than 400 species of annual and perennial woody herb, distributed in tropical and subtropical regions of the world.\(^1\) The plants are erect herbs, or it is in the form of soft or woody shrubs. Based on several studies conducted by the taxonomist, Tephrosia was classified into four sections, namely, Mundulea, Brissonia, Craccoides, and Reineria, out of which Mundulea and Reineria were represented in India. Later, the genus has been classified into three subgenera which includes Marconyx (includes T. tenuis), Brissonia (includes T. candida), and Reineria (includes rest of the species of Tephrosia). Large T. maxima is an erect or perennial under shrubs up to 1.2 m long; stem often purplish, velvet-hairy. Leaves are impaired pinnate, 4–13 cm long; leaflet 9–17, 1–2.4 × 0.5–1 cm, or obovate-oblong, base pointed to wedge-shaped, tip blunt, or flat, appressed-velvet-hairy beneath, stipules 4–7 × 2–4 mm, tapering. Flowers are borne in raceme-like few-flowered clusters in leaf-axils, up to 14 cm long. Flowers are 1.4–1.7 cm long; flower-stalks 2–3 mm long; bracts 4–5 × 1–1.5 mm. Calyx-tube is 2–3 mm long, bell-shaped, velvet-hairy; sepals unequal, 3–6 mm long, velvet-hairy. Flower is rose to pinkish-white; standard 1.5–1.7 × 1–1.3 cm, obovate. Pods are 4–6.5 × 0.4–0.6 cm, linear, slightly curved upward toward the tip. Seeds 3-4 mm long, round, dark-brown colour. Flowering occurs in June-September.\(^2\)\(^-\)\(^3\)

Phytochemical investigations revealed the presence of a number of phytocnsitituents like carbohydrates, protein, gums and mucilage, fixed oils, fats, amino acids, glycosides, alkaloids, saponins, lipids, flavonoids, tannins, phenolics, and phytosterols. Whole plant may be used for its rich flavonoid and polyphenol content. Though a lot of research is going on in the plant. The bioactivity associated with the plant has been studied extensively, indicating the phytoconstituents present in the genus of Tephrosia is available such as T. purpurea, T. falciformis, T. leptostachya T. wallichii, T. subtriflora, T. uniflora, T. villosa, T. strigo. Manifested various biological activities such as anti-diabetic, anti-ulcer, anti-diarrheal, wound healing, anti-inflammatory, insecticidal, anti-viral, anti-protozoal, anti-fungal, anti-plasmodial, and many other activities for many plants from this genus have been used traditionally for the treatment of diseases like rheumatic pains, syphilis, dropsy, stomach ache, diarrhea, asthma, abortifacient, respiratory disorders, laxative, diuretic, and inflammation etc. Several literature surveys showed a very few or no reviews were available which correlates
the data of phytochemical, pharmacological, and molecular properties of the genus Tephrosia together. Thus, the main purpose of this review is to cover completely and provide up-to-date knowledge of pharmacological and phytochemical research work carried out on this genus.\cite{4-5}

**Phytoconstituents**

To study the phenetic and phytochemical variations of six Tephrosia species (Tephrosia purpurea, Tephrosia villosa, Tephrosia noctiflora, Tephrosia tinctoria, T. maxima, and Tephrosia pumila), sixteen floral and vegetative characters of Tephrosia spp. were examined. Air-dried leaves were subjected to sequential solvent extractions using solvents with different polarities such as hexane, chloroform, and methanol. These extracts were subjected to preliminary phytochemical screening tests to detect the occurrence of alkaloids, saponins, glycosides, tannins, flavonoids, carbohydrates, protein, amino acids, phenolics, and phytosterols etc.\cite{6} Some of the constituents may have direct activity and the other inert substances may increase bioavailability and reduces the toxicity and also contain tephrosin, dengulin, quercetin, isothephosin and rotenone. In the roots and leaves 2.5% rutin is found. A new β-hydroxychalcopurpurnone, Isolonchocarpin, pongamol, Lanceolatin A, Lanceolatin B, Karanjin, Kanjone and β-sitosterolis isolated from whole plant.\cite{7-8}

**Pharmacological activities**

All over the world scientific research is getting momentum to evaluate the pharmacological activities, side effects and medicinal uses of Tephrosia purpurea (L.) and on the basis of various experimental and clinical researches, the following pharmacological activities or medicinal properties of have been reported.

**Antioxidant activity**

Due to presence of several biologically active compounds T. purpurea has great antioxidant activity. Ethanolic extract of this plant showed potential against lipid peroxidative effect as well as enhanced antioxidant potential in DMBA (7,12-dimethyl benz(a)anthracene) painted animals. Leaves of T. purpurea has antioxidant potential. Its ethanolic extract and ethyl acetate extract were studied for CCl4 (Carbon tetrachloride) induced lipid and superoxide generation among which ethyl acetate has improved antioxidant activity. Roots extract of T. purpurea showed free radical scavenging activity with oxidative stress and xanthine oxidase activity. The aqueous extract whole plant has potential of free radical scavenging activity in DPPH free radical.\cite{9-12}
Anti-Inflammatory and Analgesic activity

Anti-Inflammatory and Analgesic activity

Anti-Inflammatory and Analgesic studied the ethanolic Extracts of the aerial and root parts of Tephrosia purpurea for anti-inflammatory and analgesic activities. The extract (250, 500 mg/kg, b.w) produced dose-related inhibition of carrageenan-induced paw edema and cotton pellet-induced granuloma in rats. At the same doses, analgesic activity was also observed by tail immersion method in which temperature was maintained at 55°C. The results obtained from the two models showed that Tephrosia purpurea ethanol extracts can effectively reduce inflammation in both the acute and chronic phases and it can significantly inhibit the responses to thermal stimulus, when compared to the standard drug Indomethacin.[13]

Antimicrobial activity

The antimicrobial activity of Tephrosia purpurea. Preliminary testing of antimicrobial activity of Tephrosia purpurea against 3 standard cultures (Staphylococcus aureus, Pseudomonas aeruginosa, E. coli and one clinical isolate of Candida spp. was performed with water extracts of leaves, pods and roots using the ‘Disc Diffusion Bioassay’. Subsequently, the antimicrobial activity of ethanolic root extract against the above three standard isolates and clinical isolates of two strains of Staphylococcus, two strains of Pseudomonas and nine coli forms were tested using the ‘Well Method’. The active extracts were subjected to the Minimum Inhibitory Concentration (MIC) agar dilution method, to determine the minimum inhibitory concentration of each extract. Further, the effect of plant maturity was tested on the antimicrobial activity of Tephrosia purpurea. Ethanolic root extracts of Tephrosia purpurea were found to be active against Pseudomonas aeruginosa, two other Pseudomonas strains and two coli form strains.[14]

Wound healing activity

T. purpurea has potential of prohealing and able to improve collagen maturation by cross linking. Its antioxidants help to prevent the damage caused by free radicals by quenching superoxide radicals and also reported that ethanolic extract of T. purpurea have effective wound healing capacity because of increased fibroblast and collagen fibers promoting angiogenesis in wound. Ethanolic extract of this plant potentially stimulate wound contraction by increasing tensile strength.[15-16]

Antiulcer activity

The studied the effect of extract of T. purpurea on different types of ulcers. They found significant results in all the tests which were performed by them. Aqueous extract of T.
purpurea significantly affects ethanol induced gastric ulcers at the dose of 1-20 mg/kg. Whereas 10 and 20mg/kg give appropriate result on 0.6 M HCl induced gastric ulcers. On indomethacin induced gastric ulcer they required only 5-20 mg/kg. Similarly on cysteamine – induced duodenal ulcer 5-20mg/kg is sufficient. For the pylorus ligands rats 5-10 mg/kg dose is beneficial for the significant reduction in gastric ulcer and total acid output as compared to control group.[17]

**Spasmolytic activity**

Soni et al., (2004) performed the experiment for spasmolytic activity from leaves on isolated tracheal tissue of guinea pig. The effect of alcoholic and water extract of T. purpurea was dose dependent and the action was prolonged with increase in dose. Similarly, also tested spasmolytic effect of crude methanolic extract of whole plant of T. purpurea on isolated jejunum of rabbit for possible presence of spasmogenic and/or spasmolytic activity. The extract exhibited inhibitory effect on spontaneous contractions of isolated rabbit’s jejunum preparations and was dose dependent.[18-19]

**Diuretic activity**

This studied of diuretic effect of T. purpurea on male albino rats weighing 150 – 180 g and divided them into five different groups. Group I was served as control and was fed with normal saline. On other hand group II and III received osmoticdiuretic urea (1 g/kg b.w.), high – ceiling diuretic and furosemide. Whereas group IV and V received the different concentration of METP (methanol extract of T. purpurea) (200 mg/kg and 400 mg / kg b.w.). All the test animals were placed at room temperature 25±0.5°C without food and water for 24 hours. After 24 hours urine sample was collected and analyzed by flame photometer. They found that T. purpurea significantly increased the flow rate of urine, electrolyte excretion and maintains the pH as compared to control and similar drugs.[20]

**Anti-diabetic activity**

The anti-diabetic activity of methanolic extract of T. calophylla was carried out both by in-vitro and in-vivo methods against alloxan-induced diabetes in albino Wistar rats. The results showed that there was a significant reduction in the blood glucose levels when compared with the diabetic control group. The extract was also effective in reducing the serum concentrations of serum glutamic oxaloacetic transaminase, triglycerides (TG), total cholesterol (TC) and urea, and increased insulin level. Tephrosia calophylla could also inhibit
the in-vitro α-glucosidase and α-amylase activity. The flavonoid rich fraction of the ethanolic extract of T. purpurea was used to evaluate the anti-diabetic activity.\(^{[21-22]}\)

**Anti-hyperlipidemic activity**

Different parts of the plant like stem, root, leaves, and whole plant also (excluding leaves) extracts of T. purpurea were screened for the anti-hyperlipidemic activity. It decreased the TC, TG, low-density lipoprotein, very low-density lipoprotein, and increased high-density lipoprotein levels, thus providing a significant evidence that the plant extract processes anti-hyperlipidemic activity by inhibition of β-Hydroxy β-methylglutaryl-CoA (HMG-CoA) reductase enzyme.\(^{[23]}\)

**Anticarcinogenic activity**

Leaf extracts of T. purpurea in different solvents have good cytotoxic activity against MCF-7 human breast cancer cell line because of its flavonoids and phenolic compounds\(^{[24,25]}\) reported that methanolic extract of this plant showed great potential against n.n-diethylnitrosamine induced hepatocellular carcinoma in swiss albino found that ethanolic root extract of T. purpurea has potent chemo preventive efficacy and anti lipid peroxidative effect in DBMA induced oral carcinogens. According to\(^{[26]}\) aqueous and ethanolic extracts of roots of this plant showed potential anticancer activity against Ehrlich ascites carcinoma cells in swiss albino mice. Ethanolic extract of T. purpurea able to reduce TBARS (Thiobarbituric acid reactive substances) level and also enhances the antioxidants status in the circulation of 1, 2 - dimethylbenz -(a)- anthracenes painted hamsters.\(^{[27]}\)

**Antidiarrheal activity**

the Anti diarrheal activity of methanolic extract of whole plant extract of Tephrosia purpurea against castor oil induced diarrhea in mice. Castor oil was administered orally to mice to induce diarrhoea and subsequently, different doses of Tephrosia possible anti diarrheal activity in the control group of animals the frequency of diarrhoea induction was high and almost all of the treated animals were found to develop diarrhoea. The mice treated with verapamil were found to be highly protected (80%) from diarrhea and only one mouse was found to develop diarrhoea. The group of mice to whom 300 mg/kg Tephrosia purpurea extract was administered partial protection (40%) from diarrhoea was observed, whereas group of mice treated with 500 mg/kg of Tephrosia purpurea exhibited 80% protection from diarrhoea, which is comparable to the protection provided to the verapamil treated group.
thus oral administration of methanolic extract Tephrosia purpurea shows anti diarrheal activity against castor oil induced diarrhea.[28]

Antiviral Activity
Antiviral Activity has evaluated the Methanolic flower extracts of Tephrosia purpurea investigated for antiviral activity by using viruses viz. HEL cell cultures, Hela cell cultures and Vero cell cultures and antibacterial in Gram +ve and Gram –ve bacteria. The results indicates antiviral activity of the extract of Tephrosia purpurea flowers against viruses and also very good antibacterial activity again strains Gram + ve, and Gram – ve, strains.[29]

Hepatoprotective activity
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 aspartateaminotransferase, 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 aspartateaminotransferase, 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.[30]

Immunomodulatory activity
The flavonoid fraction from aerial parts of T. purpurea (FFTP) was studied by its effect on humoral and cellular functions and on macrophage phagocytosis in mice at the rate of 10 - 40 mg/kg. It potentially inhibited sheep red blood cells (SRBC) - induced delayed type hypersensitivity reaction when given by oral route. It also decreased erythrocytes specific haemagglutinin antibody titre in sheep. Although, it failed to show any change in macrophage phagocytic activity. Vinay et al., (2010) reported that methanolic extract of aerial parts of T. purpurea showed significant immunomodulatory effect which was evaluated by carbon clearance and WBC count method in the group of animals.[31-32]
Antiepileptic activity
T. purpurea has a long history of its use in the traditional system against epilepsy. Asuntha et al. (2010) evaluated the impact of ethanolic extract on lithium-pilocarpine induced status epilepsy and brain lipid peroxidation and in-vitro antioxidant activity. Administration of ethanolic concentrates at 1000 mg/kg showed a decrease in the severity of status epilepticus and protection from seizures.[33]

Antituberculosis activity
This documented the presence of compound rock iron [Fe (OH)3] solubilizing compound from the root extract of T. purpurea that aides in plant metabolism. This compound competes with other microbes for iron in the environment and likewise hinders M. tuberculosis growth under in-vitro conditions, thereby indicating anti-tuberculosis potential.[34]

Antimalarial activity
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).[35]

Anthelmintic activity
The ethanolic extract of T. calophylla roots was screened for anthelmintic activity at various concentrations against adult Indian earthworm, Pheretimaposthuma, as it shows anatomical and physiology resemblance with intestinal round worm’s parasite of human beings. The results obtained in this study proved that the efficacy of ethanolic extract T. calophylla taken at the dose of 100 mg/ml showed significant anthelmintic activity and it is a dose dependent activity which may be due to the presence of flavonoids in another study, the methanolic and aqueous leaf extract of T. purpurea also demonstrated in-in vitro anthelmintic activity.[36-37]

Anti-fungal activity
Tephrosia purpurea exhibited anti-fungal activity. This was found against 61 endophytic fungus strains with different colony morphologies isolated from the leaves, stem, and root of T. purpurea. Anti-fungal activity when measured by dual culture testing, out of 61 isolates, depending on the colony morphologies, the isolates exhibited broadest anti-fungal spectrum
of activity, hence proving promising anti-fungal activity of the bioactive components present in T. purpurea.\textsuperscript{[38]}

**CONCLUSION**

The present based on our review, Tephrosia purpurea whole plant can be used mainly The genus Tephrosia contains more than 400 species of flowering plants distributed worldwide. Most of the species of the genus Tephrosia including T. pondoensia, T. odorata, T. socotrana, T. rosea, T. clementii, T. densiflora, T. pumila, and T. tinctoria, etc. are poisonous due to the high content of flavonoids and are used as fish poisons. The thin-layer chromatographic finger printings revealed the presence of quercetin. Phytochemical works reveal the presence like carbohydrates, protein, gums and mucilage, fixed oils, fats, amino acids, glycosides, alkaloids, saponins, lipids, flavonoids, tannins, phenolics, and phytosterols. Whole plant may be used for its rich flavonoid and polyphenol content. Pharmacological activities of the plant extracts and its isolated compounds such as Antioxidant, Anti-Inflammatory And Analgesic, Antimicrobial, Wound Healing Potential, Antiulcer, Spasmolytic, Diuretic, Anti-Diabetic, Anti-Hyperlipidemic, Anticarcinogenic, Antidiarrheal, Antiviral, Hepatoprotective, Immunomodulatory, Antiepileptic, Antituberculosis, Antimalarial, Anthelmintic, Anti-Fungal. Further studies should also focus on its long-term and adverse toxic effects on target organs in correlation with the specific pharmacological activity. Therefore T. purpurea is the plant of choice for future as its name given in Ayurveda “Sarwawranvishapah”.

**REFERENCES**


