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Tephrosia purpurea: A Potential Healer Plant

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ABSTRACT

Tephrosia purpurea is a species of flowering plant in the pea family, Fabaceae, which has a pantropical distribution. In Ayurveda it is mentioned as “*Sarwawranvishapaha*” which implies that it can heal any kind of wound. It is wild herb and usually is found in common wasteland. The plant has no specific soil or climate requirements, however, it grows on 400-1300m above sea-level. It can be grown in dry, sandy or rocky soils. It can be found in countries like India, China, Sri Lanka, Pakistan, Bangladesh, Myanmar, and various South-east Asian countries. It has various tribal uses varying according to the tribes in respective countries. This following article gives information on various Pharmacological activities, its botanical description, how it varies in different seasons. It contains various phytoconstituents like glycosides, flavanoids, isoflavones, etc.

INTRODUCTION

The plants are used in large scale as a medicine to treat several kinds of diseases for human welfare from long time. *Tephrosia purpurea* is a species of flowering plant in the pea family, Fabaceae, has a pantropical distribution. It is a common wasteland weed. In many parts it is under cultivation as green manure crop. It is found throughout India and Sri Lanka in poor soils. It can also be found in some parts of China, Myanmar, Bhutan, Bangladesh, Indonesia and other south-Asian countries.⁽¹⁾

According to Ayurvedic texts it is called as “Sarvawranvishapah” which means the ability to cure all kinds of wounds⁽¹⁾. It is being used as folk medicine because of its several properties such as anticancer, antipyretic, antidiabetic, antiviral, anti-inflammatory etc. It is one of the most effective folk medicine for the treatment of inflammation as well as enlargement of liver and spleen. Due to this property it is also known as plihari or plihasathru where plihari denotes spleen⁽²⁾. This plant has also been used for the treatment of several gastrointestinal disorders and has ability to cure disorders related to bowel, kidney, liver and spleen⁽³⁾. It is widely distributed among India, Australia, China, and Sri Lanka up to 400 m to 1300 m altitude. It occurs naturally in the waste places along the roadsides and it prefers to grow in dry, gravelly or rocky and sandy soil⁽⁴⁾. This plant has a number of chemical compounds which are medically important. These compounds includes tephrosin, isotephrosin, rotenone, tannins, purpurin, phytosterols etc. are present in different parts of plant.

TAXONOMY

Family: Plantae

Class: Angiosperms

Sub-Class: Eudicots

Order: Fabales

Family: Fabaceae

Tribe: Milettieae

Genus: Tephrosia

Species: Purpurea

Binomial Name: *Tephrosia purpurea*

VERNACULAR NAMES

English - Wilde indigo, Fish poison, Common Tephrosia, Purple Tephrosia

Sanskrit - Sharpunkha

Hindi - Sarponkh

Rajasthani - Masa

Gujrati - Unhali

Urdu - Satawar

Tamil - Kolinchi, KollukkaiVelai, kaaivelai

Telugu - Vempali, Pamparachettu

Malayalam - Kozhinnila

Kannada - Kaggi

Marathi - Sharpankha, Unhali

Nepali - Kandesakhinu, Sakinu

Bengali - Janglineel, Bannilgach

Oriya - Soropunkha

Duk - Jangli-kulthi

French - Indigo sauvage

Hawaiian – Auhuhu

BOTANICAL DESCRIPTION

Common Tephrosia plant is annual or short-lived, up to 50 cm – 90cm tall. Leaves are compound, leaflets 7-15, 1-2.8 x 0.3-1 cm, inverted-lance shaped or obovate, base wedge-shaped, tip blunt to notched or flat, with a short sharp point; stipules 3-6 mm long, lance shaped. Flowers are about 4-9 mm long, in few-flowered, leaf-opposed, raceme-like clusters.

Flower-stalks are 3-4 mm long; bracts about 2 mm long. Calyx is 3-4 mm long, velvet-hairy; sepals tapering to a point. Flowers are pink to purplish, pea-flower shaped. Standard is about 4 mm broad, round. Staminal tubes are 4 mm long. It has campanulate persistent calyx having cup size of 1.4-2.3 mm x 1.5-3.2 mm which is unequally 4-toothed inside pubescent teeth, 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 ⁽⁴⁾. Pods are 2.5-4 cm long, 3-4 mm broad, linear-oblong, 5-7-seeded. Seeds ellipsoid, dark brown. Common Tephrosia is found in Indo-Malesia region, including Western Ghats. Flowering: October-December. The plant has a range of traditional medicinal uses, being harvested from the wild and used locally. It is also cultivated as a green manure crop ^[5]. Venation of leaves is distinct on both sides. Its inflorescence is an axillary or leaf opposed pseudo-raceme with length (1.5-) 10-15(-25) cm long sometimes having basal leaf like bracts ⁽⁴⁾.

TRIBAL USES

According to Ayurveda system, it is called as “Sarwawranvishapah” which reveals that it has the ability to heal any type of wound ⁽⁶⁾. It is used as a home remedy for healing wounds. Several ethno-botanical articles revealed this plant as a folk medicine and also used for the treatment of cuts and wounds in broad spectrum. It is one of the effective folk medicine for the treatment of inflammation as well as enlargement of liver and spleen. This property it is also known as plihari or plihasathru where plihari denotes spleen ⁽²⁾. This plant has also been used for the treatment of several gastrointestinal disorders and has ability to cure disorder related to bowel, kidney liver spleen ⁽³⁾⁽⁷⁾. Dried parts of the plant can be used effectively for the treatment of boils on skin, bleeding piles, bronchitis, etc. It also has diuretic property ⁽⁸⁾. The roots can be decocted and is useful in enlargement and damage of liver. It can be used as mouthwash and very helpful against gingivitis ⁽⁹⁾. Its roots are able to cure several skin disorders, can be used in elephantiasis, flatulence, asthma, anemia, chronic fever. Moreover, roots and seeds of this plant can be used as insecticide as well as pesticide. The roots are also used as herbal fish poison by many hunters in Gunia. Its seeds oil has anthelmintics properties and also used in scabies and leucoderma. Leaves of this herb can be used in syphilis, gonorrhoea, pectoral diseases etc. ⁽¹⁰⁾.

PHYTOCHEMISTRY

T. purpurea has been studied for its chemical constituents and pharmacological activities. Phytochemicals isolated from *T. purpurea* includes flavonoids, esters, neo-flavonoids, sterols, acids etc.

Roots

Roots contain several important phytochemicals such as tephrosin, deguelin, isotephrosin, rotenone, tannins, purpurin sterols, glycosides which has been frequently used for the treatment of wounds, boils, pimples, liver and spleen diseases, useful for the treatment of asthma, chronic diarrhoea, helpful in enrichment of blood ⁽¹¹⁾.

Seeds

Seeds contain tephrosin, deguelin, quercetin which is helpful for the treatment of poisoning due to bite of rat ⁽¹¹⁾.

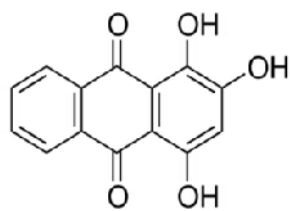
Leaves

Similar to roots and seed leaves are also have several important phytochemicals which are useful. Leaves contain osyritin, glycosides, rutin, rotenone, tephrosin, pongamol, semiglabin. These are useful for the treatment of lungs diseases, piles, syphilis, and gonorrhoea. These are also helpful for improvement of appetite ⁽¹¹⁾.

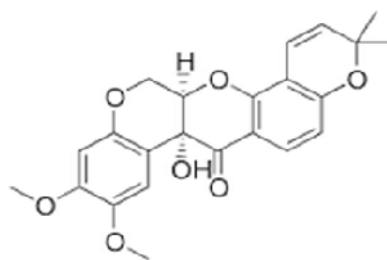
Whole plant

This plant contains a number of phytochemicals which are having several ethnopharmacological applications. This plant as a whole has lot of other applications. It is anthelmintic, blood purifier, useful for the treatment of heart diseases, liver and spleen disorders, useful for the treatment of leprosy, bronchitis and various ulcers ⁽¹¹⁾.

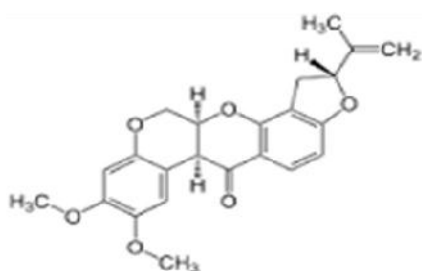
Some major phytoconstituents are shown in Fig.1 along with their structures as follows:



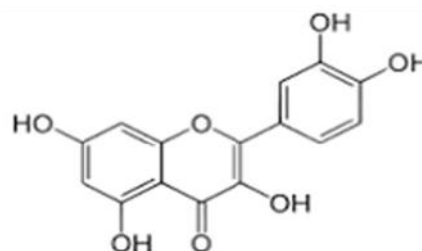
Purpurin



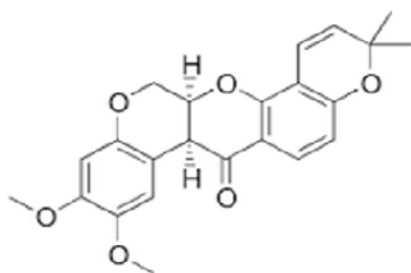
Tephrosin



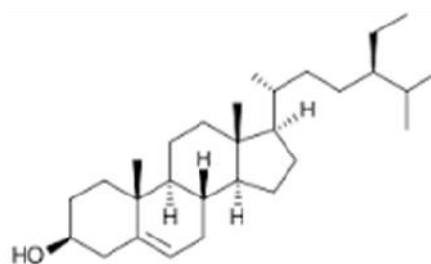
Rotenone



Quercetin



Deguelin



β -Sitosterol

Figure No. 1: Some Major Phytoconstituents of *T. purpurea*

SEASONAL VARIATION:

T. purpurea showed huge variation in the phytochemicals of the plant material collected in different seasons due to seasonal impact. They reported that the total phenolic content as well as total flavonoid content of the plant were high in 95% ethyl alcoholic extract of the material

collected in August contrary lowest in 50% hydro-ethanol extract of plant material are collected in December. They also found that most abundant flavonoid glycoside was quercetin-3-O-rhamnoglucoside in all the seasons. *T. purpurea* collected in summer (March-May), rainy (July-September) and winter (October-December) seasons were quite similar; however they showed marked differences in the quantitative content of the 3 major glycoside flavonoid quercetin-3-O-rhamnoglucoside, biochanin A-7-O-rhamnoglucoside and kaempferol-3-O-rhamnoglucoside. Total concentration of all three flavonoid glycosides were maximum in the 95% ethanolic extract of rainy season sample, followed by the 95% ethanol extract of summer season sample and least in 50% hydroalcoholic extract of winter season ⁽²⁶⁾.

PHARMACOLOGY ACTIVITY

Wound Healing activity

Tephrosia purpurea has potential of healing and able to improve collagen maturation by cross linking. It contains antioxidants that help to prevent the damage caused by free radicals by quenching superoxide radicals and is also reported that extract obtained from ethanol of *T. purpurea* have effective wound healing capacity because of increased number of fibroblast and collagen fibers promoting angiogenesis inside the wound. Extract obtained from ethyl alcohol of this plant potentially stimulate wound contraction by increasing its tensile strength ^{(12) (13)}.

Anti-carcinogenic activity

Extracts obtained from leaves of *T. Purpurea* in different solvents have good cytotoxic activity against MCF-7 that is human breast cancer cell line because of its flavonoids and phenolic compounds and it is also reported that methanolic extract of this plant showed great potential against n,n-diethylnitrosamine induced hepatocellular carcinoma in swiss albino rat. ⁽¹⁴⁾⁽¹⁵⁾ The ethanolic root extract of *T. purpurea* has potent chemopreventive efficacy and also has anti-lipid peroxidative effect in DBMA induced oral carcinogens ⁽¹⁶⁾. The aqueous and ethyl alcoholic extracts of roots of this plant showed potential anticancer activity against *Ehrlich ascites* carcinoma cells in swiss albino mice ⁽¹⁷⁾. Extract of *T. purpurea* obtained from decoction in ethyl alcohol was able to reduce TBARS (Thio-Barbituric Acid Reactive Substances) level and also enhances the antioxidants status in the circulation of 1, 2-dimethylbenz-(a)-anthracenes painted hamsters ⁽¹⁸⁾.

Anti-inflammatory activity

Extract of whole plant (roots as well as aerial parts) obtained from decoction in ethyl alcohol gives dose related inhibition of both acute as well as chronic phase inflammation⁽¹⁹⁾. Oral administration of ethanolic extract of *T. purpurea* shows significant anti-inflammatory effect in subcutaneous inflammation. It is also reported that anti-inflammatory activity of *T. purpurea* seeds extract is due to presence of various bioactive compounds such as flavonoids and triterpenoids⁽²⁰⁾. Ethyl alcoholic root extract of *T. purpurea* at dose of 200 and 400 mg/kg have a significant effect in the management of inflammation and pain. It reduces the carrageenan induced paw edema volume in rats. The administration of 40 mg/ kg methanolic extract of *T. purpurea* stem showed effective inhibition in edema volume in carrageenan induced model because of high concentration of compound which inhibits prostaglandin synthesis.

Anti-Ulcer activity

Studies show that the antiulcer activity of aqueous extract of *Tephrosia purpurea* in rats and mice in which gastric ulcers were induced by oral administration of ethanol or 0.6 M HCl or indomethacin or by pyloric ligation and duodenal ulcers were induced by oral administration of cysteamine HCl. The antiulcer activity of *Tephrosia purpurea* was assessed by determining and comparing the ulcer index, total gastric acid output and pepsin activity were estimated in the pylorus ligated rats/mices. The anti-ulcer property of plant extract was more prominent in HCl, indomethacin and pyloric ligation models. The results suggested that the plant extract possesses significant antiulcer property which could be either due to cytoprotective action or by strengthening of gastric and duodenal mucosa and thus enhancing mucosal defense⁽²¹⁾.

Anti-Microbial activity

The antimicrobial activity of *Tephrosia purpurea* was screened. 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 *coliforms* 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 coliform strains ⁽²²⁾.

Anti-Diarrheal activity

Evaluation of 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 purpurea* were administered orally to see the possible antidiarrhoeal 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 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, thus oral administration of methanolic extract *Tephrosia purpurea* shows anti diarrheal activity against castor oil induced diarrhea ⁽²³⁾.

Antioxidant activity

The antioxidant activity of ethanolic extract of *Tephrosia purpurea* was performed for in Carbon tetrachloride (CCl₄) induced lipid peroxidation *in-vivo* and superoxide generation *in-vivo*. The ethyl acetate fraction of the same extract was studied for free radical scavenging and anti lipid peroxidation activity. The IC₅₀ values in both of these *in-vitro* assays were found to be significantly reduced for ethyl acetate fraction compared with the ethanolic extract of the plant. The observation was further supported by comparing the *in-vivo* antioxidant activity for both the ethanolic extract and its ethyl acetate fraction. The study concluded that the ethanolic extract of *Tephrosia purpurea* exhibits antioxidant activity *in-vivo* and the ethyl acetate soluble fraction has improved antioxidant potential than the ethanol extract. Results revealed the chemical constituent of plant is responsible for their free radical scavenging activity and also responsible for their hepatoprotective activity ⁽²⁴⁾.

Anti-incendiary and pain relieving action

Base of *Tephrosia purpurea* plant was removed with ethanol dissolvable. Ethanolic extract was favored for calming and pain relieving movement different trial creature models. Wistar

pale skinned person rats were utilized to assess mitigating and pain relieving movement for that reason root concentrate of *Tephrosia purpurea* was Carrageenan-induced rat paw edema and cotton pellet granuloma models. Diclofenac and Morphine were utilized as reference medications for calming and pain relieving exercises separately. Ethyl alcoholic concentrate of *Tephrosia purpurea* was indicated critical result on both exercises. Different parts of plant are by and large guaranteed to be utilized for treatment of diseases like bronchitis, asthma, aggravation, bubbles, pimples, development of spleen, infections of liver, heart, kidney and blood, in tumors, ulcers, infection and asthma. Thusly, in present survey endeavor has been made to investigate information on legends uses, phytochemistry and pharmacological exercises of *Tephrosia purpurea*.

Anti-viral activity

Evaluation of the methanolic flower extracts of *Tephrosia purpurea* were investigated for antiviral activity by using viruses namely, HEL cell cultures, Hela cell cultures and Vero cell cultures and antibacterial in Gram +ve and Gram –ve bacteria. The results indicated antiviral activity of the extract of *T. purpurea* flowers against viruses and a very good antibacterial activity against Gram positive (+ve), and Gram negative (-ve), strains⁽²⁷⁾.

The other pharmacological activity of *T. purpurea* is summarized in Table no. 1 as follows:

Table No. 1:

S. No.	Pharmacological activity	Part involved
1	Anti-ulcer activity	Roots
2	Anti-carcinogenic activity	Roots
3	Anti-microbial	Roots
4	Anti-inflammatory	Roots
5	Antioxidant	Roots, Leaves, Seeds
6	Ameliorates carbon tetrachloride (CCl ₄) induced hepatic injury	Roots
7	CNS depressant and analgesic activity	Roots
8	Ameliorates benzoyl peroxide induced cutaneous Toxicity	Leaves
9	Alleviates phorbol ester induced tumour promotion	Leaves

10	Spasmolytic activity	Leaves
11	Antihyperglycemic and anti lipid peroxidative activity	Leaves
12	Anti-Pyretic	Leaves
13	Anti-hyperlipidemic activity	Leaves
14	Anthelmintic activity	Leaves
15	Ameliorates diethylnitrosamie and pot. bromate mediated renal oxidative stress	Whole plant
16	Antileishmanial activity	Whole plant
17	Anti-epileptic activity	Whole plant
18	Anticarcinogenic and anti-hypercholesterolemic	Whole plant
19	Anxiolytic activity	Whole plant
20	Diuretic activity	Whole plant
21	Anti-diarrheal	Whole plant
22	Hepatoprotective activity	Aerial part
23	Anti-cholestatic activity	Aerial part
24	Inhibition of mast cell degranulation and haemolysis	Aerial part
25	Immunomodulatory activity	Aerial part
26	Anti-asthmatic activity	Aerial part
27	Wound healing activity	Aerial part
28	Anti-tumor activity	Seeds
29	Anti-hyperglycemic and antioxidant activity	Seeds
30	Anti-viral activity	Flowers

TOXICITY

The acute toxicity test in swiss albino mice at the oral dose of 50, 300, and 2000 mg/kg and their behavioral changes and mortality was observed. For subcutaneous toxicity they took Wistar rats of either sex which were administrated with two doses 200 and 400 mg/kg and were observed for 28 days. They found that *T. purpurea* was well tolerated up to dose of 2000 mg/kg⁽²⁵⁾.

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