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Review Article

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Therapeutic potential of *Tephrosia purpurea*

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ABSTRACT

Nature's beauty in terms of health care is appreciated by developing various systems of traditional system (Ethno-medicine). There is growing focus on the importance of medicinal plants in the traditional health care system in solving health care problems. The demand for herbal products is growing exponentially throughout the world. Finding healing power in plants is an ancient idea. Recently there has been a shift in universal trend from synthetic to herbal medicine, which we can say Return to Nature'. Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments. Tephrosia purpurea (TP) is a species of flowering plant in the pea family, Fabaceae, a common wasteland weed and grows in poor soils. TP has played an important role in the traditional medicine. Thus, the modern pharmacological and clinical investigation of TP is a valuable herbal therapy that has an antioxidant, antimicrobial, anti-inflammatory, anti-viral and antiulcer properties. Overall, several properties appears to be the most promising pharmacological effect of TP. However, the lack of a detailed ethnopharmacological, pharmacological and phytochemical analysis of TP is an important limitation. Thus, there is a need of further research to explore the meaningful properties of TP. However, review of this paper enlightens the ethnopharmacological, pharmacological, modern pharmaceutical uses of TP.

Keywords: *Tephrosia purpurea*, Ethanopharmacology, Traditional uses

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INTRODUCTION

Tephrosia purpurea Linn. (Leguminoseae), commonly known in Sanskrit as Sharapunkha is a highly branched, sub-erect, herbaceous perennial herb. In Ayurvedic literature this plant has also given the name of "Sarwa wranvishapaka" which means that it has the property of healing all types of wounds [1]. It is an important component of some preparations such as "Tephroli" and "Yakrifit" used for liver disorders [1,2]. The roots and seeds are reported to have insecticidal and piscicidal properties and also used as vermifuge. The roots are also reported to be effective in leprosy wound and their juice, to the eruption on skin [3]. The aqueous extract of seeds has shown significant in vivo hypoglycaemic activity in diabetic rabbits [4]. The ethanolic extracts of *Tephrosia purpurea* possessed potential antibacterial activity. The total flavanoids were extracted from plant found to have antimicrobial activity[5].

During our literature survey, we found that this plant have more potential as far as therapeutic concern. In present review, we have tried to summarize the research studies carried out for a scientific validation of the plant and its extracts. This review certainly help to the researchers those are working on this very plant for their research work.

Geographical distribution

Tephrosia purpurea is a common wasteland weed species of flowering plant belongs to the pea family,that has a pantropical distribution. In many parts it is under cultivation as green manure crop. T. purpurea is widely distributed

throughout the world. It is the native plant of Africa, Southeast Asia to Australia, Western part of Pacific, China, Sri Lanka and India. In India, It is found in the areas of Andhra Pradesh, Haryana, Rajasthan, and Tamil Naidu[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

Botanical description
Tephrosia purpurea is a small shrub that grows up to 1.5 meters tall. It has bi-pinnate leaves with 7 to 15 leaflets, the terminal leaflet being solitary. The leaflets are 10 to 32 mm long and 5 to 11 mm wide. The peas like flowers are white to purple and arranged in inflorescences that are up to 25 cm long. The individual flowers have corolla parts that are between 2 to 3 mm long. The pods are straight and somewhat up curved at the terminal end and may range from 20 to 45 mm in length and 3 to 5 mm breadth. When dry, the pods split along two valves to reveal 2 to 9 black rectangular seeds 2.5 to 5 mm long and 1.8 to 3 mm wide [10,11].

Figure 1: Photograph of *Tephrosia purpurea* plant

Traditional uses
The plant is well documented in various traditional system of medicine to cure various disease conditions viz. Roots of *Tephrosia purpurea* are used for the treatment of bronchitis, wounds, pimples, boils, inflammation, liver disorders, asthma, snake bite diarrhoe and urinary disorders [12]. Seeds are used for poisoning due to rat bite. Leaves are used for diseases of lungs and chest, intestinal problems, gonorrhea, piles and syphilis [13]. Whole plant was used as the reatment for asthma, ulcers, leprosy, blood purifier, piles, and for dental cures. Roots and Flowers are used for cough and cold also effective for the problems related to kidney[13].

Ethno pharmacological activities
Tephrosia purpurea is used to cure several types of external wounds[14] and gastro-duodenal disorders[3]. The plant has also been claimed to cure kidney, liver spleen, heart and blood related disorders [3,4]. The dried herbs are effective as tonic laxative, diuretics, and used in the treatment of bronchitis, bilious febrile attack, boils, pimples and

bleeding piles[15]. An extract of pods is effective as analgesic, anti-inflammatory, and their decoction is used in vomiting like symptoms[5]. A decoction of *T. Purpurea* is prescribed in traditional medicinal systems for the treatment of these conditions [13]. Ethanolic extract of plant has been reported to have anticancer activity against in-vitro KB-cells culture[16].The aqueous extract of seeds has significant in-vivo antidiabetic activity[17] and ethanolic extracts possessed potential antibacterial activity[18]. Furthermore, the decoction of roots is believed to be efficacious against dyspepsia, chronic diarrhea and colic. Moreover, flavonoids have been found as antimicrobial [19].Roots are given in dyspepsia and chronic diarrhea [20],[21]. In Ayurvedic system of medicine various parts of this plant are used as remedy for impotency, asthma, diarrhea, gonorrhea, rheumatism, ulcer, urinary, tumors, leprosy, and bronchitis [22],[9],[23],[24].

Chemical constituents

The plant contain flavonoids such as rutin, purpurin, purpurenone and purpuritenin and quercetin, retenoids like deguelin, elliptone, rotenone, tephrosin and sterols such as sitosterol[25].An isoflavone, 7, 4-dihydroxy-3, 5-dimethoxyisoflavone and chalcone, (+)-tephropurpurin, are also reported to be present in Tephrosia purpurea[3].The major constituents in TP are Rutin, quercetin, retenoids deguelin, elliptone, rotenone, tephrosin and lupeol[26],[27] and minor are flavanones, lanceolatin A, B & C, isolonchocarpin, and purpurin from root and from entire plant is pongamol **[**28, 29]. An isoflavone 7, 4-dimethoxy -3, 5-dimethoxy isoflavone; a chalcone (+)-tephropurpurin, (+)-purpurin, pongamol, lanceolatin–B and pterocarpans [22],[30],[31]. Different phtoconstituents present in the plant are been shown in figure 2.

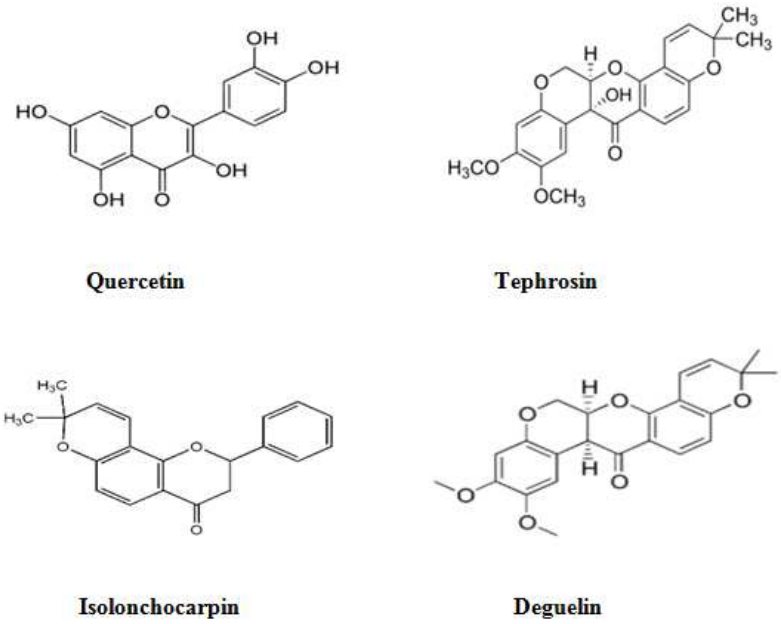

Figure 2: Chemical structure of important phytoconstituents present in *Tephrosia purpurea*

Whereas constituents with their therapeutic potential has been illustrated in table 1.

Table 1: Chemical constituents with ethanopharmacological uses of *Tephrosia purpurea*

Part used	Chemical constituent	Uses
Roots	Tephrosin, diguelin, isotephrosin, rotenone, tannins, phytosterols, glycosides, purpurin, isolonchocarpin	Diuretic, enriches the blood, useful in bronchitis, wounds, boils, pimples, liver and spleen diseases, asthma, inflammation, antiulcer, hepatoprotective, used in poisoning dur to snakebite, useful in enlargement of spleen, antidiarrhoel, also used in tympanitis, dyspepsia and chronic diarrhea.
Seeds	Tephrosin, diguelin, quercetin	Used in poisoning due to rat bite.
Leaves	Osyritin, 2% glycoside, rutin, rotenone, tephrosin, pongaglabol, semiglabrin,	Useful in diseases of lungs and chest, tonic to intestines, improves the apetite, treatment of piles, syphilis, gonorrhea.
Whole plant	β–sitisterol, ursolic acid, spinosterol, epoxyflavon, pongamol, tetratriacontane, rotenone, tephrosin, butelinic acid, 12-α-hydroxy rotenone, dimethylglabranin	Blood purifier, antihelmintic, digestible, antipyretic, alexeteric, cures diseases of liver, spleen, heart, blood, cures tremors, ulcers, leprosy, asthma, bronchitis, piles,

Mechanism of action of *Tephrosia purpurea*[32],[33],[26]

- Inhibit the growth of gram +ve and –ve bacteria, and fungus like Aspergillus nigar and Candida albicans

- Generation of free radicals.
- Increase activity of enzymatic antioxidant (SOD, CAT, GSH) and Insulin secretion.
- Decreases inflammatory cytokines, COX and LOX.

Phramacological uses of the plant has been demonstrated in figure 3.

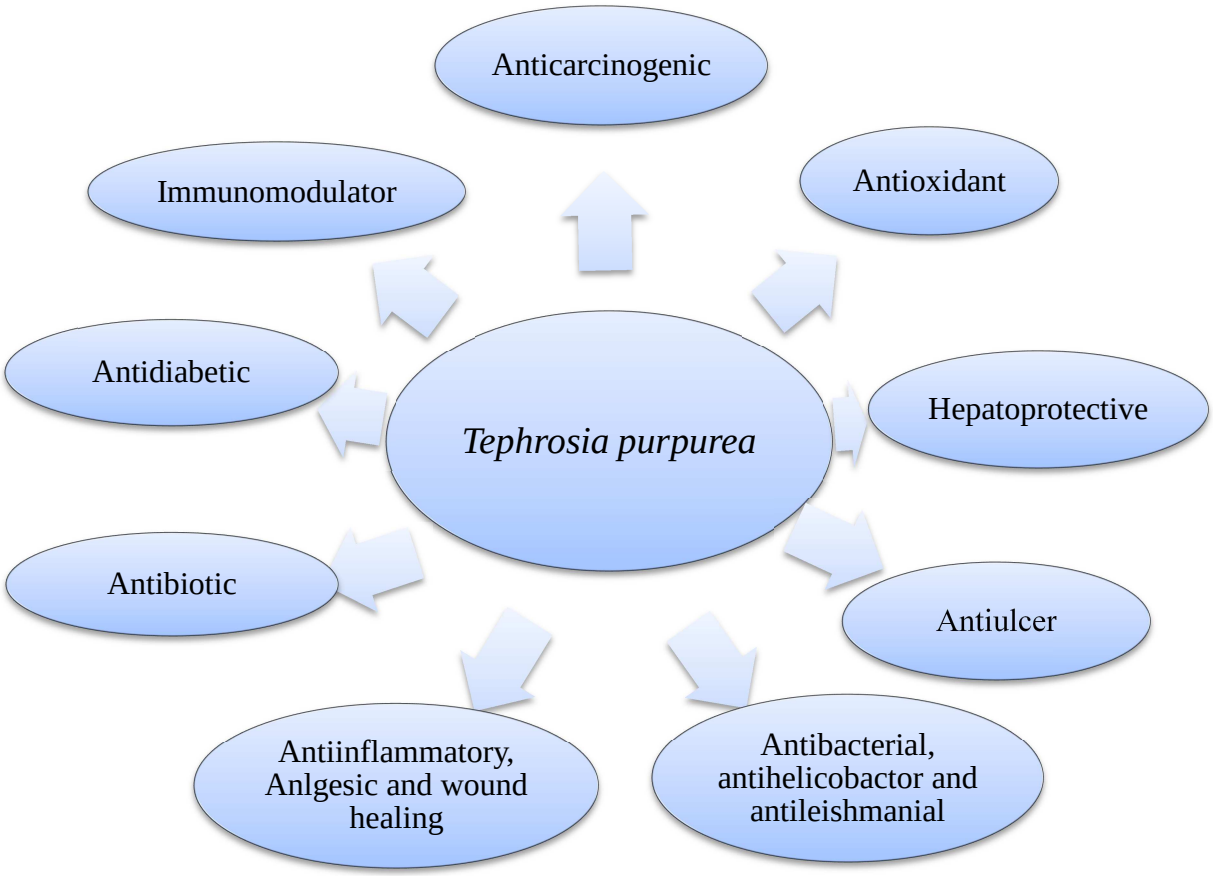

Figure 3: Pharmacological aspects of *Tephrosia purpurea*

❖Pharmacological profile of the plant (Scientifically validated uses)

The plant attracted the researchers for exploring its potentials as it is used for the treatment of large no. of ailments and improvement of many pharmacological activities. Its important activities are listed below, for which the plant (whole plant) was evaluated and found effective:

Pharmacological profile of Whole Plant:-

➢ **Antitumor activity:** Saleem et.al showed the Chemoprotective efficacy of *Tephrosia purpurea* ameliorates benzoyl peroxide- induced oxidative stress in murine skin against N-diethylnitrosamine- initiated and potassium bromate- mediated oxidative stress and toxicity in rat kidney. Further plant extract was found effective against 12-o-tetradecanoyl phorbal-13- acetate induced cutaneous oxidative stress and toxicity in murine skin. The pre treatment with Tephrosia purpurea prior to application of croton oil resulted in inhibition of cutaneous carcinogenesis [34],[13].

➢ Three species of Tephrosia (Tephrosia purpurea, Tephrosia maxima and Tephrosia calophylla) were assessed for toxicity on Artemia salina and animal cell lines. The investigation revealed that all three species of Tephrosia has been the potent cytotoxic agent and the order of there increasing cytotoxicity was T.purpurea< T.maxima< T.calophylla.

➢ **Anti-helicobacter:** The methanolic extract of *Tephrosia purpurea* has been evaluated for anti-helicobacter pylori activity. The methanolic extract showed the promising activity against clinical isolates and standard strains of helicobacter pylori including metronidazole-resistant strains. n-hexane and chloroform fractions of the extract possess significant activity. The extract and less polar fractions remains functionally active in acidic solution and

even with antibiotic resistant strains. Apolar fractions of Tephrosia purpurea have therapeutic potential in combating helicobacter pylori mediated gastroduodenal disorders.[29]

- **Antioxidant activity:** Different extracts and fractions of *Tephrosia purpurea* were studied for its antioxidant activity[13].The aqueous extract of the whole plant showed the free radical scavenging activity in DPPH free radical assay[35].The dried alcoholic extract of the plant showed free radical scavenging , hydroxyl radical scavenging[33].Inhibition of the carbon tetrachloride- induced lipid per oxidation in vivo and superoxide generation in activities [36]
- **Antileishmanial activity:** *Tephrosia purpurea* shows significant antileishmanial activity. Khan et.al found that the fraction obtained from the N-butanol extract of *Tephrosia purpurea* showed potent antileishmanial activity at 50 mg/kg for 5 days by providing oral route against leishmania donovani infection[37].
- **Wound healing property:** The ethanolic extract of plant possess wound healing properties. With an increase in the presence of fibroblasts and collagen fibers, and the promotion of angiogenesis in wounded area[38].

Pharmacological profile of the root

- **Antilithiatic activity:** Aqueous extract of *Tephrosia purpurea* root showed antilithiatic activity in two models of urolithiasis [39].The effect of aqueous extract of Tephrosia purpurea on the excretion and deposition of various calculi forming constituents was reported[39].
- **Anti-asthmatic activity:** Ethyl acetate extract of *Tephrosia purpurea* roots showed a significant protection of rat mesenteric mast cells from disruption caused by antigen. However, extract does not produced any significant difference in the count of all types of WBC detected in the bronchial fluid of sensitized animals [1].
- **Antimicrobial activity:** *Tephrosia purpurea* has potent antimicrobial effect against acne-inducing bacteria [16]. Methanol extract of Tephrosia purpurea root showed the antimicrobial activity. *Tephrosia purpurea* shows antimicrobial effect due to the presence of flavonoids [23].The fresh root extract of *Tephrosia purpurea* showed antibacterial activity evaluated by agar well diffusion [1].
- **Antibacterial activity:** Alcoholic extract of the root of *Tephrosia purpurea* possess mild antibacterial activity[40].The fresh juice of *Tephrosia purpurea* shows more significant antibacterial activity in comparison to aqueous extract of *Tephrosia purpurea* roots[41]. Ethanolic and methanolic extract of *Tephrosia purpurea* possess more potent antibacterial activity [40].

Pharmacological profile of seed

- **Antihyperglycemic activity:** The alcohol extract of *Tephrosia purpurea* seeds showed antihyperglycemic activity in streptozotocin induced diabetic rats at a dose of 300mg/kg bw orally showed potent antihyperglycemic and antilipidemic effects. It also increased the activities of enzymatic and nonenzymatic antioxidants [41].Alcoholic dried extract of Tephrosia purpurea showed significant inhibitory lipid peroxidation effect[33].
- The ethanolic extract of plant *Tephrosia purpurea* shows antihyperglycemic activity against high fat diet wistar rats model. A decrease in total cholesterol level of rats compared to hyperlipidemic control was observed. Hence, the extract shows the positive antihyperglycemic activity [42].
- **Immunomodulatory activity:** The oral aministration of flavonoid fraction of *Tephrosia purpurea* showed potent effect on cellular and hormonal functions and on macrophage phagocytosis in mice significantly inhibited sheep red blood cells induced delayed type hypersensitivity reaction. Significant dose-related decrease is determined in sheep- erythrocyte- specific haemagglutination antibody titre [43].

Pharmacological profile of aerial parts

- **Hepatoprotective activity:** Extracts of aerial parts of *Tephrosia purpurea* was reported for its efficacy in rats by inducing hepatotoxicity with D-glactosamine HCl (acute) and carbon tetrachloride (chronic). The administration of Tephrosia purpurea along with the hepatotoxins offered a protective action in both aute (D-galactosamine) and chronic (Ccl_4) models [44].

- Ethanolic extracts of leaves of *Tephrosia purpurea* showed the hepatoprotective activity . against carbon tetrachloride and it was confirmed that ethanolic extract of leaves shows more potent hepatoprotective activity than isolated flavonoids [26].
- Protective effect of HD-03, an herbal formulation in rats and an effect of *Tephrosia purpurea*, an herbal hepatoprotective on drug metabolism in patients with cirrhosis and hepatic enzyme function was been reported [45].

- **Antiallergic activity:** Ethanolic extract of aerial parts of *Tephrosia purpurea* showed the inhibitory effect on late-phase allergy by the inhibition of leukotriene synthesis [5].
- **Analgesic activity:** Five different fractions of *Tephrosia purpurea* were tested for analgesic activity using acetic acid induced writhing in mice and tail flick test in rats. Out of five fractions TPI and TPIII possess potent analgesic activities against different models of inflammation and pain [46].
- **Antacid activity:** The extract of *Tephrosia purpurea* was evaluated for antacid potential. Air bubbles were used from an aerator to mimic the peristaltic movements of stomach. Evaluation of potency of plant was done by extracting with three solvents increasing order of polarity[47]. Different parameters evaluated were neutralizing

effect, duration of neutralization effect and capacity and effect of temperation on pH. The result obtained showed that the methanolic extract showed higher neutralization effect duration effect and capacity. Whereas, ethyl acetate and chloroform extract showed moderate effect but less compared to standard drug [48].

- **Nephroprotective activity:** *Tephrosia purpurea* leaves possess a significant nephroprotective and curative activities without any toxicity. It also shows antioxidant potential and inhibit the overproduction of NO and Cox-2 expression. These activities is due to the presence of phenolic and flavonoids compounds like quercetin [26].
- **Antidote activity:** The protective activity of *Tephrosia purpurea* extract was evaluated against arsenic induced toxicity [33]. A significant decrease in the elevated glucose level, LDH levels and an increase in haematological levels was has been determined. Also, a reduce in haemorrhagic enteritis and presence of intact villi was noticed compared to arsenic treatd group. No significant difference in serum calcium, serum cholesterol and arsenic concentration in tissue was noticed compared to arsenic treated group [33].
- **Toxicological studies on *Tephrosia purpurea***

- The ethanolic extract of *Tephrosia Purpurea* was evaluated for acute toxicity test in swiss albino mice. No significant alteration in hematological, biochemical parameters mortality and behavior changes was observed in mice were observed [49].
- The toxic properties of the plant are due to the presence of rotenoids, like rotenone, which block cellular respiration through the inhibition of mitochondrial exzyme NADH-dehydrogenase [50].

CONCLUSION

- The objective of this review paper is to explore the recent advances in the study of *Tephrosia purpurea* as to show its therapeutic potential. The detailed information as presented in this review on the phytochemical and various therapeutic properties of the plant might provide detailed evidence for the use of this plant in different diseases. Some of the studies inter-relate with other studies such as antibacterial, antiallergic, analgesic, anticancer, anti-inflammatory, anti-ulcer activities by means of correlated mechanistic pathways which can give a clear picture in relating them echanistic path- ways useful for defining a disease in-specific. This review article focus on the potential of *Tephrosia purpurea* to be indulged in new therapeutic drugs and provide the basis for future research to explore the potential of herbs for the cure and management of health care.

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