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Review Article

Tephrosia purpurea Linn (Sharpunkha, Wild Indigo): A Review on Phytochemistry and Pharmacological Studies

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ABSTRACT

Tephrosia purpurea (fabaceae) commonly known in sanskrit as 'sharapunkha' is highly branched ,herbaceous, suberect, 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, rheumatism and cures disease of heart, spleen and blood. The pharmacological studies have shown that *Tephrosia purpurea* posses following biological activity such as antiulcer, antimicrobial, antibacterial, anti viral, anti asthmatic ,hepatoprotective, antihyperglycemic and antihyperlipidemia, immunomodulatory activity, antioxidant, wound healing property, antiallergic activity. A wide variety of phytochemicals are isolated from the plant *Tephrosia purpurea* which has concerned with their medicinal uses. The present review high lights the mainly phytochemistry and pharmacological activity of the plant.

1. Introduction

Ayurvedic is originated in india long back in prevedic period. Ayurveda means 'science of life' as people are more concern about their future complications people now refer ayurvedic treatment, medicines. Many herbal drugs are shifts from fringe to main stream to use herbal remedies for the treatment of the disease with lesser side effects as compare to synthetic chemicals. Recently attention has been paid to to provide ecofreindly and biofreindly products to the people. Considering the adverse effect of synthetic chemicals people are looking for safe and effective treatment. This review highlights as such ayurvedic plant 'sharpunkha'.

According to ayurvedic literature *Tehrosia purpurea* belonging to fabaceae have subfamily papillonaceae. There are approximately 400 species included in this genus. In ayurvedic literature *Tephrosia purpurea* has described 'sarva warnavishapak'means it has property to healing all types of wounds [1-2]. The plants in this genus are widely distributed in tropical, sub-tropical and arid regions of the world. It is an important component of some preparations such as Tephroli and Yakrifit used for liver disorders. Traditionally drug is used as liver tonic. *Tephrosia purpurea* it is common known as wild indigo in Tamil 'Kolanji'

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1.1 Botanical Details [3]

Scientific name	*Tephrosia purpurea*
Common names	Sharpunkha, wild indigo
Kingdom	Plantae
Sub kingdom	Tracheobionta
Superdivision	Spermatophyta
Divison	Magnoliophyta
Class	Magnoliopside
Sub class	Rosidae
Order	Fabales
Family	Leguminosae (fabaceae)
Subfamily	Papilonaceae
Genus	Tephrosia Pers.
Species	*Tephrosia purpurea* (Linn) Pers.

Table1: Shows botanical details of plant *Tephrosia purpurea*

1.2 Morphological Details

Tephrosia purpurea is a self generating erect or spreading perennial herb found throughout India. It can be found as an ingredient in traditional herbal formulations. *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[3].

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; petiole 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,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, stamina 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.

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[4].

Whole plant may be used for its rich flavonoid and polyphenol content. Though a lot of research is going on in the plant.. 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 Number of species of *Tephrosia* is available such as *T.purpurea, T.falciformis, T.leptostachya T.wallichii, T.subtriflora, T.uniflora, T.villosa, T.strigo*[1].

1.3 Traditional Uses

Plant is bitter, astringent, acrid, thrmogenic, anthelmentic, anti pyretic, uterine tonic[5]. *Tephrosia purpurea* traditionally used to cure several types of external wounds and gastro-duodenal disorders [6]. Drug is used in cough, tightness of chest. Decoction of root is useful in enlargement and obstruction of liver, spleen and kidney. Also used for dyspepsia and chronic diarrhea [7]. Gargle of *Tephrosia purpurea* is used to wash out mouth[8].Root is also used in inflammation, skin disorders, elephantitis, flactulance, haemmaroids, asthma, bronchitis, anaemia, dysmenorrhea, chronic fever, boils, pimples, gingivitis[9]. Infusion of seed is used as anthelmentic oil. Also used in skin disorders like scabies and leucoderma[10]. Leaves of the plant is used in dyspepsia, pectoral disease, haemmarrhoid, syphills, gonnorhea[11].

Whole plant has been used to cure tumors, ulcers, leprosy, allergic and inflammatory condition such as rheumatism asthma and bronchitis[12] An extract of pods is effective as analgesic, anti-inflammatory, and their decoction is used in vomiting like symptoms. Ethanolic extract of plant has been reported as anticancer activity against *in-vitro* KB-cells culture[13].

Figure1: Shows image of plant *Tephrosia purpurea*

1.4 Uses as folk medicine

Used for coughs, tightness of the chest, bilious febrile attacks, obstructions of spleen, liver and kidney. Recommended as blood purifier, for boils and pimples. Roots used for dyspepsia and chronic diarrhea. Infusion of seeds used as cooling medicine. Decoction of pounded leaves used for snake bites. In Ceylon, used as anthelmintic for children. In Punjab, infusion of seeds considered cooling. In Sri Lanka, decoction of roots used as nematicide for treatment of Toxocara canis larvae which causes lung disease. Also used for colic, diarrhea and dyspepsia, and as anthelmintic. Fresh root-bark, ground and made into a pill, mixed with a little black pepper, used for obstinate colic. In Indian medicine, a common ingredient of formulations for liver ailments. Also, used for bilious febrile attacks, liver and splenic affections, cirrhosis and hepatitis. Oil from seeds used for scabies, eczematous itching, and other skin eruptions. Used for piles, syphilis and gonorrhea. Leaves used as fodder in India and South Africa. In India, grown as green manure in paddy fields. In India, dry plants collected as fuel. Seeds used as substitute for coffee. Used as insect repellent[14].

1.4.1Industrial uses: [3]

Fodder: Information on the fodder value of *Tephrosia purpurea* is conflicting. In India and in South Africa, it is used as a fodder before flowering, but in Australia it is reported to cause livestock poisoning.

Fuel: The energy value of the wood of *Tephrosia purpurea* is 14 500 kj/kg. In northern India, dry plants are collected for fuel.

Poison: The toxic properties of *Tephrosia purpurea* are due to the presence of flavonoids; those recorded include rotenone and several of its isomers named deguelins. One of the deguelins, tephrosin, is poisonous to fish, but not to mammals. The leaves contain up to 2.5% rutin (a flavonol glucoside). Pounded leaves are used to stupefy and catch fish.

Tannin or dyestuff: The leaves are occasionally used to dye orange-brown, or, in a mixture with Mucuna cyanosperman Schumann, black [9].

Other products: In Indo-China the seeds are used as a substitute for coffee.

Shade or shelter: It is applied as temporary shade.

Soil improver: *Tephrosia purpurea* is used as green manure for vegetables, rice, coconut and banana, especially in India and Sri Lanka, and on a more limited scale in Indonesia, Malaysia and southern China. When grown as a green manure on saline-sodic soils in Rajastan (India), it is most successful in reducing soil salinity and lowering the pH[13].

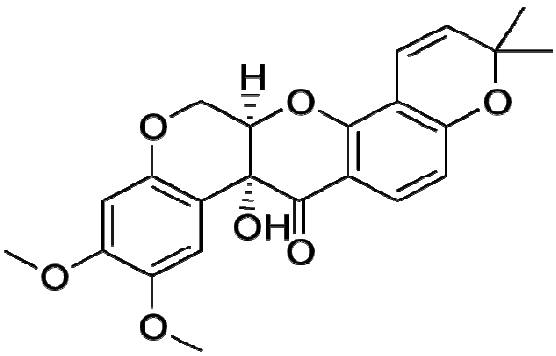
1.5 Phytochemistry

Isolonchocarpin is the first isolated from the root extract of *Tephrosia purpurea* suggested by optical activity and 1H NMR spectra. Three other crystalline compounds were isolated from petrol soluble fraction of CHCI3 extract along with (-)-isolonchocarpin. These were identified as pongamol, lanceolatin B and lanceolatin A, further compounds confirmed by Melting Point (MP), UV, IR and direct comparison with authentic samples[15].

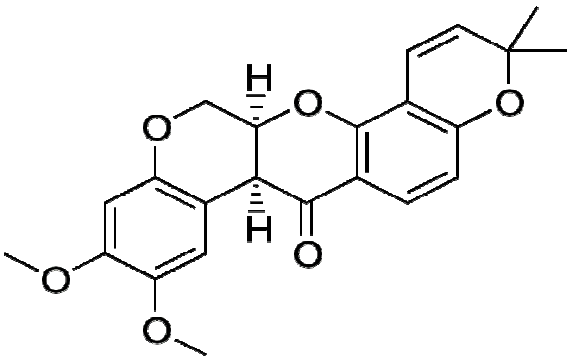
Ten unusual and closely related flavanoids were isolated and characterized from the roots of *Tephrosia purpurea*. Three of these compounds are new natural products and they all contain an isopentenyl derived unit attached to C-8 (in the flavones) or the corresponding C-3′(in the chalcones), suggesting that they are derived from a common biosynthetic precurso. The ^{1}H and ^{13}C NMR. Spectra used in structural elucidation[16].

The petrol soluble fraction of the chloroform extract of *Tephrosia purpurea* roots was investigated . The residue when chromatographed over silica gel and the fractions further purified yielded 4 pure compounds (purpurenone, purpurin, dehydrolsodericin, maackiain) together with a mixture of semiglabrin and pseudosemiglabrin and identified by HRMS and ^{13}C NMR data[17].

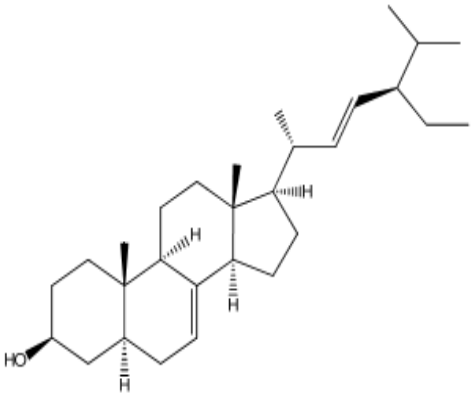
By column chromatography of the benzene extract of seeds in the of the new flavanone, named as purpurin was isolated . Identication was done by ^{1}H NMR and Mass spectral analysis and the results suggested the structure as 2, 3 dihydrosemiglabrin[18].



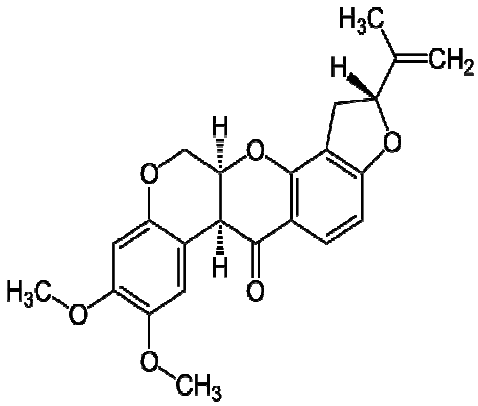
Tephrosin



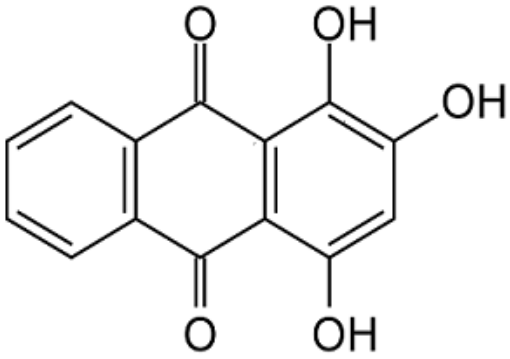
Diguelin



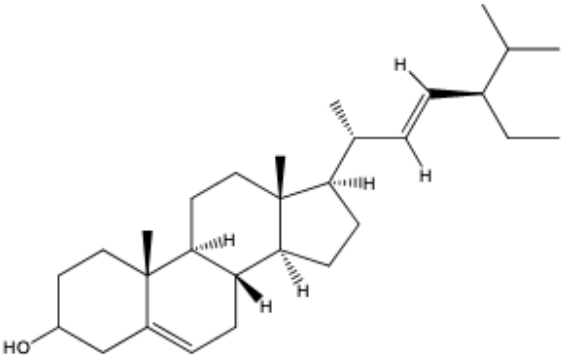
Spinosterol



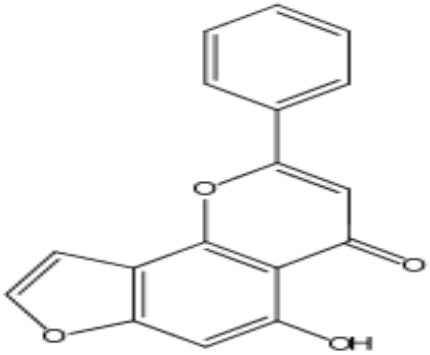
Rotenone



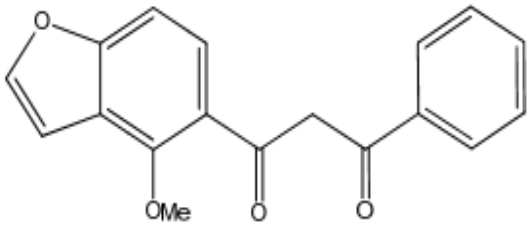
Purpurin



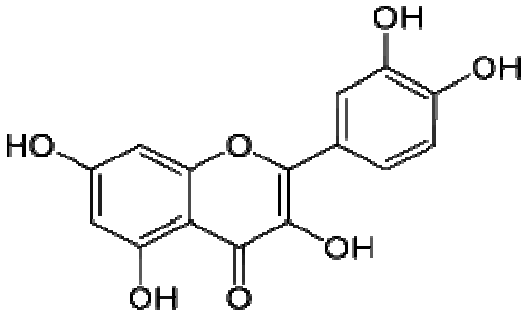
β-sitosterol



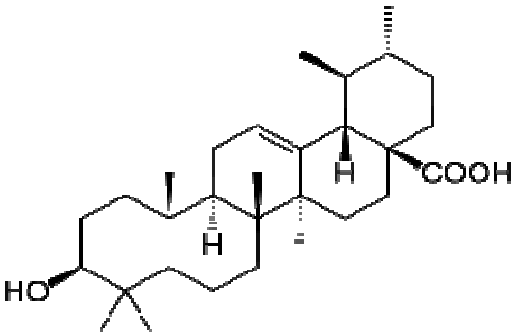
Pongaglabol



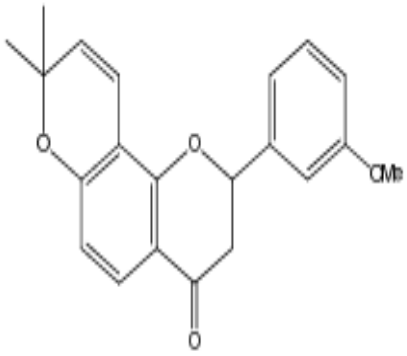
Pongamol [19]



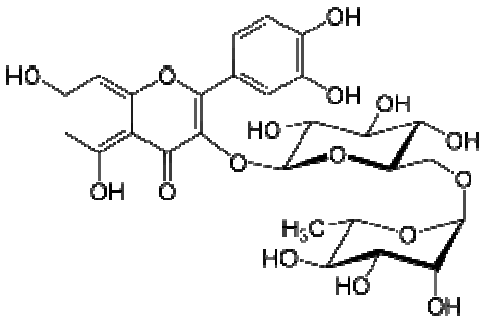
Quercetin



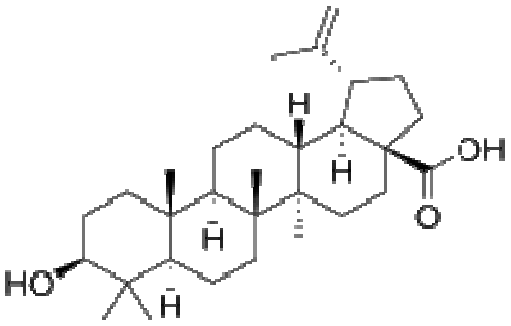
ursolic acid



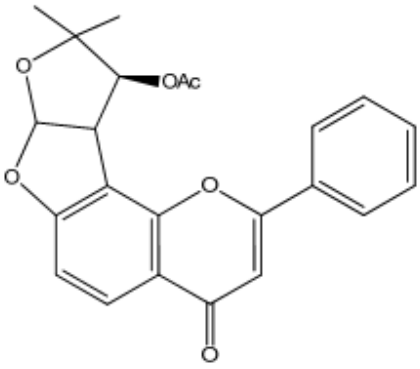
5-methoxy isolonchocarpin



Rutin



Butelinic acid



Semiglabrin

Isolation of novel neoflavonoid glycoside, serratin 7-O-[beta-D-glucopyranosyl-(1-4)- O-beta-D-galactopyranoside] from the chcl3 soluble fraction of the *Tephrosia purpurea* stem and the structure confirmed by chemical and spectral analysis[20].

Isolation of tephrosin, pongaglabol, and semiglabrin from *T.purpurea* aerial parts and identification was done by NMR spectra[21].

Isolation of a new benzopyrone derivative *Tephrosia purpurea* from the alcoholic extract of aerial parts of *Tephrosia purpurea* by normal phase column chromatography using toluene: ethyl acetate (70:30) as mobile phase and structure was elucidated by spectroscopic methods. Results suggest that the Compound Tephrosia Pupurea was found to be 3-hydroxy, 6-methoxy, 2-oxy (3- butanone), 7 (dioxolane-4-one), 2, 3,-dihydrobenzopyrone [22].

Investigation of the aerial extract of *Tephrosia purpurea* yielded the rare prenylated flavonoids, tephropurpulin A and isoglabratephrin, in addition to a previously identified flavonoid, glabratephrin. By ^{1}H NMR, ^{13}C NMR, DEPT, 1H–1H COSY, 1H–13C COSY, HMBC,EIMS and HREIMS data analysis compounds were assigned the name tephropurpulin A, isoglabratephrin and glabratephrin: and structures were confirmed by X-ray analysis[23]. Methylenechloride extract of aerial parts of *Tephrosia purpurea* resulted in isolation and structural elucidation of three compounds namely, an aromatic ester; was identified as 2-propenoic acid, 3-(4-(acetyloxy)-3-methoxypheny)-3(4-actyloxy)-3-methoxyphenyl)-2-propenylester,sesquiterpene of the rare rotundane skeleton; was assigned to the sesquiterpene of rotundane skeleton 4-isopropyl-1,8-dimethyldecahydro-azulene-5, 8, 9-triol and a prenylated flavonoid; as apollinine. The structures of the compounds were established by comprehensive 1H NMR, 13C NMR, DEPT, 1H–1H COSY, 1H–13C COSY, HMBC and EIMS[24].

Isolation of three novel flavonoids,(+)-tephrorins A and B and (+)-tephrosone, from *Tephrosia purpurea* leaves extract. Their structures were elucidated by NMR spectral analysis, and their absolute configurations were determined by Mosher ester methodology. Compounds 1 and 2 are flavanones containing an unusual tetrahydrofuran moiety[25].

1.6 Pharmacological activity

1.6.1 Root:

I. *Anti ulcer*

The antiulcer activity of aqueous extract of *Tephrosia purpurea* was studied in rats 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 HCI. The antiulcer activity of AETP was assessed by determining and comparing the ulcer index, gastric total acid output and pepsin activity were estimated in the pylorus ligated rats. The antiulcer property of plant extract was more prominent in hcl, indomethacin and pyloric ligation models. The results suggest 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 defence[26].

II. *Anti carcinogenic and anti lipid per oxidative*

The chemopreventive potential of ethanolic root extract of *Tephrosia purpurea* on 7,12- dimethylbenz(a)anthracene (DMBA)- induced buccal pouch carcinoma in hamster. Oral administration of test extract significantly prevented the incidence, volume and burden of the tumor.Ethanolic extract has potent chemopreventive efficacy in DMBA-induced oral carcinogenesis[27].

III. *Anti microbial against acne inducing bacteria*

Propionibacterium acnes and *Staphylococcus epidermidi* recognized as pus-forming bacteria in triggering an inflammation in acne. Study was carried to evaluate anti microbial activity of 12 medicinal plants. It revealeds *Tephrosia purpurea* posses significant zone of inhibition in disc diffusion method against al *Propionibacterium acnes* and *Staphylococcus epidermidis.* MIC value of both the bacteri for *Tephrosia purpurea* are 0.675mg/ml and 2.5 mg/ml respectively[28].

IV. *Anti inflammatory and analgesic*

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 pawedema and cotton pellet-induced granuloma in rats. At the same doses, analgesic activity was also observed by tail immersion method in which temperature 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[29].

V. ***Anti oxidant***

Primary phytochemical screening and *in-vitro* antioxidant activity was performed on hydroalcoholic extract of shade dried roots of *Tephrosia purpurea* .The hydroalcoholic extract was prepared andevaluated for its primary phytochemical analysis for total phenolic content and *invitro* antioxidant activity study by DPPH free radical scavenging activity, super oxide free radical activity and nitric oxidescavenging activity. The hydroalcoholic extract of *Tephrosia purpurea* showed antioxidant activity by inhibiting DPPH and hydroxyl radical, nitric oxide and super oxide anion scavenging, hydrogen peroxide scavenging, and reducing power activities. Results indicate that hydroalcoholic root extract of *Tephrosia purpurea* have marked amount of total phenols which could be responsible for the antioxidant activity[30].

VI. ***Ameliorates carbon tetra chloride induced hepatic injury***

By evaluation of the protective role of the ethanolic extract of the root of *Tephrosia purpurea* ; an important Indian medicinal plant widely used in the preparation of ayurvedic formulations, on ccl4 induced oxidative damage and resultant dysfunction in the liver of rats. The experiments were performed using five groups of animals. The experimental animals were administered with 30% ccl4 in liquid paraffin (1ml/kg bw) for 10 days at 72 hr intervals and the fine crude plant root powder ethanolic extract (EETP) and Silymarin a standard drug, 25 mg/kg bw were fed to the ccl4 treated animals. The effect of EETP and silymarin on Total protein, albumin, bilirubin, cholesterol and glycogen were measured. Further, the effects of the extract on hepatospecific enzymes such as, aspartate transaminase (AST), alanine transaminase (ALT), acid phosphatase (ACP), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and 5' nucleotidase(5'NT) were estimated. The EETP and Silymarin produced significant effect by decreasing the serum levels of bilirubin and cholesterol whereas Total protein, albumin, glycogen and hepatospecific enzymes were significantly increased. From these results, it was suggested that *Tephrosia purpurea* protects the liver against ccl4 induced oxidative damage probably by increasing antioxidative defense activities[31].

VII. ***CNS depressant and analgesic activity***

Investigation of CNS depressant and analgesic activities of the ethanol, ethyl acetate, chloroform and petroleum ether extracts of *Tephrosia purpurea* root using actophotometer for CNS depressant activity and analgesic activity using Tail immersion method in albino rats of both sexes. Animals were divided in to ten groups each consisting of six animals. Group 1 served as control and Group 2 received standard drug. Group 3 to Group 10 were assigned for our investigation. Group 3 received ethanol extract of 250 mg/kg and Group 4 received 500 mg/kg ethanol extract of *Tephrosia purpurea* root. Group 5 treated with ethyl acetate extract 250 mg/kg and Group 6 treated with 500 mg/kg ethyl acetate extract of *Tephrosia purpurea* root. Group 7 received chloroform extract 250 mg/kg and Group 8 received 500 mg/kg chloroform extract of *Tephrosia purpurea* root.Group 9 injected with petroleum ether extract 250 mg/kg and Group 10 received 500 mg/kg petroleum ether extract of *Tephrosia purpurea* root. The result of the study reflected that all the extracts of *Tephrosia purpurea* root were found to possess CNS depressant and analgesic activities. Among the above four extracts ethanol extract of *Tephrosia purpurea* root of 500 mg/kg possessed higher CNS depressant activity (89.04%) with a probability <0.001 and it also possessed approximately similar analgesic activity as that of standard analgesic drug diclofenac sodium after 120 minutes [32].

1.6.2 Leaves:

I. ***Ameliorates benzoyl peroxide induced cutaneous Toxicity***

Mohammad saleem et al (1999) has evaluated the modulatory effect of *Tephrosia purpurea* on benzoyl peroxide-induced by cutaneous oxidative stress . Benzoyl peroxide is an effective cutaneous tumour promoter acting through the generation of oxidative stress. Benzoyl peroxide treatment increases cutaneous microsomal lipid peroxidation and hydrogen peroxide generation. The activity of cutaneous antioxidant enzymes, catalase glutathione peroxidase, glutathione reductase and glutathione *S*-transferase is decreased and the levels of cutaneous glutathione are depleted. Prophylactic treatment of mice with *Tephrosia purpurea* 12 h before benzoyl peroxide treatment resulted in the diminution of benzoyl peroxide-mediated damage. The susceptibility of cutaneous microsomal membrane to lipid peroxidation and hydrogen peroxide generation was significantly reduced ($P < 0.05$ and $P < 0.001$, respectively). In addition depleted levels of glutathione and inhibited activity of antioxidant enzymes were recovered to a significant level ($P < 0.05$). The protective effect of *Tephrosia purpurea* was dose-dependent. The results suggest that *Tephrosia purpurea* is an effective chemopreventive agent in skin that may suppress benzoyl peroxide-induced cutaneous toxicity [33].

II. ***Alleviates phorbol ester induced tumour promotion***

Saleem et al (2001) has evaluated *Tephrosia purpurea* has been shown to possess significant activity against hepatotoxicity. Earlier we showed that *Tephrosia purpurea* inhibits benzoyl peroxide-mediated cutaneous oxidative stress and toxicity. In the present study, we therefore assessed the effect of *Tephrosia purpurea* on 12-O-tetradecanoyl phorbal-13-acetate (TPA; a well-known phorbol ester) induced cutaneous oxidative stress and toxicity in murine skin. The pre-treatment of Swiss albino mice with *Tephrosia purpurea* prior to application of croton oil (phorbol ester) resulted in a dose-dependent inhibition of cutaneous carcinogenesis. Skin tumor initiation was achieved by a single topical application of 7,12-dimethyl benz(a)anthracene (DMBA) (25 microg per animal per 0.2 ml acetone) to mice. Ten days later tumor promotion was started by twice weekly topical application of croton oil (0.5% per animal per 0.2 ml acetone, v /v). Topical application of *Tephrosia purpurea* 1 h prior to each application of croton oil (phorbol ester) resulted in a significant protection against cutaneous carcinogenesis in a dose-dependent

manner. The animals pre-treated with *Tephrosia purpurea* showed a decrease in both tumor incidence and tumor yield as compared to the croton oil (phorbol ester)-treated control group. In addition, a significant reduction in TPA-mediated induction in cutaneous ornithine decarboxylase (ODC) activity and [3H]thymidine incorporation was also observed in animals pre-treated with a topical application of *Tephrosia purpurea* . The effect of topical application of *Tephrosia purpurea* on TPA-mediated depletion in the level of enzymatic and non-enzymatic molecules in skin was also evaluated and it was observed that topical application of *Tephrosia purpurea* prior to TPA resulted in the significant recovery of TPA-mediated depletion in the level of these molecules, namely glutathione, glutathione S-transferase, glutathione reductase and catalase. From these data we suggest that *Tephrosia purpurea* can abrogate the tumor-promoting effect of croton oil (phorbol ester) in murine skin[34].

III. *Spasmolytic activity*

The spasmolytic activity of ethanol extract of *Tephrosia purpurea* on guinea pigs trachea. The results of experiments clearly showed the spasmolytic activity of the drug. The preliminary phytochemical investigation,however shows the presence of glycosides and saponins may be responsible for this activity[35].

IV. *Anti hyperglycemic and anti lipid peroxidative activity*

Diabetes mellitus is a worldwide leading metabolic syndrome, associated with profound alterations in carbohyrate, lipids, lipoproteins and protein metabolisms. Worldwide, traditional practitioners for the treatment of diabetes and its complications use a wide variety of medicinal plants. In the present study the aqueous extract of *Tephrosia purpurea* leaves was evaluated for its antihyperglycemic and antihyperlipidemic effects in streptozotocin induced diabetic rats. Profound alterations in the concentrations of blood glucose, lipids and lipoproteins were observed in diabetic rats. Oral administration of *Tephrosia purpurea* leaves extract to diabetic rats at a dose of 600 plasma insulin as well as normalized the lipids and lipoproteins profile. The present study thus demonstrated that extract has prominent antihyperglycemic and antihyperlipidemic effects in streptozotocin induced diabetic rats[36].

V. *Anti oxidant*

in –vitro antioxidant activity of aqueous and ethanolic extracts was carried out . The total Phenolic content of aqueous and ethanolic extracts showed the content values of 9.44 ± 0.22% w/w and 18.44 ± 0.13% w/w and total flavonoids estimation of aqueous and ethanolic extract showed the content values of 0.91 ± 0.08 % w/w and 1.56 ± 0.12%w/w for Quercetin and for 1.85 ± 0.08 % w/w and 2.54 ± 0.12% w/w Rutin respectively . The therapeutic effects of tannins and flavonoids can be largely attributed to their antioxidant properties.Among these results ethanolic extract has more potent than traditionally claiming aqueous decoction. They concludes that *Tephrosia purpurea* leaves possesses the antioxidant substance which may be potential responsible for the treatment ojaundice and other oxidative stress related diseases[37].

VI. *Anti Pyretic*

Fever is generated when body's immune response is triggered by pyrogens (fever producing substances) .Pyrogens usually come from outside the body and in turn ,stimulate the production of pyrogens inside the body .the plant is reported contain coumarins ,flavanoids, caratenoids, flavanoids, iso-flavanones and quercetin .the plant has been reported to have anti pyretic, anti helmentic, hepatoprotectve, anti ulcer, anti –inflammatory, anti microbial properties.methanolic extract of *Tephrosia purpurea* leaves was evaluated for anti pyretic activity. anti pyretic property of methanolic extract was evaluated by brewer's yeast induced pyrexia test , the pyrexia in rat was reduced significantly ($p<0.01$)compared to the control[38].

VII. *Anti hyperlipidemic activity*

The ethanolic extract of plant of *Tephrosia purpurea* in experimentally induced hyperlipidemic wistar rat. The antihyperlipidemic activity of ethanolic extract at dose of 400 mg/kg b.w. And 800 mg/kg b.w. was found to be significant as indicated by decrease in total cholesterol level of rats when compared to hyperlipidemic control. The present study demonstrated the possible therapeutic application of the plant of *Tephrosia purpurea* (Linn) in control of hyperlipidemia [39].

VIII. *Anthelminticactivity*

The various concentrations of aqueous and methanolic extract were evaluated for their anthelmintic activities on adult Indian earthworms, Pheretima posthuma. The activities are well compared with the standard drug Albendazole.phyto chemical studies reveals The predominant action of albendazole on worm is inhibitory action on micro tubular function. The methanolic leaf extract not only shows paralysis but death of the organism with increasing concentration. Panalysis of methanolic leaf extract showed the presence of tannins and phenolic compounds as one of the chemical constituents along with alkaloids. Tannins and phenolic compounds were shown to possess anthelmintic activity.Tannins are found to bind to free proteins in the gastrointestinal tract of the host animal or glycoprotein on the cuticle of the parasite and cause death[40].

1.6.3 Whole plant

I. *Ameliorates diethylnitrosamie and pot.bromate mediated renal oxidative stress*

Chemopreventive efficacy of *Tephrosia purpurea* against Ndiethylnitrosamine- initiated and potassium bromate-mediated oxidative stress and toxicity in rat kidney A single intraperitoneal dose of N-diethylnitrosamine (200 mg/kg body weight) one hr prior to the dose of kbro3 (125 mg/kg body weight) increases microsomal lipid peroxidation and the activity of xanthine oxidase and decreases the activities of renal antioxidant enzymes viz., catalase, glutathione peroxidase, glutathione reductase and glucose-6-phosphate dehydrogenase, phase II metabolizing enzymes such as glutathione-S-transferase and quinone reductase and causes depletion in the level of renal glutathione contenin pharmacokinetics studies, it has been found that kbro3 is degraded *in vivo* and *in vitro* to bro3 and contact with renal tubular epithelium . N-diethylnitrosamine is converted to active electrophilic species following a, b or w hydroxylation, resulting

in the formation of unstable hydroxyalkyl compounds that are subsequently converted to alkyl carbonium ions . *Tephrosia purpurea* prevented the N-diethylnitrosamine and kbro3-mediated inhibition of renal glutathione content. *Tephrosia purpurea* also act as a modifier of oxidant response of kidney and therefore its antioxidant potential may have the counteracting effect on oxidant-mediated generation of oxidative stress[41].

II. *Anti leishminal activity*

N-butanol fraction of *Tephrosia purpurea* extract at dose of 50 mg/kg for 5 days treatment exhibited significant antileishmanial activity against *Leishmania donovani* infection in hamsters16 Activity was further confirmed in a secondary model, i.e., Indian langur monkeys (*Presbytis entellus*). Thus, the fraction F062 from this plant possesses potential to produce significant antileishmanial activity by oral route without producing any toxic side effect[42].

III. *Anti epileptic activity*

Status epilepticus was induced in male albino rats of Wistar strain by administration of pilocarpine (30 mg/kg, *i.p.*) 24 h after lithium chloride (3 meq/kg, *i.p.*). Different doses of the extract of *Tephrosia purpurea* were administered orally one hour before the injection of pilocarpine. The severity of status epilepticus was observed and recorded every 15 min till 90 min , sing the scoring system. The *in vivo* lipid peroxidation of rat brain tissue was measured. The *in vitro* NO free radical scavenging activity of plant extract was assessed. The interaction between plant extract and 2-diphenyl-2-picryl hydrazyl (DPPH) was also observed for *in vitro* free radical scavenging activity. The severity of status epilepticus was reduced with the administration of ethanolic extract of *Tephrosia purpurea*. Ethanolic extract of the plant exhibited both *in vivo* and *in vitro* antioxidant activity. The ethanolic extract of *Tephrosia purpurea* was found to be useful to control lithium-pilocarpine induced *status epilepticus* in albino rats of Wistar strain[43].

IV. *A source of beta sitosterol anti carcinogenic and anti hypercholesterolemic*

Epidemiological and experimental studies have suggested a protective role of beta-sitosterol in the development of some types of cancer such as breast, colon and prostate cancer. *In vivo* studies have shown that the phytochemical inhibited proliferation and induce apoptosis in human solid tumors such as colon and breast cancers. The studies are about the protective effect of beta-sitosterol on breast cancer. When it was reported as a selective inhibitor of human melanoma, then it was demonstrated, that it induces apoptosis in human melanoma *in vitro* and *in vivo* model systems β sitosterol is play a vital role for their anti carcinogenic activity .In combination with similar phytosterols, it reduces blood levels of cholesterol, and is sometimes used in treating hypercholesterolemia[44].

V. ***Anxiolytic activity***

The anxiolytic activity of a hydroalcoholic extract of *Tephrosia purpuria* in mice using the elevated plus-maze, elevated zero-maze, Y-maze and hole-board models. The results indicate that hydroalcoholic extract of *T. Purpuria* having anxiolytic activity and phytochemical screening revealed the presence of saponins and flavonoids. It may possible that the mechanism of anxiolytic action of plant could be due to the binding of any of these phytoconstituents to the GABAA-BZD complex[45].

VI. *Diuretic activity*

Tephrosia purpurea (Fabaceae) is a well-known traditional plant with diuretic effect but no scientific work published till date to support the claimed ethnomedical use. Therefore, the present study appraised the diuretic potential of methanol extract of *Tephrosia purpurea* (METP) in male wistar rats. The animals were divided into five groups for diuretic activity. The first group served as saline control (0.9%% saline solution, 25 ml/kg, body weight (b.w)), the second group received osmotic diuretic, urea (1 g/kg b.w), the third group received high-ceiling diuretic, furosemide (5 mg/kg b.w), and the other two groups were administered various concentrations of METP (200 mg/kg and 400 mg/kg b.w) orally to hydrated rats and their urine volume was measured at 5th and 24th hr after drug administration, while animals were deprived of food and water. After collection of urine, the parameters such as urine output, diuretic activity, electrolyte excretion of Na(++), K(++), Ca(2++), and Cl(-), and ph were analyzed. METP at various dose levels exhibited significant diuretic activity as evidenced by increased urine volume, electrolyte concentration, and alkaline ph in comparison to control group of animals. The present study provides a quantitative basis for explaining the folkloric use of *Tephrosia purpurea* as a diuretic agent in Indian traditional system of medicine[46].

VII. *Anti diarrheal*

Anti diarrheal activity of methanolic extract was evaluated using 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 Tp.Cr were administered orally to see the possible antidiarrhoeal activityin 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 Tp. exract was administered partial protection (40%) from diarrhoea was observed, whereas group of mice treated with 500 mg/kg of Tp. Cr 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[47].

1.6.4 Aerial part

I. *Hepato protective activity*

Aerial part extract of *Tephrosia. Purpurea* evaluated for efficacy in hepatotoxicity using acute (D-galactosamine) and chronic model (CCl_4) in rats. *Tephrosia purpurea* (aerial parts) powder was administered orally at a dose of 500 mg/kg. Serum levels of transaminases (SGOT and SGPT) and bilirubin were used as the biochemical markers of hepatotoxicity. Histopathological changes in the liver were also *Tephrosia purpurea produced* hepato protection as evidenced by the inhibition of the rise in SGOT, SGPT and bilirubin levels. Also the absence of necrotic lesions in liver samples from *Tephrosia purpurea* treated group, suggested that its hepato protective action may be due to its membrane stabilising effect on hepatic cells. $CC1_4$ induced chronic

hepatotoxicity study also showed highly significant increase in serum transaminases and bilirubin values after 8 weeks. The lower levels of enzymes and bilirubin and the absence of mortality observed with *Tephrosia purpurea* treated group are indicative of the hepatoprotective action.[48] The potential hepatoprotective activity of Poly herbal formulation HD-03 and gives insight into its mechanism of action. PCM, TAA and INH are known to cause hepatocellular damage and are commonly employed as experimental hepatotoxic agents PCM, TAA and INH produce toxicity via their detoxification products it is likely that HD-03 may be acting by altering their detoxification leading to reduced generation of the toxic metabolites HD-03 was earlier found to normalise the free-radical induced hepatotoxicity on administration of CCl_4 (unpublished data). From the above experimental data, it is evident that HD-03 affords protection by acting through a mechanism non-specific to PCM:TAA:INH induced hepatotoxicity[49]. Protective effect of Tefroli tonic (a polyherbal mixture containing *Tephrosia purpurea*) against cadmium induced hepatotoxicity in experimental rats.Subcutaneous injection of cadmium chloride to rats caused liver damage.The administration of Tefroli tonic has maximum protective effect against cadmium chloride induced hepatotoxicity in rats[50]. The aqueous–ethanolic extract of *Tephrosia purpurea* aerial parts (100, 300 and 500 mg/kg/day) for hepatoprotective activity against thio acetamide induced hepatotoxicity. Oral administration of *Tephrosia purpurea* at 500 mg/kg resulted in a significant reduction in serum aspartate amino transaminase 35%, alanine aminotransaminase 50%, gamma glutamyl transpeptidase 56%, alkaline phosphatase 46%, total bilirubin 61% and liver MDA levels 65% and significant improvement in liver glutathione 73% when compared with thioacetamide damaged rats. Histology of the liver sections of the animals treated with the extract also showed dose-dependent reduction of necrosis[51].

II. *Anti cholestic activity*

Anticholestatic acitivity of HD-03, (a polyherbal product in which *Tephrosia purpurea* is one of the component) in thioacetamide (TAA)-induced experimental cholestasis in anaesthetized guinea pigs, which significantly prevented thioacetamide induced changes in bile flow, bile acids and bile salts excretion. HD-03 has been reported possess potent choleretic and anticholestatic properties[52].

III. *Inhibition of mast cell degranulation and haemolysis*

The ethanolic extract of *Tephrosia purpurea* for its *in-vitro* effect on rat mast cell degranulation and erythrocyte membrane integrity *in-vitro*. The extract in concentration of 25-200 µg/ml showed a dose dependant inhibition of rat mast cell degranulation induced by compound 48/80 and egg albumin. Tephrosia. Purpurea extract was found to inhibit haemolysis of erythrocytes induced by hypotonic solution but accelerated haemolysis induced by heat at a concentration of 100 µg/ml. The studies Anti diarrhel activity reveal that the ethanolic extract of *Tephrosia purpurea* may inhibit degranulation of mast cells by a mechanism other than membrane stabilization [53].

IV. *Immunomodulatory activity*

Flavonoid fraction of *Tephrosia purpurea* for its effect on cellular and humoral functions and on macrophage phagocytosis. The results exhibit that flavonoid fraction significantly suppress the production of circulating antibodies. The present study establishes the cellular and humoral immunomodulatory property of the flavonoid fraction of *Tephrosia .purpurea in-vivo*[54].

V. *Anti asthmatic activity*

Ehanolic extract of aerial part of *Teprosia Purpurea* to determine mast mast cell stabilizing potential to evaluate asthmatic activity against 48/80 and clonidine induced mast cell degranulation in adult albino wistar rat .the present study represents compound 48/80 and clonidine produced 75.83% and 73.67% mast cell degranulation respectively.ethanolic extract of *Tephrosia purpurea* at concentration of 250,500,and 750 µg/ml shows effect reduction of mast cell degranulation in dose dependent manner ($p<0.01$)as compared to 48/80 and clonidine .however effect is lower as compared to dexamethasone and chromoglycate so conclude ethanolic extract of *Tephrosia purpurea* posees good mast cell stabilizing property and therefore can be used in asthma[55].

VI. *Wound healing activity*

Wound healing potential of different root extracts of *Tephrosia purpurea* Pers. Was evaluated by excision, incision and dead space wound models in rats. The result showed that methanolic extract possesses a definite pro healing action. This was demonstrated by a significant increase in the rate of wound contraction and by enhanced epithelization. Significant increase in tensile strength and collagen levels were observed, which was further supported by histopathological studies and gain in granuloma breaking strength[56].

1.6.6 Seed:

I. *Antitumor activity*

The effect of *Tephrosia purpurea* on 12-O-tetradecanoyl phorbal-13-acetate (TPA; phorbol ester) induced cutaneous oxidative stress and toxicity in murine skin. The present study shows that topical application of *T.purpurea* prior to TPA and croton oil treatment resulted in significant inhibition of TPA-induced cutaneous ODC activity,[3H]thymidine incorporation and croton oil-promoted skin tumorigenesis, respectively, in a dose-dependent manner. The present study also suggests a delay in onset of tumor formation with the animals pre-treated with *Tephrosia purpurea* in DMBA-initiated and croton oil-promoted mice skin, which further suggests the antitumorpromoting potential of *T.purpurea*. In addition, *Tephrosia purpurea* reversed TPA-mediated inhibition of the activities of antioxidant enzymes such as glutathione S-transferase, glutathione reductase, catalase and cutaneous glutathione[57].

II. *Anti hyperglycemic and anti oxidant activity*

Aqueous seed extract of *Tephrosia purpurea* on blood glucose and antioxidant status in streptozotocin induced diabetic rats. Hyperglycemia associated with an altered hexokinase and glucose-6-phosphatase activities, elevated lipid peroxidation, disturbed enzymatic [Superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (gpx)] and non enzymatic [Glutathione,

vitamin C and vitamin E] antioxidant status were observed in streptozotocin induced diabetic rats. Oral administration at a dose of 600 mg/kg showed significant improvement in above mentioned parameters. The results clearly indicate that aqueous seed extract of *Tephrosia purpurea* has potent antihyperglycemic and antioxidant effects in streptozotocin-induced diabetic rats[58].

III. *Anti oxidant*

Ethanolic extract of *Tephrosia purpurea* for its antioxidant activity in carbon tetrachloride-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 antilipid 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 [59]. Ten traditional plant were investigated for their anti oxidant property. Results revealed the chemical constitute of plant is responsible for their free radical scavenging activity and also responsible for their hepatoprotective activity[60].

1.6.7 Flower:

I. *Antiviral activity*

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 st gram + ve, and gram – ve, strains[61].

Part	Pharmacological Activity	References
Root	**1.** Anti ulcer activity [26] **2.** Anti carcinogenic and anti lipid per oxidative [27] **3.** Anti microbial [28] **4.** Ant-inflammatory and analgesic[29] **5.** *In-vitro* anti oxidant [30] **6.** Ameliorates CCl_4 induced hepatic damage [31] **7.** Anti-pyretic,anti inflammatory [32] **8.** CNS depressant and analgesic [32]	Deshpande ss *et al* 2003 Kavitha K *et al* 2006 Kumar GS *et al* 2007 Gopalkrishan *et al* 2007 Shah R *et al* 2010 Sangeetha B *et al* 2010 Valli G *et al* 2011 Valli G *et al* 2011
Leaves	**1.** Ameliorates benzoyl peroxide induced cutaneous Toxicity[33] **2.** Alleviates phorbol ester induced tumour promotion [34] **3.** Spasmolytic[35] **4.** Hepatoprotective [36] **5.** Anti oxidant[37] **6.** Anti pyretic[38] **7.** Antihyperlipidemic[39] **8.** Anthelmentic [40]	Mohamad S *et al* 1999 Saleem M *et al* 2001 Soni KK *et al* 2004 Pavan P *et al* 2007 Patel A *et al* 2010 Kumar S *et al* 2011 Sayad M *et al* 2012 Manjula RR *et al* 2013
Whole plant	**1.** Ameliorates diethyl nitrosamie and pot.bromate mediated renal oxidative stress[41] **2.** Antileishmania[42] **3.** Anti epilepsy[43] **4.** A source of beta sitosterol anti carcinogenic and anti hypercholesterolemic[44] **5.** Anxiolytic activity[45] **6.** Diuretic activity[46] **7.** Anti diarrheal[47]	Khan N *et al* 2001 Sharma P *et al* 2003 Auntha G *et al* 2010 Kishore K *et al* 2011 Kumar S *et al* 2011 Ashok kumar D *et al* 2012 Khalid HJ *et al* 2013
Aerial part	**1.** Hepato protective[48 ,49,50,51] **2.** Ani cholestic [52] **3.** Inhibition of mast cell degranulation[53]	Murthy MSR *et al* 1993 Mitra SK *et al* 1999 Nair P *et al* 2006 Khatria A *et al* 2009 Mitra SK *et al* 1999 Gokhle AB *et al* 2000

	4. Immune modulatory [54] **5.** Anti asthmatic [55] **6.** Wound healing and burns[56]	 Damre AS *et al* 2003 Gajera PB *et al* 2011 Chaudhri TB *et al* 2012
Seed	**1.** Tumour protection activity57 **2.** Anti hyperlipidemic and antiglycemic [58,59] **3.** Anti oxidant[60]	Saleem M *et al* 2001 Sethupathy PP *et al* 2006 Soni KK *et al* 2009 Kumar vivek *et al* 2011
Flower	**1.** Anti viral and anti bacterial [61]	Kokila A *et al* 2010

Table2: Shows *Tephrosia purpurea* Pharmacological activities

2. Conclusion

Ayurvedic plant based medicines have their advantages over the uses of allopathic treatment.*Tephrosia purpurea* has its traditionally as well used as folk medicine. Various preclinical investigation has been carried on tephrosia purprea,such pharmacological activities are hepatoprotective,anti microbial,anti hyperlipidemic, anti asthmatic, blood purifier, anti carcinogenic,anti diarrheal ,anti hhyperglycemic,anti viral,anti cholestic activity,diuretic.the plant is enrich with reported wide range of chemical constitute.thus the present review article explore the properties of the *Tephrosia purpurea* ,though *Tephrosia purpurea* is ingridents of various marketed formulation *Tephrosia purpurea* should be designed to investigate the molecular mechanism(s) of action of isolated phytoprinciples using specific biological screening models and clinical trials, and also to discover novel leads from them. Also studies should be extended to standardize the various extracts of *Tephrosia purpurea* for the purpose of their use in specific herbal formulations. The data presented here, emphasize the potential of tradition medicine *Tephrosia purpurea* .

Conflict of interest statement

The authors report no conflict of interest. The authors, alone are responsible for the content and writing of the paper.

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