Phytopharmacology of *Tephrosia purpurea* Linn: An Overview

Virupanagouda P.Patil*, Shivakumar Hugar, Nanjappaiah H.M, Navanath Kalyane, Mohan Chowdhary and Pandarinath.

P.G. Dept. of Pharmacology, B.L.D.E.A's College of Pharmacy, B.L.D.E.University Campus, Bijapur-586103.Karnataka.INDIA

Summary

Tephrosia purpurea is a wild plant commonly known as "Sarapunkha" and has been recognized in different traditional system of medicines for treatment of various diseases of human beings. Different parts of the plant are traditionally claimed to be used for the treatment of ailments including diarrhoea, bronchitis, asthma, inflammation, boils, pimples, enlargement of the spleen, diseases of liver, heart, kidney and blood, in tumours, ulcers, leprosy and asthma. Therefore, in the present review an attempt has been made to explore the data on folklore uses, phytochemistry and pharmacological activities of *Tephrosia purpurea*.

Key words: Wild indigo, Anti-microbial, Hepatoprotective, Leguminosae, flavonoids.

***Corresponding Author**
E-Mail: patilk183@gmail.com
Mobile: +919844164121
Fax:08352262642

Introduction

Medicinal plants and derived medicines are widely used as natural alternatives to synthetic chemicals in traditional cultures all over the world and they are becoming increasingly popular in modern society.[1] There has been an exponential growth in the field of herbal medicine in last few decades in developed and developing countries. It is increasingly popular owing to its natural origin and lesser side effects[2].

Tephrosia purpurea Linn belongs to family Leguminosae is an erect or spreading annual or short-lived perennial herb, sometimes bushy, 40-80 cm tall distributed widely in countries like China, India, Sri Lanka, Malay Peninsula and Hawaii[1]. Medicinally, all parts of the plant have tonic and laxative properties. The root is having bitter bad taste and it is an alexipharmic used in snake bite poisoning, ulcers, wounds, diarrhoea, bronchitis, asthma, inflammation, boils, pimples, enlargement of the spleen. Leaves are tonic to the intestine, improves the appetite, useful in diseases of lungs and chest, good in piles, syphilis and gonorrhea. The seeds are useful in poisoning due to rat-bite. The whole plant bitter in taste and acrid, digestible, anthelmintic, alexeteric, antipyretic, and cures diseases of liver, spleen, heart, kidney, blood, tumours, ulcers, leprosy, asthma, bronchitis, caries of the teeth and febrile attacks[3]. Fresh root bark ground and made in to a pill, with a little black pepper, is frequently given in cases of obstinate colic. The plant is used internally as a blood purifier and is considered a cordial.

Other uses

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

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

Poison: The toxic properties of *T. 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.

Soil improver: T. 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.

Taxonomy		**Botanical distribution**	
Kingdom	:Plantae	English	:Wild indigo
Division	:Magnoliophyta	Kannada	:Panki,Kaggi
Class	:Magnoliopside	Sanskrit	:Sharpunkha
Order	:Fabales	Gujarati	:Unhali
Family	:Leguminosae (Fabaceae)	Malayalam	:Kozhenjil
Genus	:*Tephrosia*	Bengali	:Sarphonka
Species	:*purpurea* (L.)	Filipino	:Balba-latong


Plant


Leaves


Seeds


Flowers

Botanic description

Tephrosia purpurea is a perennial herb, with stem slender, erect ordecumbent at base. Leaves: imparipinnate; stipules narrowly triangular, Lateral leaflets: acute at base, apex rounded to emarginate, venation usually distinct on both surfaces. Flowers: in fascicles of 4-6, 4-8.5 mm long, purplish to white; calyx campanulate, 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.

Geographical distribution

The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

Ecology

T. purpurea occurs naturally in grassy fields, waste places and thickets, on ridges and along roadsides, in Java. In Hawaii, it grows near the seashore. T. purpurea is native to tropical Asia, and is found from India and Sri Lanka to southern China and through South-East Asia to tropical Australia and the Polynesian Islands. It is now naturalized and cultivated pantropically.

Biophysical limits

Altitude: Up to 400 m altitude, it generally grows at low altitudes but may be found to 1300 m altitude.
Soil types: It prefers dry, gravelly or rocky and sandy soils, but in Madras (India) it grows well on loamy soils. It is tolerant of saline-sodic soil conditions[4].

Phytochemicals of *Tephrosia purpurea*

Rao and Raju (1979) were isolated Isolonchocarpin, this is the first report of the isolation of optically active isolonchocarpin from a natural source, from the roots of *T. purpurea* and suggested by optical activity and ^{1}H NMR spectra. Three other crystalline compounds were isolated from petrol soluble fraction of $CHCI_3$ 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[5].

Andrew Pelter et al (1981) were isolated and characterised ten unusual and closely related flavonoids from the roots of *T. 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 precursor. The ^{1}H and ^{13}C NMR. spectra used in structural elucidation[6].

E Venkata Rao and N Ranga Raju (1984) were examamined the petrol soluble fraction of the chloroform extract of *T. purpurea* roots. 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[7].

Rajinder Kumar Gupta et al (1980) studied column chromatography of the benzene extract of seeds resulted in the isolation of the new flavanone, named as purpurin. Identication was done by ^{1}H NMR and Mass spectral analysis and the results suggested the structure as 2, 3- dihydrosemiglabrin[8].

Saxena V.K and Choubey A (1997) were isolated a novel neoflavonoid glycoside, serratin 7-O-[beta-D-glucopyranosyl-(1-4)-O-beta-D-galactopyranoside] from the $CHCl_3$ soluble fraction of the *T. purpurea* stem and the structure confirmed by chemical and spectral analysis[9].

Ahmad V.U. *et al* (1999) have isolated tephrosin, pongaglabol, and semiglabrin from *T. purpurea* aerial parts and identification was done by NMR spectra[10].

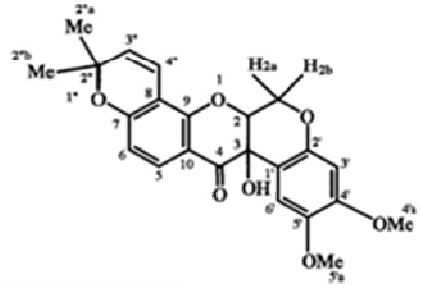
Shankar MB *et al* (2005) have isolated a new benzopyrone derivative (TP) from the alcoholic extract of aerial parts of *Tephrosia purpurea* by normal phase column chromatography using toluene: ethyl acetate (70:30) as mobile phase and structure was elucidated by spectroscopic methods. Results suggest that the Compound TP was found to be 3-hydroxy, 6-methoxy, 2-oxy (3-butanone), 7 (dioxolane-4-one), 2, 3,-dihydrobenzopyrone[11].

Mohamed-Elamir F *et al* (2009) were Chemically investigated the aerial parts 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, $^{1}H–^{1}H$ COSY, $^{1}H–^{13}C$ 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[12].

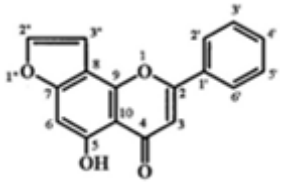
Investigation on the methylenechloride extract of aerial parts of *T. purpurea* by Ali K Khalafalah et al (2010) resulted in isolation and structural elucidation of three compounds namely, 1: an aromatic ester; was identified as 2-propenoic acid, 3-(4-(acetyloxy) -3-methoxypheny)-3(4-actyloxy)-3-methoxyphenyl)-2-propenyl ester, 2: a sesquiterpene of the rare rotundane skeleton; was assigned to the sesquiterpene of rotundane skeleton 4-isopropyl-1,8-dimethyl-decahydro-azulene-5, 8, 9-triol and 3: a prenylated flavonoid; as apollinine. The structures of the compounds were established by comprehensive ^{1}H NMR, ^{13}C NMR, DEPT, $^{1}H–^{1}H$ COSY, $^{1}H–^{13}C$ COSY, HMBC and EIMS[13].

Chang LC *et al* (2000) were isolated three novel flavonoids, (+)-tephrorins A and B and (+)-tephrosone, from *Tephrosia purpurea* leaves. 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[14].

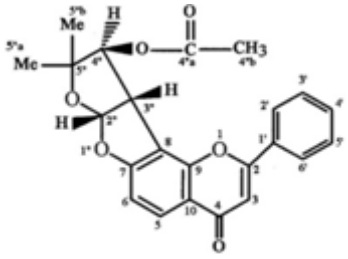
Virinder S *et al* (1989) were isolated β-Sitosterol, ursolic acid and sigmasterol-α from the petrol and benzene extracts of the whole plant by column chromatography. The ethanol extract of the plant on column chromatography yielded only one compound viz. pongamol as the enol structure, whose identification was done by MP, spectroscopic (IR, UV, ^{1}H NMR, ^{13}C NMR) and crystallographic methods[15].



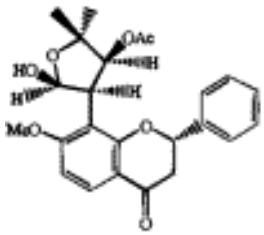
Tephrosin



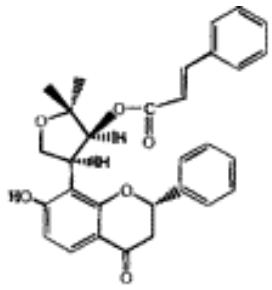
Pongaglabol



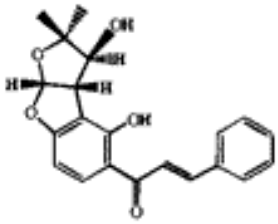
Semiglabrin



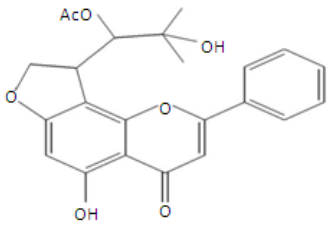
Tephrorin A



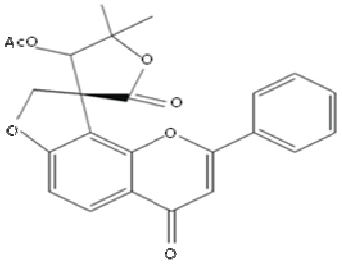
Tephrorin B



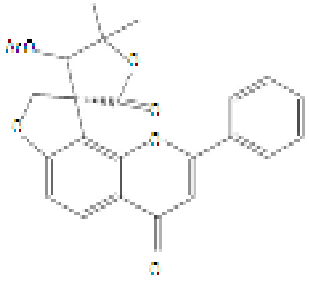
Tephrosone



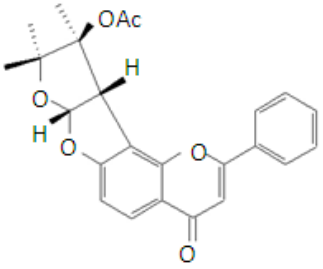
Tephropurpulin A



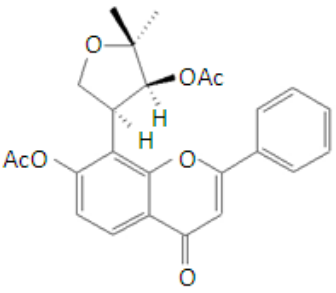
Isoglabratephrin



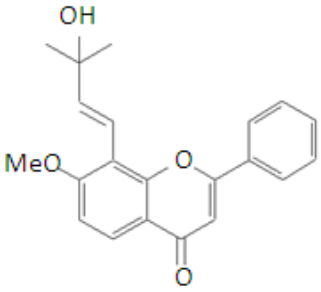
Glabratephrin



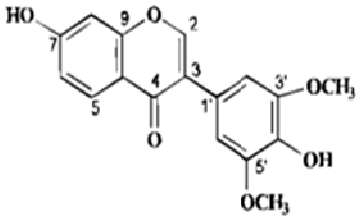
Semiglabrin



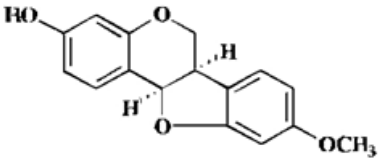
Terpurinflavone



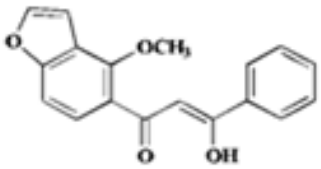
Lanceolatin



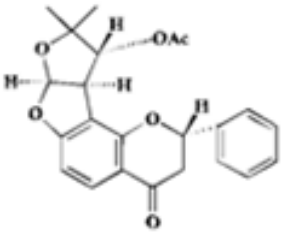
7,4-dihydroxy-3,5-dimethoxyisoflavone



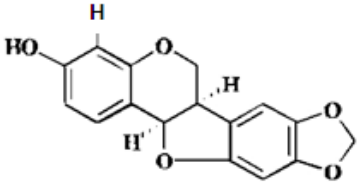
(-)-medicarpin



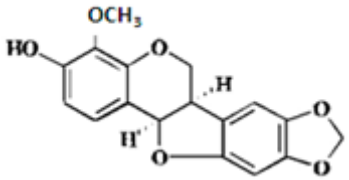
(+)-tephropurpurin



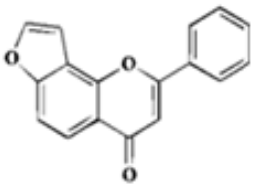
(+)-purpurin



(-)-maackiain



(-)-3-hydroxy-4-methoxy-8,9-methylene-dioxypterocarpan



Pongamol

Biological and pharmacological activities

During past several years, *Tephrosia purpurea* has been gaining a lot of interest according to researcher's point of view. Recently many pharmacological studies have been conducted on *Tephrosia purpurea*. A summary of findings of these studies presented below.

Antimicrobial activity

Sharma P. Rastogi *et al* (2003) reported that 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 hamsters[16].

Thetwa LK *et al* (2006) were tested the seed extracts of the plant *Tephrosia purpurea* for their antimicrobial and antifungal properties against some human, animal and plant pathogenic organisms. The study revealed that the seed extract showed a good inhibition effect against all the tested microorganisms[17].

Kumar GS *et al* (2007) were evaluated antimicrobial activity of ethanolic extract of *Tephrosia purpurea* roots by disc diffusion and broth dilution methods. The results generated from the study revealed the significant antimicrobial activity of test extract[18].

Rangama BNLD *et al* (2009) were screened water extracts of leaves, pods and roots of *Tephrosia purpurea* for antimicrobial activity was performed by 'disc diffusion bioassay' and'well method'. The root extract of *T. purpurea* showed considerable inhibition of the three *Pseudomonas* isolates i.e. *P. aeruginosa* [NCTC 10662] *Pseudomonas* strain 1 and 2 and two of the coli form strains i.e. coli form strain 6 and coli form strain 9. No inhibition was shown by the leaf extract on any of the isolates tested[19].

Annalakshmi Chinniaha *et al* (2009) were reported methanolic extract of *Tephrosia purpurea* and two of its relatively less polar fractions showed potent anti-*Helicobacter pylori* activity against clinical as well as standard strains. Results revealed the functional efficacy of methanolic extract at acidic pH mimicking stomach environment and did not develop drug resistance upon repeat exposure and also exhibited synergistic potential with common antibiotics[20].

Surve Suvidha S and Patil Anuja (2009) were evaluated pet ether, ethanol and aqueous extracts of seeds of *Tephrosia purpurea* for anthelmintic activity. Ethanol and aqueous seeds extracts exhibited anthelmintic activity in dose-dependent manner giving shortest time of paralysis and death of *Pheretima posthuma* at 100 mg/ml concentration. Ethanolic extract was found to be most potent among the all extracts and showed the maximum anthelmintic activity due to the presence of different constituents such as alkaloids, glycosides, steroids and sterols, anthraquinones, flavonoids, triterpenoids and fixed oil[21].

Devprakash KK *et al* (2011) were investigated *T. purpurea* for *in-vitro* antimicrobial activity against pathogens namely *Staph. aureus, E. coli*, *P. aeruginosa,* and *B. subtitils* by disc diffusion method compared with standard antibiotic. The ethanolic extract of plant showed better antibacterial activity than aqueous extract against all organisms. The phytochemical analysis revealed the presence of flavanoids, glycosides, phenols, tannins, saponins and alkaloids. The observed antibacterial activity of the plant extracts was linked to the presence of Tannins in the test extracts[22].

Sachin Parashram Venkatraman (2011) studied the antimicrobial activity of pet ether, ethanol and aqueous extracts of seeds of *T. purpurea.* Among tested extracts, pet ether extract was found to be having potent antimicrobial activity[23].

Wanyama P *et al* (2011) found that *Tephrosia purpurea* stem extract showed antiplasmodial activity against the D6 (chloroquine sensitive) and W2 (chloroquine-resistant) strains of *Plasmodium falciparum* with IC_{50} values of 10.47 ± 2.22 µg/ml and 12.06 ± 2.54 µg/ml, respectively. The new compound, terpurinflavone, showed the highest antiplasmodial activity with IC_{50} values of 3.12 ± 0.28 µM (D6) and 6.26 ± 2.66 µM (W2)24.

Analgesic and Anti-inflammatory activities

Gopalakrishnan S *et al* (2010) were investigated an 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 maintained at 55°C. The results obtained from the two models showed that *T. purpurea* ethanol extracts can effectively reduce inflammation in both the acute and chronic phases and it can **si**gnificantly inhibit the responses to thermal stimulus, when compared to the standard drug, Indomethacin[25].

Shenoy Smita *et al* (2010) reported that ethanolic extract of *T. Purpurea* administered orally did not exert anti-inflammatory effect in acute inflammation. But the same extract has significant anti-inflammatory effect in subacute inflammation since it inhibits the proliferative phase of inflammation[26].

Antihyperglycemic and antilipidperoxidative effects

Pavana P *et al* (2007) evaluated the antihyperglycemic and antilipidperoxidative effects of ethanolic seed extract of *Tephrosia purpurea* in streptozotocin induced diabetic rats. Oral administration of plant extract at a dose of 300 mg/kg showed significant antihyperglcemic and antilipidperoxidative effects as well as increased activities of enzymatic antioxidants and levels of non enzymatic antioxidants. Authors also noticed that antihyperglycemic effect of plant extract was comparable to that of the reference drug glibenclamide[27].

Pavana P *et al* (2007) demonstrated that aqueous extract of *Tephrosia purpurea* leaves possesses significant antihyperglycemic and antihyperlipidemic effects in streptozotocin induced diabetic rats. The activities of extract were evidenced by observing significant reduction of blood glucose and increased level of plasma insulin as well as normalized the lipids and lipoproteins profile[28].

B.R.Balakrishnan *et al* (2007) investigated the lipid lowering properties of methanolic extract of *Tephrosia purpurea* leaves on experimentally triton induced rats. Extract on oral administration at doses of 300 and 600 mg/kg in triton induced rats showed significant reduction in total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C) and triglycerides (TG) levels, while high density lipoprotein cholesterol (HDL-C) level was significantly increased when compared to control group. The results suggested that methanolic plant extract can reduce lipid levels[29].

Joshi *et al* (2008) studied *T. purpurea* root extracts (Pet-Ether, ethanol and aqueous alcohol) for anti-diabetic activity. Single dose administration of all the extracts did not exhibit any hypoglycemic effect but repeated administration of alcoholic and hydro-alcoholic extracts showed significant antidiabetic activity.

These results suggest that aqueous and hydro-alcoholic extracts possess antidiabetic activity[30].

Pavana P *et al* (2009) studied the effects of 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[31].

Hepatoprotective activity

Murthy and Srinivasan (1993) examined *T. purpurea* aerial parts for its efficacy in hepatotoxicity induced by D-galactosamine HCl (acute) and carbon tetrachloride (chronic) in rats. Serum levels of transaminases (SGOT and SGPT), bilirubin and histopathological changes in the liver were used as the biochemical markers of hepatotoxicity. The administration of *T. purpurea* along with the hepatotoxins offered a protective action in both acute (D-galactosamine) and chronic (CCl_4) models[32].

Datta *et al* (1997) examined “Yakrifit" (a polyherbal product in which *T. purpurea* is a part), for its appetite stimulant activity. All the animals recovered in 3 to 7 days, regained appetite for food and water and their general condition had improved[33].

Mitra *et al.* (1998) studied HD-03 (a polyherbal product in which *T. purpurea* is a part) formulation for its hepatoprotective effect against paracetamol (PCM), thioacetamide (TAA) and isoniazid (INH) induced hepatotoxicity. From the results it is evident that HD-03 affords protection by acting through a mechanism non-specific to PCM/TAA/INH induced hepatotoxicity. Thus the stimulation of hepatic cell regeneration, membrane-stabilisation and altered mode of detoxification of compounds or activation of

reticulo-endothelial system appears to be some modes of actions of HD-03 in affording hepatoprotection[34].

Mitra *et al.* (1999) examined anticholestatic acitivity of HD-03, (a polyherbal product in which *T. 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[35].

Lucas and Ananada Rajasekhar (2000) studied antihepatotoxic activity of *T. purpurea* used in Ayurveda. From the results it is evident that plant exhibited antihepatotoxic effect by stimulating cell regeneration[36].

Shankar MB *et al* (2005) studied the hepatoprotective activity of a new benzopyrone derivative (TP) isolated from the alcoholic extract of aerial parts of *Tephrosia purpurea.* Hepatoprotective activity of TP and the alcoholic extract was evaluated using carbon tetrachloride, paracetamol and rifampicin as toxicants. Results suggest that alcoholic extract (200 mg/kg) and benzopyrone derivative (100 mg/kg) caused significant fall of the serum enzyme levels (SGOT, SGPT) of the animals. Alcoholic extract of *T. purpurea* and TP have shown significant hepatoprotective activity in rats against all the toxicants that were studied[11].

Prabhu Nair S (2006) showed protective effect of Tefroli tonic (a polyherbal mixture containing *T. purpurea*) against cadmium induced hepatotoxicity in experimental rats. Subcutaneous injection of cadmium chloride to rats caused liver damage and was observed by analysis of serum bilirubin and assay of marker enzymes such as trnsaminase and phosphates of serum and liver. The administration of Tefroli tonic has maximum protective effect against cadmium chloride induced hepatotoxicity in rats[37].

Jain A *et al* (2006) reported that the ethanol extract of leaves and flavonoid (isolated from leaves extract) from *Tephrosia*

purpurea were evaluated for hepatoprotective activity in rats by inducing hepatotoxicity with carbon tetrachloride. Serum level of transaminases, alkaline phosphatase and total bilirubin were used as biochemical markers of hepatotoxicity. Histopathological changes in the liver were also studied. The results of the study indicated that the hepatoprotective activity was more in ethanolic extract of leaves than isolated flavonoid. The higher activity of leaves extract may be contributed due to synergistic effect of flavonoids present in the drug[38].

Amit Khatria *et al* (2009) were evaluated the aqueous–ethanolic extract of *Tephrosia purpurea* aerial parts (100, 300 and 500 mg/kg/day) for hepatoprotective activity against thioacetamide-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[39].

Varsha Kashaw *et al* (2011) were studied the dried ethanolic extract of *Tephrosia purpurea* for its efficacy in both acute (D-galactosamine) and chronic models (CCl_4) of experimentally induced hepatotoxicity. Results revealed the mechanism of hepatoprotection by *T. purpurea* mainly involves membrane stabilization of liver cells as indicated by decrease in levels of SGOT, SGPT and bilirubin levels, wherein it prevents cellular leakage and loss of functional integrity of liver cell membranes caused by various hepatotoxic agents. *T. purpurea* also leads to increase in hepatic regeneration, which again contributes to its hepatoprotective efficacy[40].

Nephroprotective activity

Kumar VP et al (2001) studied the nephroprotective activity of alcohol extract of *T. purpurea* in gentamicin-induced kidney cell damage and *in-vitro* hydroxyl radical scavenging activity. The

hydroxyl radical scavenging effect of the extract was enhanced with increases in the concentration of drug, suggesting the role of free radical scavengers in minimizing gentamicin-induced kidney cell damage[41].

Naghma Khan *et al* (2001) were investigated a chemopreventive efficacy of *T. purpurea* against N-diethylnitrosamine-initiated and potassium bromate-mediated oxidative stress and toxicity in rat kidney. The data indicate that *T. purpurea is* a potent chemopreventive agent against renal oxidative stress and carcinogenesis induced by N-diethylnitrosamine and $KBrO_3$ by reducing lipid peroxidation and xanthine oxidase activities and enhancing antioxidant enzymes acivity[42].

Swathi *et al*. (2008) evaluated aqueous extract of *T. purpurea* roots for its antilithiatic activity in two models of urolithiasis. The aqueous extract of *T. purpurea* was found to be effective in reducing the formation of and dissolving existing calcium oxalate (Gentamicin and 5% ammonium oxalate) and magnesium ammonium phosphate stones(zinc discs)[43].

Jain and Singhai *et al* (2009) shown *T. purpurea* leaves possesses marked nephroprotective and curative activities without any toxicity. The proposed mechanisms of activities are antioxidant activity and inhibition of overproduction of NO and COX-2 expression and it may be attributed to phenolic and flavonoidal compounds like quercetin[44].

Membrane stabilizing potency

Gokhale A.B et al (2000) reported the ethanolic extract of *T. pu*rpurea 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. T. 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 reveal that the ethanolic extract of *T. purpurea* may inhibit degranulation of mast cells by a mechanism other than membrane stabilization[45].

Sandhya S. *et al* (2010) have made an attempt to evaluate *in-vitro* anti inflammatory activity of *Tephrosia purpurea* by means of HRBC membrane stabilizing method using three extracts like chloroform, ethyl acetate and methanolic extracts of the root of both the plants, *Tephrosia maxima* and *Tephrosia purpurea* Pers. to identify the potent extract. It was observed that all the three extracts of both the plants showed significant HRBC membrane stabilization activity with regard to the standard hydrocortisone of 88.2% at 500 µg/ml. The methanolic extract of the plants was found be a better choice with a percentage protection of 79.49% and 79.01% at 500µg/ml for *Tephrosia maxima* and *Tephrosia purpurea* respectively[46].

Anti-oxidant activity

Soni K *et al* (2006) investgated the ethanol 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 IC_{50} 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 *T. purpurea* exhibits antioxidant activity *in-vivo* and the ethyl acetate soluble fraction has improved antioxidant potential than the ethanol extract[47].

Jain A *et al* (2006) have taken up the investigation of *in-vitro* antioxidant activity of *Tephrosia purpurea* leaves in DPPH free radical scavenging, and nitric oxide scavenging methods. The ethanol extract showed good antioxidant activity in these above methods. This activity may be due to the presence of flavanoids[48].

Bhaskar Rao *et al.* (2007) evaluated *in vitro* antioxidant properties of aqueous extracts of *Alternanthera sessilis* and *T. purpurea*. Both the plants are beneficial as an antioxidant sources and the plants possess significant levels of enzymatic antioxidants, non-enzymatic antioxidants and also exhibits antioxidant capacity[49].

Avani Patel *et al* (2010) studied the leaves of *T. purpurea* Linn (sarpankh), *in-vitro* antioxidant activity of aqueous and ethanolic extracts. The results revealed that leaves of this plant have antioxidant potential. Among these results ethanolic extract has more potent than traditionally claiming aqueous decoction. They concludes that *T. purpurea* leaves possesses the antioxidant substance which may be potential responsible for the treatment of jaundice and other oxidative stress related diseases[50].

Rumit Shah *et al* (2010) studied the 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 and evaluated for its primary phytochemical analysis for total phenolic content and *in-vitro* 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 *T. purpurea* have marked amount of total phenols which could be responsible for the antioxidant activity[51].

Vivek Kumar R *et al* (2011) In the present paper ten plants (*Picrorrhiza kurroa, Tephrosia purpurea, Terminalia Arjuna, Tinospora cordifolia, Glycyrrhiza glabra, Azadirachta indica, Apium graveolens, Swertia chirata, Phyllanthus amarus, and Aloe vera)* their possible constituents responsible for its antioxidant property were compared by reducing power, 2, 2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity method. The study clearly indicates that the extract of all ten plants possesses antioxidant property. Thus, this investigation is the first report on the comparative analysis of the antioxidant properties of 10 important Hepatoprotective drug[52].

Antitumor activity

Mohammad Saleem *et al* (2001) assessed 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 *T. purpurea* in DMBA-initiated and croton oil-promoted mice skin, which further suggests the antitumor-promoting potential of *T.purpurea*. In addition, *T. purpurea* reversed TPA-mediated inhibition of the activities of antioxidant enzymes such as glutathione S-transferase, glutathione reductase, catalase and cutaneous glutathione[53].

Wound healing activity

Saleem M.Alam A *et al* (1999) studied the modulatory effect of *Tephrosia purpurea* on benzoyl peroxide-induced cutaneous oxidative stress. The susceptibility of cutaneous microsomal membrane to lipid peroxidation and hydrogen peroxide generation was significantly reduced and in addition depleted levels of glutathione and inhibited activity of antioxidant enzymes were recovered to a significant level in a dose-dependent manner. The results suggest that T. purpurea is an effective chemopreventive agent in skin that may suppress benzoyl peroxide-induced cutaneous toxicity[54].

Santram Lodhi *et al* (2006) studied the wound healing potential of ethanolic extract of *Tephrosia purpurea* aerial parts in the form of simple ointment using three types of wound models in rats as incision wound, excision wound and dead space wound. The results showed that ethanolic extract ointment possesses a definite prohealing action. This was demonstrated by a significant increase in the rate of wound contraction and by enhanced epithelialization. Significant increase in tensile strength, hydroxyproline content and collagen levels were observed, which was further supported by histopathological studies and gain in granuloma breaking strength.

This indicated improved collagen maturation by increased cross-linking while an increase in dry granuloma weight indicated higher protein content[55].

Tejal B. Chaudhari *et al* (2010) reported 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 prohealing 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].

Antiulcer activity

Deshpande S.S. *et al* (2003) studied 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[57].

Anti-epileptic activity

Asuntha G *et al* (2010) studied the anti-epileptic activity of *Tephrosia purpurea* in *Status epilepticus* induced in rats by administration of pilocarpine after lithium chloride. The results of lithium-pliocarpine induced *status epilepticus* model demonstrated that the ethanolic extract of *Tephrosia purpurea* has significant ability in reducing the severity of *status epilepticus* and also possess both *in vitro* and *in vivo* antioxidant activity[58].

Anxiolytic activity

Sathish Kumar A *et al* (2011) studied 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.[59]

Immunomodulatory activity

Damre AS *et al* (2003) studied the flavonoid fraction of *Tephrosia purpurea* (FFTP) 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 *T. purpurea in-vivo*[60].

Anticarcinogenic

Kavitha, K and Manoharan S (2006) investigated 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[61].

Antiviral activity

Kokila AP *et al* (2010) studied the methanol extracts of *Tephrosia purpurea* flowers for antiviral 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 *T. purpurea* flowers against viruses and also very good antibacterial activity against gram + ve, and gram – ve, strains[62].

Spasmolytic Activity

Soni KK *et al* (2004) have investigated 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[63].

Antiallergic activity

Gokhale AB and Saraf MN (2000) examined the influence of ethanolic extract of *Tephrosia purpurea* aerial parts on release of mediators of anaphylaxis induced by chemical and immunological stimuli. Treatment with ethanolic extract of Tephrosia purpurea showed a dose related inhibition of edema induced by compound 48/80 and egg albumin. The extract inhibited passive paw anaphylaxis in rats and also inhibited histamine release induced in passive peritoneal anaphylaxis. The studies reveal that the ethanolic extract of Tephrosia purpurea has antiallergic activity[64].

Conclusion

The literature study reveals that the different parts of *Tephrosia purpurea* contain wide varieties of phytoconstituents possessing different pharmacological activities. This will supports its use in various conditions like inflammation, enlargement of the spleen, obstructions of the liver and kidneys, diseases of lungs, blood and in tumors etc. However extensive study is required to elaborate its constituents and pharmacological activities for extension to human use.

References

1. Ben-Erik Vanwyk, Michael Wink. Medicinal plant of the world. 1st ed. South Africa: Briz publication 2009;(7): 43.
2. Rangama BNLD, Abayasekara CL, Panagoda GJ and Senanayake MRDM. Antimicrobial activity of *Tephrosia purpurea* (Linn.) Pers. and *Mimusops elengi* (Linn.) against some clinical bacterial isolates. .Natn Sci Foundation Sri Lanka 2009; 37(2): 139-145.

3. KR Kirtikar and BD Basu. Indian medicinal plants. 2nd ed. Dehradun: International book distributors and publishers 1996; 724.
4. Orwa C, Mutua A , Kindt R , Jamnadass R, Simons A. Agroforestree Database:A tree reference and selection guide version 4. 2009; 1-5.
5. Rao E Venkata and N Ranga Raju. Occurrence Of (-)-Isolonchocarpin in the roots of *Tephrosia purpurea.* Phytochemistry 1979; 18: 1581-1582.
6. Andrew Pelter, Robert S Ward, Rao E Venkata and Ranga N Raju. 8-Substituted flavonoids and 3′-substituted 7-oxygenated chalcones from Tephrosia purpurea. J Chem Soc 1981; 1: 2491-2498.
7. E Venkata Rao and N Ranga Raju. Two flavonoids from *Tephrosia purpurea.* Phytochemistry 1984; 23(10): 2339-2342.
8. Gupta RK, Krishnamurti M and Parthasarathi J. A new flavanone from *Tephrosia purpurea* seeds. Phytochemistry 1980; 19: 1264.
9. Saxena VK, Choubey A. A novel neoflavonoid glycoside from Tephrosia purpurea stem. Fitoterapia 1997; 68(4): 359-360.
10. Ahmad VU, Ali Z, Hussaini SR, Iqbal F, Zahid M, Abbas M, Saba N. Flavonoids of *Tephrosia purpurea*. Fitoterapia 1999; 70: 443-445.
11. Shankar MB, Parikh JR, Geetha M, Mehta RS, Saluja AK. Hepatoprotective activity of a benzopyrone from *Tephrosia purpurea* Pers. Journal of Natural Remedies 2005; 5(2): 115-120.
12. Mohamed Elamir F, Hegazy A , Mohamed H, Abd El-Razek , Fumihiro Nagashima C, Yoshinori Asakawa C, Paul W Pare. Rare prenylated flavonoids from *Tephrosia purpurea*. Phytochemistry 2009; 70: 1474–1477.
13. Ali K Khalafalah1, Afifi H Yousef1, Abeer M Esmail1, Mohamed H Abdelrazik, Mohamed EF Hegazy, Abou-El-Hamd H Mohamed. Chemical constituents of *Tephrosia purpurea*. Pharmacognosy Research 2010; 2(2): 72-75.
14. Chang LC, Chαvez D, Song LL, Farnsworth NR, Pezzuto JM, Kinghorn AD. Absolute configuration of novel bioactive flavonoids from *Tephrosia purpurea*. Org Lett 2000; 2: 515-518.

15. Virinder S Parmar, Jatendra S Rathore, Rajni Jain, Deirdre A, Henderson and John F Malone. Occurrence of pongamol as the enol structure in *Tephrosia purpurea*. Phytochemistry 1989; 28(2): 591-593.
16. Sharma P, Rastogi S, Bhatnagar S, Srivastava JK, Dube A, Guru P, Kulshrestha DK, Mehrotra BN, Dhawan BN. Antileishmanial Action of *Tephrosia purpurea* Linn extract and its fractions against experimental visceral Leishmaniasis. Drug Development Research 2003; 60(4): 285-293.
17. Thetwa LK, Shrivastava Alka, Shrivastava Seema, Deshmukh NC, Augor MR and Tandon RC . Antimicrobial efficacy of successive seed extracts of *Tephrosia purpurea*. Asian Journal of Chemistry 2006; 18(1): 745-746.
18. Kumar GS, Jayaveera KN, Ashok Kumar CK, Umachigi P Sanjay, BM Vrushabendra Swamy, DV Kishore Kumar. Antimicrobial effects of Indian medicinal plants against acne-inducing bacteria. Tropical Journal of Pharmaceutical Research 2007; 6(2): 717-723.
19. BNLD Rangama1, Abayasekara1 CL, Panagoda GJ and Senanayake MRDM. Antimicrobial activity of *Tephrosia purpurea* (Linn.) Pers. and *Mimusops elengi* (Linn.) against some clinical bacterial isolates. Natn Sci Foundation Sri Lanka 2009; 37(2): 139-145.
20. Annalakshmi Chinniaha, Satyabrata Mohapatrab, Suchandra Goswamia, Mahapatrab Anita, Sudip K Kara, UV Mallavadhanib, Das PK. On the potential of *Tephrosia purpurea* as anti-Helicobacter pylori agent. Journal of Ethnopharmacology 2009; 124: 642-645.
21. Surve Suvidha S, Patil Anuja. Evaluation of pharmacognostical, phytochemical and pharmacological activity of *Tephrosia purpurea* Linn. International Journal of Pharma Research and Development 2009; 1(5).
22. Dev Prakash, KK Srinivasan, T Subburaju, Sachin kumar Singh. Antimicrobial activity of alcoholic and aqueous extracts of *Tephrosia purpurea*. Asian Journal of Biochemical and Pharmaceutical Research Issue 2011; 2(1).
23. Sachin Parashram Venkatraman. Phytochemical evaluation and antimicrobial activity of seeds of *Tephrosia purpurea* linn. Imperial J Pharmaceutics & Cosmetology2011; 1(1): 38-46.

24. Wanyama P Juma, Hoseah MA, Fredrick L Eyase BC, Lois MM , Matthias Heydenreich , Faith A.Okalebo , Peter M Gitu , Martin G Peter , Douglas S Walsh , Mabel Imbuga, Abiy Yenesew. Terpurinflavone: An antiplasmodial flavone from the stem of *Tephrosia Purpurea*. Phytochemistry Letters 2011; 4: 176–178.
25. Gopalakrishnan S, Vadivel E and Dhanalakshmi K. Anti-inflammatory and analgesic activities of *Tephrosia purpurea* Linn. aerial and root extracts. Journal of Pharmacy Research 2010; 3(5): 1103-1106.
26. Shenoy Smita, Shwetha K, Prabhu K, Maradi R, Bairy KL, Shanbhag T. Evaluation of antiinflammatory activity of *Tephrosia purpurea* in rats. Asian Pacific Journal of Tropical Medicine 2010; 193-195.
27. Pavana P, Sethupathy S, Manoharan S. Antihyperglycemic and antilipidperoxidative effects of *Tephrosia purpurea* seed extract in streptozotocin induced diabetic rats. Indian Journal of Clinical Biochemistry 2007; 22(1): 77-83.
28. Pavana P, Manoharan S, Renju GL, Sethupathy S. Antihyperglycemic and antihyperlipidemic effects of *Tephrosia purpurea* leaves extract in streptozotocin induced diabetic rats. Journal of Environmental Biology 2007; 28(4): 833-837.
29. Balakrishnan BR, Sangameswaran B, Rshid Akhtar, Jayakar B and Bhaskar VH. Anti-hyperlipidemic effects of *Tephrosia purpurea* Linn on triton induced rats. The Pharmacist 2007; 2(1): 31-33..
30. Joshi NC, Murugananthan G, Thabah P and Nandakumar K. Hypoglycaemic and antidiabetic activity of *T. purpurea* (Linn.) root extracts. Pharmacologyonline 2008; 3: 926-933.
31. Pavana P, Sethupathy S, Santha K, Manoharan S. Effects of *Tephrosia purpurea* aqueous seed extract on blood glucose and antioxidant enzyme activities in streptozotocin induced diabetic rats. Afr J Trad CAM 2009; 6 (1): 78-86.
32. Murthy MSR and Srinivasan M. Hepatoprotective effect of *T. purpurea* in experimental animals. Indian Journal of Pharmacology 1993; 25 (1): 34-36.

33. Datta AM, Bhatt TK and Dalal DS. Use of herbal liver tonic Yakrifit in equine practice. Indian Veterinary Journal 1997; 74 (5): 424-425.
34. Mitra SK, Venkataranganna MV, Sundaram R and Gopumadhavan S. Protective effect of HD-03, an herbal formulation, against various hepatotoxic agents in rats. Journal of Ethnopharmacology 1998; 63 (3): 181-186.
35. Mitra SK, Venkataranganna MV, Gopumadhavan S and Sundaram R,.Anticholestatic activity of HD – O3 an herbal formulation in hioacetamide (TAA) induced experimental cholestasis. Indian Journal of Experimental Biology 1999; 37 (4): 409-410.
36. Lucas DS and Ananada Rajasekaran R. A review of experimental studies on antihepatotoxic activity of certain medicinal plants used in Ayurveda. Phytomedicine 20007; l: 23.
37. Prabhu Nair S. Protective effect of Tefroli – a polyherbal mixture (Tonic) on cadmium chloride induced hepatotoxic rats. Pharmacognosy Magazine 2006; 2 (6): 112-118.
38. Jain A, Singhai AK, VK Dixit. A comparative study of ethanol extract of leaves of *Tephrosia purpurea* pers and the flavonoid isolated for hepatoprotective activity. Indian J Pharm Sci 2006; 68(6): 740-743.
39. Amit Khatria, Arun Gargb, Shyam S Agrawal. Evaluation of hepatoprotective activity of aerial parts of *Tephrosia purpurea* L. and stem bark of *Tecomella undulate.* Journal of Ethnopharmacology 2009; 122: 1–5.
40. Varsha Kashaw, Amit kumar Nema1, Abhinav Agarwal. Hepatoprotective prospective of herbal drugs and their vesicular carriers. A Review International Journal of Research in Pharmaceutical and Biomedical Sciences 2011; 2(2).
41. Kumar VP, Shashidhara S, Kumar MM, Sridhara BY. Hydroxyl radical scavenging and protective role of *Tephrosia purpurea* in gentamicin-induced kidney cell damage. Pharmaceutical Biology (Formerly International Journal of Pharmacognosy) 2001; 39(5): 325-328.
42. Naghma Khan, Sonia Sharma, Aftab Alam, Mohammad Saleem and Sarwat Sultana. *Tephrosia purpurea* Ameliorates N-diethylnitrosamine and potassium bromated mediated renal

oxidative stress and toxicity in Wistar rats. Pharmacology & Toxicology 2001; 88: 294-299.

43. Swathi D, Sujatha D, Bharathi K and Prasad KVSRG. Antilithiatic activity of the aqueous extract of the roots of *T. purpurea* Linn. Pharmacognosy Magazine 2008; 4(6): 206-211.
44. Jain A and Singhai AK. Effect of *T. Purpurea* pers. on gentamicin model of acute renal failure. 13th International Conference on Biomedical Engineering 2009; 23: 1438-1442.
45. Gokhale AB, Dikshit VJ, Damre AS, Kulkarni KR, Saraf MN. Influence of ethanolic extract of *Tephrosia purpurea* Linn. on mast cells and erythrocytes membrane integrity. Indian journal of Experimental Biology 2000; 38(8): 837-840.
46. Sandhya SK, Venkatramana, Vinod KR, Chaitanya RK, Chandrasekhar J, Sudhakar K and Rajeswar T. Membrane stabilizing potency of two *Tephrosia* species. Journal of Phytology 2010; 2(6): 42-46.
47. Soni K , Kumar PS, Saraf MN. Antioxidant activity of fraction of *Tephrosia purpurea* Linn. Indian Journal of Pharmaceutical Sciences 2006; 68(4): 456-460.
48. Jain A, Singhai AK ,Dixit VK. In vitro evaluation of *Tephrosia purpurea* Pers for antioxidant activity. Journal of Natural Remedies 2006; 6(2): 162-164.
49. Bhaskar Rao D, Subhashini Devi P, Aparanji P, Rama Rao M and Raghava Rao T. In vitro evaluation of antioxidant properties and their capacity of aqueous extract of *Alternanthera sessilis* and *T. purpurea*. Biosciences, Biotechnology Research Asia 2007; 4(2): 551-560.
50. Patel Avani, Patel Amit, Patel NM. Estimation of flavonoid, polyphenolic content and In-vitro antioxidant capacity of leaves of *Tephrosia purpurea* Linn. (Leguminosae). International Journal of Pharma Sciences and Research 2010; 1(1): 66-77.
51. Rumit Shah, Heena Kathad, Rajal Sheth, Naveen Sheth . In vitro antioxidant activity of roots of *Tephrosia purpurea* linn . International Journal of Pharmacy and Pharmaceutical Sciences 2010; 2(3): 30-33.
52. Vivek Kumar R, Satish Kumar, Shashidhara S, Anitha S, ManjulaM. Comparison of the antioxidant capacity of an

important hepatoprotective plants. International Journal of Pharmaceutical Sciences and Drug Research 2011; 3(1): 48-51.
53. Mohammad Saleem, Salah-Uddin Ahmed, Aftab alam and Sarwat sultana. *Tephrosia purpurea* alleviates phorbol ester-induced tumor promotion response in murine skin. Pharmacological Research 2001; 43(2): 135-144.
54. Saleem M, Alam A, Ahmed S, Iqbal M, Sultana S. *Tephrosia purpurea* ameliorates benzoyl peroxide-induced cutaneous toxicity in mice: Diminution of oxidative stress. Pharmacy and Pharmacology Communications 1999; 5(7): 455-461.
55. Santram Lodhi, Rajesh Singh Pawar, Alok Pal Jain, AK Singhai. Wound healing potential of *Tephrosia purpurea* (Linn.) Pers. in rats. Journal of Ethnopharmacology 2006; 108: 204–210.
56. Tejal B Chaudhari, Dipak A Tambe, Sanjay R Chaudhari, Machindra J Chavan, Dinesh P Hase. An investigation of wound healing activity of *Tephrosia purpurea* (Linn.) Pers. root extracts in rats. Journal of Pharmacy Research 2010; 3(9): 2215-2217.
57. Deshpande SS, Shah GB, Parmar NS. Antiulcer activity of *Tephrosia purpurea* in rats. Indian Journal of Pharmacology 2003; 35: 168-172.
58. Asuntha G, Prasannaraju Y, Sujatha D, Prasad KVSR3. Assessment of effect of ethanolic extract of *Tephrosia purpurea* (L.) Pers., Fabaceae, activity on lithium-pilocarpine induced status epilepticus and oxidative stress in Wistar rats. Brazilian Journal of Pharmacognosy 2010; 20(5): 767-772.
59. Sathish Kumar A, Amudha P and Satheesh Kannan C. Evaluation of anxiolytic activity of hydroalcoholic activity of *Tephrosia purpuria* (l) pers on swiss albino mice. International Journal Pharmaceutical Sciences and Research 2011; 2(5): 1262-1269.
60. Damre AS, Gokhale AB, Phadke AS, Kulkarni KR, Saraf MN. Studies on the immunomodulatory activity of flavonoidal fraction of *Tephrosia purpurea.* Fitoterapia 2003; 74: 257-261.
61. Kavitha K, Manoharan S. Anticarcinogenic and antilipidperoxidative effects of *Tephrosia purpurea* (Linn.) Pers. in 7, 12-dimethylbenz(a)anthracene (DMBA) induced

hamster buccal pouch carcinoma. Indian J Pharmacol 2006; 38 (3): 185-89.

62. Kokila AP, Anup N Patel, Sarju N Prajapati. Preliminary phytochemical screening and study of antiviral activity and antibacterial activity of *Tephrosia purpurea* flower. Life sciences Leaflets2010; 1: 7-13.
63. Soni KK,Khare ML,Saxena RC. Spasmolytic activity of a herbal drug isolated from *Tephrosia purpurea* in guinea pigs. Ancient Science of Life 2004;23(4): 59-65.
64. Gokhale AB, Saraf MN. Studies on antiallergic activity of ethanolic extract of *Tephrosia purpurea* Linn. Indian Drugs 2000; 37(5): 228-232.