

A review on pharmacological profile of an important hepatoprotective herbal plant: *Tephrosia purpurea*

Reni Nigam^{1*}, Rashmi Arnold²

¹Department of Biotechnology, AKS University, Satna, Madhya Pradesh, India

²Department of Botany, Govt. Girls PG College, Rewa, Madhya Pradesh, India

Abstract

Tephrosia purpurea is a member of fabaceae family have subfamily of papillonaceae. It is a small herb having extensive variety of healing properties and used widely in many countries across the world. It is a wild plant known as Sarpankh in Hindi, Fish poison in English and found to be effective in treating many chronic degenerative or mild to moderate functional ailments (alcoholic liver cirrhosis, viral hepatitis, pre-cirrhotic condition, protein energy malnutrition, radiation and chemotherapy induced liver damage). *Tephrosia purpurea* extracts have a wide range of pharmacological activities viz. hepatoprotective, anti-carcinogenic, antimicrobial, antibacterial, antiulcer, antihyperglycemic antihyperlipidemia, antilipidperoxidative, immunomodulatory activity, antioxidant, wound healing property, antiallergic activity, anti-inflammatory, anti *H. pylori*, nephroprotective, haemolysis, antileishmanial, antilithiatic and inhibition of mast cell degranulation etc. This review summarizes the information about its traditional uses, pharmacological profile, biological activities and isolated chemical constituents of the plant.

Keywords: pharmacological, hepatoprotective herbal plant, *Tephrosia purpurea*

Introduction

The genus tephrosia, pantropical taxa with around 400 species are incorporated in this genus. The plants in genus tephrosia are indigenous to India and distributed throughout the world, found in Ceylon, Mauritius, Tropical, Africa, Arid regions and Subtropical regions of the world. It is common in India, Sri Lanka, Malay Peninsula, China and Hawaii ^[1]. In India, there are twenty-four species were recorded and found in the areas of Andhra Pradesh, Haryana, Rajasthan and Tamil Naidu. As per taxonomic classification, *Tephrosia purpurea* is member of fabaceae family have subfamily of papillonaceae ^[2]. It is a highly branched suberect herbaceous perennial, up to 60m in height with spreading branches; the leaves are imparipinnate, with narrow, oblanceolate leaflets; the flowers are purple red or in extra-axillary racemes, the pods are slightly curved, 3-4.5cm long, grey, smooth and containing 5-10 seeds per pod ^[3]. *Tephrosia purpurea*, is a wild plant known as "Sarapunkha" in Sanskrit, Sarpankh in Hindi, 'Purple tephrosia' or 'Wild indigo' and Fish poison in English. As indicated by Ayurveda literature, *Tephrosia purpurea* has additionally given the name of "wranvishapaka" which implies that it has the property of curing different types of wounds ^[4, 5]. *Tephrosia purpurea* has various pharmacological activities against various diseases and it contains important phytochemical constituents that have been studied and proven to be effective and valuable therapeutic compounds. The present study aims to review the studies conducted on various pharmacological activities of *Tephrosia purpurea*.

Medicinal uses of *Tephrosia purpurea*

It is one of the most significant plants used in the conventional system of medicine. Various parts of plants are used as herbal remedy for treatment of various ailments.

Root

In Unani medicinal system, root is suggested valuable in treatment of different diseases like bronchitis, liver and spleen illness, inflammation, boils, pimples, rheumatism, asthma, dyspepsia, diarrhoea and urinary issues ^[6]. The fresh root-bark in pill form are given with black pepper in colic issue. In Sri Lanka, roots decoction is utilized as a nematicide for curing lung infection caused by *Toxocora canis* larvae. It is helpful in leprosy wound and juice of root is used directly the rash of the skin and a liniment prepared from the roots is utilized in elephantiasis disease ^[7]. Root powder is smoked for diseases associated with respiration and is also applied on wounds and leprosy. Roots have piscicidal and insecticidal properties and also used as vermifuge ^[8].

Leaves

Tephrosia purpurea leaves are utilized as a tonic to the intestine, improve hunger, excellent in piles, suggested valuable in diseases of chest and lungs, syphilis and gonorrhoea and also used in pectoral disease, dyspepsia and haemorrhoid ^[7].

Pods

Tephrosia purpurea pods extract is found to be effective as anti-inflammatory, analgesic and decoction of pod is important as vermifuge and to avert vomiting symptoms ^[8].

Seed

Infusion of seed is valuable as anthelmintic oil and seeds yield beneficial oil used for skin illness like scabies and leucoderma, itch, eczema and other skin eruptions.

Fruits

In southern India, a decoction of *Tephrosia purpurea* fruit is used against intestinal worms and a fruit extract is utilized

to reduce inflammatory troubles and bodily pain.

Whole plant

Its aerial parts are utilized for treatment of various disease like cutaneous toxicities, asthma, cough, pain and inflammation. The dried plant is found to be effective as diuretic, tonic, laxative and also used in curing of bleeding piles, boils, bilious febrile attack, pimples and obstructions of the spleen, liver and kidneys. It is also suggested to utilized as a blood purifier [4, 5].

Taxonomic classification

Table 1

Sub kingdom	<i>Tracheobionta</i>
Superdivision	<i>Spermatophyta</i>
Division	<i>Magnoliophyta</i>
Class	<i>Magnoliopsida</i>
Sub class	<i>Rosidae</i>
Order	<i>Fabales</i>
Family	<i>Leguminosae (fabaceae)</i>
Subfamily	<i>Papilionaceae</i>
Genus	<i>Tephrosia Pers.</i>
Species	<i>Tephrosia purpurea (Linn) Pers.</i>

Phytoconstituents of *Tephrosia purpurea*

There are various phytochemicals reported in *Tephrosia purpurea*; glycosides of *Tephrosia purpurea* like quercetin and rutin, rotenoids like rotenone, deguelin, elliptone and tephrosin, flavonoids like pongaglabol, tephrosin, semiglabin, purpuritenin, purpureamethide, pongamol, karanjin, lanceolatin B, (+)-tephrorins A, (+)-tephrorins B, (+)-tephrosone, purpurenone, (+)-purpurin, (-)purpurin, dehydroisoderricin, (-)-maackiain, pseudosemiglabrin, (-)-semiglabin, terpuriniflavone, pongamol, (-)-isolonchocarpin, 7,4'-dihydroxy-3',5'-dimethoxyisoflavone, (+)-tephropurpurin, (-)-3-hydroxy-4-methoxy-8,9-, methylenedioxypterocarpan, (-)-medicarpin, 3'-methoxydesmoxiphyllin B, 3,9-dihydroxy-8-methoxycoumestan, isoglabratephrin, tephropurpulin A, quercitin, rutinylaidzein, Ester stigmast-5, 22-dien-34, 21diol-34, 21-dihexadecanoate, glycosides-serratin 7-O-[β-D-glucopyranosyl-(1→4)-O-β-D-galactopyranoside, sterol -β-sitosterol, spinasterol-α Acid, ursolic acid [9].

The chief secondary phytoconstituents in *Tephrosia purpurea* are quercetin, rutin, elliptone, rotenoids, deguelin, rotenone, lupeol and tephrosin and small are flavanones, lanceolatin A, B & C, isolonchocarpin and purpurin from root and from whole plant is pongamol [5,9,10,11].

Pharmacological profile of *Tephrosia purpurea*

In tephrosia genus, several plants are studied for their healing and beneficial potential. A detailed account of the research done on *Tephrosia purpurea* is shown below.

Anticancer, Cytotoxic and Chemo preventive activity

The *Tephrosia purpurea* ethanolic root extract has a potent chemopreventive efficacy and significant antilipidperoxidative effect against 7, 12-dimethylbenz[a]anthracene (DMBA) induced oral carcinogenesis [12]. Anticancer activity of *Tephrosia purpurea* root extract was reported against human breast cancer cell line [7]. In the same study, *Tephrosia purpurea* root (aqueous and ethanol

extracts) also showed anticancer activity against Ehrlich Ascites Carcinoma cell lines in Swiss albino mice [11].

Antiulcer activity & Anti-*Helicobacter pylori* activity

The antiulcer activity of *Tephrosia purpurea* aqueous root extract was tested on animal. The significant antiulcer property of extract may be either due to cytoprotective action of the extract or by strengthening of gastric and duodenal mucosa and thus enhancing mucosal defense [13]. Anti-*Helicobacter pylori* activity of different fractions of methanolic extract of *Tephrosia purpurea* against clinical isolates and standard strains of *Helicobacter pylori*, including metronidazole-resistant strains were reported [14].

Hepatoprotective activity

The hepatoprotective impact of *Tephrosia purpurea* ethanolic root extract had been reported [15]. Furthermore, examined the hepatoprotective impact of ethyl acetate part of *Tephrosia purpurea* ethanolic root extract (EETP) (25 and 50 mg/kg/day, parenterally) in rats by instigating hepatotoxicity with carbon tetrachloride (CCl₄) (0.5 ml/kg, intraperitoneal) [16]. The powdered aerial parts of *Tephrosia purpurea* administration in rats avert the elevation of enzymes for example (SGOT), (SGPT), bilirubin levels [17]. Furthermore, *Tephrosia purpurea* ethanolic root extract displayed hepatoprotective activity and decrease in hepatospecific enzymes [18]. The treatment with *Tephrosia purpurea* leaves reestablished the level of liver marker enzymes in rats [19]. In Indian market, one of the most effective ingredients of herbal formulations accessible for liver diseases is *Tephrosia purpurea* [20].

Wound healing activity

The wound healing activity of *Tephrosia purpurea* hydro alcoholic extract was studied in streptozotocin induced diabetic rats. The outcomes demonstrated that extract exhibited prominent wound healing activity [21]. The wound healing activity of ointment prepared from *Tephrosia purpurea* (aerial part) was indicated significant (P<0.05) increment in fibroblast cells, collagen fibers and blood vessels formation [22].

Antidiabetic activity

Tephrosia purpurea seeds have significant antihyperglycemic and antilipidperoxidative impacts as well as improved antioxidant defense mechanism in diabetic rats [23]. In another examination, hydro alcoholic and aqueous leaves extract shown anti-diabetic potential but was also seen as low when monitored side by side with standard medication glibenclamide with the dose (5 mg/kg bodyweight) [24].

Antihyperlipidemic activity

Tephrosia purpurea ethanolic extract at different doses was found to have significant antihyperlipidemic activity in Wistar rat [25]. The outcomes showed the decline in level of total cholesterol in rats when compared with hyperlipidemic control. The antihyperlipidemic activity various parts extract of *T. purpurea* was tested, out of which the entire plant extract (300 mg/kg) demonstrated less critical antihyperlipidemic activity. In addition to aforementioned activities, the cholesterol lowering effect of extract was seen in poloxamer 407 treated rats [7].

Phytochemical analysis

The morphological, microscopical, physicochemical and phytochemical screening of *Tephrosia purpurea* root, found from various districts of Gujarat was investigated. The phytochemical investigation uncovered the presence of glycosides, phytosterols, saponins and flavonoids [26]. Powdered drug, petroleum ether extract, ethanolic extract and chloroform extract of *Tephrosia purpurea* demonstrated the presence of amino acids, proteins, tannins, alkaloids and flavonoids [27]. Phytochemical investigation of plant extracts portrayed the quantitative and qualitative phytochemical constituents in the plants. Flavonoids, alkaloids and phenol were present in higher concentration in *Tephrosia purpurea* when contrasted with other medicinal plants [28]. The shankpushpi obtained from herbal drug markets of India were subjected to phytochemical marker and physicochemical examination. The examination included preliminary phytochemical screening, thin layer chromatography (TLC) profiling and determination of ash values, extractive values, estimation of sugar, starch and tannin content. Based on aforementioned study, it was inferred that the larger part of the acquired commercial samples of shankpushpi belong to three plant species specifically *C. pluricaulis*, *E. alsinoids* and *Tephrosia purpurea* as individual or in blend [29]. The results of phytochemical screening of extract demonstrated the presence of terpenoids, saponins, phlobatannins, tannins while flavonoids and anthraquinones were missing. The plant extract demonstrated toxic impact on brine shrimps and it likewise indicated restraint against three fungal species viz. *Aspergillus fumigates*, *Aspergillus flavus* and *Aspergillus niger* [30].

Antibacterial activity

The *Tephrosia purpurea* leaves extracts indicated significant antimicrobial activity against Gram positive, Gram negative bacterial and fungal pathogen namely *E. coli*, *S. aureus*, and *C. albicans* respectively [31]. *Tephrosia purpurea* ethanolic roots extract showed strong inhibitory impacts against *Propionibacterium acnes* [32]. It was revealed that root extracts of *Tephrosia purpurea* had huge zone of inhibition in disc diffusion method against three *Pseudomonas* isolates for example *P. aeruginosa* [NCTC 10662], *P. strain 1*, *P. strain 2* and two of the coliform strains i.e., coliform strain 6 and coliform strain, while ethanolic leaves extracts and all the aqueous extracts showed no action against clinical isolate [9]. Triterpenoid and saponin from *Tephrosia purpurea* seeds extract shown *in vitro* microbial activity against Gram positive bacterium-*S. pneumoniae*, while complete inhibition on the development of *A. alternata* was seen [33]. The *Tephrosia purpurea* extract indicated antibacterial action against *S. aureus*, *E. coli*, *K. pneumonia* and *P. aeruginosa* with zone of inhibition (7mm), (8mm), (10mm), (8mm) respectively. Extract showed no antifungal activity against *A. niger* and *C. albicans*. Cytotoxic activity of *Tephrosia purpurea* was discovered most strong (330.6530%) [34].

Antifungal activity

The *Tephrosia purpurea* methanolic extract indicated remarkable activity against *C. albicans* and *A. niger* [35]. The methanol and n- butanol extract of *Tephrosia purpurea* displayed antifungal action (15 and 10 mm) against *P. debaryanum*. The results of antifungal impact of *Tephrosia*

purpurea aqueous extract revealed no activity against *P. debaryanum* [36]. Only three species of genus *Tephrosia* like *Tephrosia hildebrandtii*, *Tephrosia tinctoria* and *Tephrosia purpurea* possess antifungal potential [9].

Antioxidant activity

The *in vitro* antioxidant activity of *Tephrosia purpurea* ethanolic leaves extract was examined by Jain *et al.*, (2006) [37]. In another study, it was revealed that root extract scavenged free radicals in a concentration dependent manner [38]. It was seen that *Tephrosia purpurea* possess the antioxidant substance which might be possibly liable for treatment of jaundice and other oxidative stress-related illnesses [39]. The aqueous extract of *Tephrosia purpurea* entire plant additionally showed free radical scavenging activity in 1,1-diphenyl-2-picryl hydrazyl (DPPH) test [40]. The hydroalcoholic root extract *Tephrosia purpurea* showed antioxidant activity by repressing nitric oxide, hydroxyl radical, super oxide anion scavenging, hydrogen peroxide scavenging, reducing power and 1,1-diphenyl-2-picryl hydrazyl (DPPH) activities [41].

The plants contain antioxidant substances that can clarify their utilization in conventional drug as hepatoprotective in the past in addition to the present [42]. *Tephrosia purpurea* showed antioxidant activity at 3mg/mL concentration against 2, 2-diphenyl-1-picrylhydrazyl (DPPH), phosphomolybdate, hydroxyl radicals, hydrogenperoxide, 2, 2'-azino-bis (ABTS) and beta carotene respectively [43].

Neurobehavioural effects and Antifilarial activity

Rajaretinam and Ghana, reported that *Tephrosia purpurea* hexane extract had strong acetylcholine esterase inhibitory action in zebra fish. The results proposed that it could be additionally utilized as a novel drug molecule for the management of Alzheimer's disease [44]. Toxicity effect of *Tephrosia purpurea* stem and leaves were tested against filarial vector *Culex quinquefasciatus* [45].

Antiallergic activity

Tephrosia purpurea ethanolic extract had antiallergic activity. Treatment with *Tephrosia purpurea* ethanolic extract inhibited passive paw anaphylaxis in rats and furthermore inhibited release of histamine induced in hypersensitivity [46].

Larvicidal activity

Deepak Kumar *et al.*, studied the efficacy of ethyl acetate and petroleum ether extract of *Tephrosia purpurea* entire plant at different concentrations against larvae of *Culex quinquefasciatus*. The results suggested that plants used as insect control and as an alternative method for minimizing the toxic impact of some pesticide [47].

Miscellaneous activities

Tephrosia purpurea roots (ethanol and aqueous extract) had shown to possess anti-urolithiatic activity tested in ethylene glycol-induced renal calculi in rats [48]. Damre *et al.*, investigated the *Tephrosia purpurea* flavonoid fraction for its immunomodulator activity. From the investigation, it is evident that there is dose-related decline in antibody titer and regulates both the cell-mediated and the humoral immunity [49]. *Tephrosia purpurea* methanol extract had significant diuretic activity at different dose levels and it

was tested by electrolyte concentration, increased urine volume and alkaline pH in contrast with control animals ^[50].

Conclusion

The medicinal plants are explored widely in search of identifying remedy for several diseases. The present review study emphasizes on the wide range of potentiality for pharmacological, therapeutic and phytochemicals of the important Indian traditional medicinal plants *Tephrosia purpurea*. From the above review and explanations, it can be concluded that it has been used as an important medicinal, therapeutic and pharmaceutical source for different ailments briefly mentioned in this review. The review study also gives a clear idea on traditionally uses of this plant that it is important for healing various diseases and also used to fight against severe life-threatening diseases and with the continuous research, it can be used as an herbal alternative therapy.

References

- Rangama BNLD, Abayasekara CL, Panagoda GJ, Senanayake MRDM. Antimicrobial activity of *Tephrosia purpurea* (Linn.) Pers. and *Mimusops elengi* (Linn.) against some clinical bacterial isolates. Journal of the National Science Foundation of Sri Lanka. 2009; 37(2):139-145.
- Negi JS, Negi PS, Pant GJ, Rawat MS, Negi SK. Naturally occurring saponins: Chemistry and biology. Journal of Poisonous and Medicinal Plant Research. 2013; 1(1):001-006.
- Muthukrishnan S, Murugan S, Krishnamoorthy P. Phytochemical and antimicrobial profile of *Tephrosia purpurea*. International Journal of Pharmaceutical Development & Technology. 2014; 4(4):267-270.
- Devprakash SK, Subburaju T, Singh SK. Antimicrobial activity of alcoholic and aqueous extracts of *Tephrosia purpurea*. Asian Journal of Biochemical and Pharmaceutical Research. 2011; 2(1):670-675.
- Sharma R, Mehan S, Kalra S, Khanna D. *Tephrosia purpurea* –A Magical Herb With blessing in human biological system. International journal of recent advances in pharmaceutical research. 2013; 3(3):12-22.
- Waghmare J. Hepatoprotective activity of *Tephrosia purpurea* (Linn) Pers panchang churna on alcoholic hepatitis of chronic alcoholics. International Journal of Ayurveda and Integrative Medicine. 2014; 4:61-66.
- Dalwadi PP, Patel JL, Pragnesh VP. *Tephrosia purpurea* Linn (Sharpunkha, Wild Indigo): A review on phytochemistry and pharmacological studies. Indian Journal of Pharmaceutical and Biological Research. 2014; 2(1):108-121.
- Khalafalah AK, Yousef AH, Esmail AM, Abdelrazik MH, Hegazy ME, Mohamed AE, et al. Chemical constituents of *Tephrosia purpurea*. Pharmacognosy Research. 2010; 2(2):72-75.
- Touqeer S, Saeed MA, Ajaib MA. Review on the phytochemistry and pharmacology of genus *Tephrosia*. Phytopharmacology. 2013; 4(3):598-637.
- Gulecha V, Sivakuma T. Anticancer activity of *Tephrosia purpurea* and *Ficus religiosa* using MCF 7 cell lines. Asian Pacific Journal of Tropical Medicine. 2011; 4(7):526-529.
- Muralidhar A, Somasekhar A, Sumanjali A. Anticancer activity of *Tephrosia purpurea* root extracts against Ehrlich Ascites Carcinoma (EAC) cells in swiss albino mice. A. Der Pharmacia Sinica. 2014; 5(2):81-87.
- 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 journal of pharmacology. 2006; 38(3):185-189.
- Deshpande SS, Shah GB, Parmar NS. Antiulcer activity of *Tephrosia purpurea* in rats. Indian Journal of Pharmacology. 2003; 35(3):168-172.
- Chinniah A, Mohapatra S, Goswami S, Mahapatra A, Kar SK, Mallavadhani UV, et al. On the potential of *Tephrosia purpurea* as anti-Helicobacter pylori agent. Journal of Ethnopharmacology. 2009; 124(3):642-645.
- Sangeetha B, krishnakumari S. *Tephrosia purpurea* (Linn.) Pers: a folk medicinal plant ameliorates carbon tetrachloride induced hepatic damage in rats. International Journal of Pharma and Bio Sciences. 2010; 1(2):1-10.
- Shah R, Parmar S, Bhatt P, Chanda S. Evaluation of hepatoprotective activity of ethyl acetate fraction of *Tephrosia purpurea*. Pharmacology online. 2011; 3:188-194.
- Abraham G. A review on hepato-protective herbs used in Ayurveda. Global Journal of Research on Medicinal Plants & Indigenous Medicine. 2014; 3(7):303-311.
- Ali MI, Kumar KA. Recent update on hepatoprotective potential of herbal plant. International Journal of Environmental Science and Technology. 2015; 1:25-50.
- Tamizharasan T, Malarvannan L. Hepatoprotective activity of *Tephrosia purpurea* on carbon tetrachloride induced hepatotoxicity. International Journal of Scientific Research. 2015; 1(2):60-65.
- Kalshatti MS, Ghurghure SM. A Review on herbal hepatoprotectives: current cenario. Avishkar – Sol UN Res J. 2015; 4:75-78.
- Sudhakar P, Kumar AS, kannan CS, Maheshwaran P. Wound healing potential of *Tephrosia purpurea* (L) pers. in streptozotocin induced diabetic rats. International Journal of Advances in Pharmaceutical Research. 2013; 4(3):1557-1562.
- Garg P, Deep A. Wound healing potential of herbal drugs: A mini review. European journal of pharmaceutical and medical research. 2017; 4(10):209-212.
- 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.
- Vijayakumar P, Thirumurugan V, Bharathi K, Surya S, Kavitha M, Muruganandam Saraswathy N, et al. An Evaluation of anti-diabetic potential and physico - phytochemical properties of *Tephrosia purpurea* (Linn.) International Journal of Pharmaceutical Sciences Review and Research. 2014; 24(1):46-50.
- Mustak S. Comparative study of *Tephrosia purpurea* (Linn) leaves and Lovastatin on cholesterol level of hyperlipidemic wistar rats. Journal of Pharmacy and Biological Sciences. 2012; 1(2):25-30.
- Shah R, Shah R, Chanda S. Pharmacognostical and preliminary phytochemical investigation of *Tephrosia*

- purpurea* (Linn.). pers. Root from Gujarat region. International Journal of Pharmaceutical Research. 2011; 3(2):49-52.
27. Padhan DK, Pattnaik S, Behera AK, Padhan J. Comparative phytochemical study of *Desmostachya bipinnata* and *Tephrosia purpurea*. International Journal of Research in Pharmaceutical and Biomedical Sciences. 2012; 3(1):196-200.
 28. Gnanaraja R, Prakash V, Peter S, Mahendraverman M. Qualitative and quantitative phytochemicals analysis of selected fabaceae medicinal plants from Allahabad region. The Pharma Innovation Journal. 2014; 3(7):53-56.
 29. Irsad S, Mishra PK, Rawat AKS, Khatoon S. Authentication of samples of shankpushpi through physicochemical, phytochemical analysis and TLC fingerprinting. International journal of traditional knowledge. 2016; 15(4):646-653.
 30. Khan LU, Khan R, Ahmed M, Khan WU, Khan MW. Phytochemical investigation and pharmacological activities of *Tephrosia purpurea* (L.) Pers. Bark. Int. J Biol. Biotech. 2017; 14(2):173-178.
 31. Kapoor BBS, Purohit V. Antimicrobial screening of some fabaceous plant species of Rajasthan desert. International Journal of Pharmacy and Biological Sciences. 2013; 3(3):201-203.
 32. Kumar GS, Jayaveera KN, Kumar ACK, Umachigi Sanjay P, Vrushabendra Swamy BM, Kumar KDV, *et al.* Antimicrobial effects of Indian medicinal plants against acne-inducing bacteria. Tropical Journal of Pharmaceutical Research. 2007; 6(2):717-723.
 33. Khan NA. *In vitro* antimicrobial activity of triterpenoid saponin from *Tephrosia purpurea* seeds extract. European Journal of Chemistry. 2011; 2(2):189-192.
 34. Jahan N, Sherwani SK, Naqvi GR. Antibacterial potency of plants against clinical samples and toxicity against selected medicinal plant. Int Res J Pharm. 2013; 4(40):109-112.
 35. Gupta M, Mazumder UK, Gomathi P, Selvan VT. Antimicrobial activity of methanol extracts of *Plumeria acuminata* Ait. leaves and *Tephrosia purpurea* (Linn.) Pers. roots. Natural Product Radianc. 2008; 7:102-105.
 36. Ambikapathy V, Gomathi S, Panneerselvam A. Effect of antifungal activity of some medicinal plants against *Pythium debaryanum* (Hesse). Asian Journal of Plant Science and Research. 2011; 1(3):131-134.
 37. 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.
 38. Choudhary GP. *In vitro* antioxidant studies of the ethanolic extract of *Tephrosia purpurea* L. Indian J Clinical Biochemistry. 2007; 22(1):77-83.
 39. Patel A, Patel A, Patel A, Patel NM. Determination of polyphenols and free radical scavenging activity of *Tephrosia purpurea* Linn leaves (Leguminosae). Pharmacognosy Research. 2010; 2(3):152-158.
 40. Gunjegaonkar SM, Saraswathi CD, Hrishikeshavan HJ, Harish MS, Nargund LVG. Hepatoprotective and antioxidant activity of *Tephrosia purpurea* whole plant aqueous extract. Pharmacology online. 2010; 2:568-574.
 41. Shah R, Kathad H, Sheth R, Sheth N. *In vitro* antioxidant activity of roots of *Tephrosia purpurea* Linn. International Journal of Pharmacy and Pharmaceutical Sciences. 2010; 2(3):30-33.
 42. Kumar V, Kumar S, Shashidhara S, Anitha S, Manjula M. Comparison of the antioxidant capacity of an important hepatoprotective plants. International Journal of Pharmaceutical Sciences and Drug Research. 2011; 3(1):48-51.
 43. Khan LU, Khan R, Ahmed M, Khan WU, Khan MW. Phytochemical investigation and pharmacological activities of *Tephrosia purpurea* (L.) Pers. Bark. Int. J Biol. Biotech. 2017; 14(2):173-178.
 44. Rajaretinam RK, Gnana PVS. Rapid neurobehavioural analysis based on the effects of an acetylcholinesterase inhibitor from *Tephrosia purpurea* in Zebrafish. Annals of neurosciences. 2012; 19(1):8-13.
 45. Tarek MY, El-Sheikh Naglaa MS. Evaluation of the toxicity effect of *Tephrosia purpurea* extracts against filarial vector *Culex quinquefasciatus*. Asian journal of applied science vol. 2014; 2(6):798-804.
 46. Gokhale AB, Saraf MN. Studies on antiallergic activity of ethanolic extract of *Tephrosia purpurea* Linn. Indian Drugs. 2000; 37(5):228-232.
 47. Deepak Kumar P, Dhamodaran Nilani P, Balakrishnan N. Larvicidal activity of *Tephrosia purpurea*, (L) against the larvae of *Culex quinquefasciatus*. Journal of Applied Pharmaceutical Science. 2012; 2(7):219-221.
 48. Shukla A, Mourya P. Investigations for anti-urolithiatic activity of *Tephrosia purpurea* roots against ethylene glycol-induced renal calculi in rats. Asian Journal of Pharmacy and Pharmacology. 2016; 2(2):40-43.
 49. Damre AS, Gokhale AB, Phadke AS, Kulkarni KR, Saraf MN. Studies on the immunomodulatory activity of flavonoidal fraction of *Tephrosia purpurea*. Fitoterapia. 2003; 74(3):257-261.
 50. Ashok kumar D, Narayana TV, Mazumder UK, Gupta M. Exploration of diuretic potential and electrolyte excretion of *Tephrosia purpurea* (Fabaceae) in rats. Journal of Dietary Supplements. 2012; 9(1):9-18.