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ISAR Journal of Multidisciplinary Research and Studies
Abbriviate Tittle- ISAR J Mul Res Stud
ISSN *(Online)*- 2583-9705
https://isarpublisher.com/journal/isarjmrs

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Pharmacognostical and Pharmacological activity of genus *Tephrosia*

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Article History
Received: 05.09.2023
Accepted: 08.09.2023
Published: 20.09.2023

Abstract: Plants in the *Tephrosia* genus are members of the Fabaceae family. It is a flowering plant that belongs to the angiosperm family and has over 350 different species. It is widely distributed throughout the world's tropical and subtropical climates. Since the herbal remedy is popular because it has few side effects, the genus *Tephrosia* is frequently used in traditional medicine to treat a variety of ailments. Among their many pharmacological effects are hepatoprotective, anti-diabetic, antioxidant, anti-hyperlipidemic, larvicidal, anti-inflammatory, wound healing, anti-cancer, and in some species, anti-feedant functions. They also have larvicidal, larvicidal, anti-inflammatory, and anti-ulcer properties. In order to support the continued use of these plants and lay the groundwork for future research, it is crucial to build a foundation by compiling a variety of pertinent data into a single document. As a result, the present study reviewed the key studies done on the *Tephrosia* genus.

Keywords: *Tephrosia*; Fabaceae; Traditional medicine; Phramacognostical; Pharmacological activity.

INTRODUCTION

Herbal medicines historically refer to substances derived from naturally occurring plants that have been used to cure illness in conventional indigenous or local medicine with little to no refining procedure.[1] According to estimates from the World Health Organisation (WHO), two to three times as many people as those who use conventional pharmaceuticals also utilise herbal remedies. Traditional medicine, which includes herbal medications, has lately been defined by the World Health Organization as therapeutic practises that were in use before the advancement and spread of modern medicine, frequently for hundreds of years. The majority of therapeutic plant extracts are used in herbal medicines, which are conventional treatments. Herbal medicine continues to be the main primary healthcare provider for around 75–80% of the world's population, particularly in developing countries.[2]

Scientific classification of genus *Tephrosia* belongs to the Kingdom: Plantae Clade: Tracheophytes Clade: Angiosperms Clade: Eudicots Clade: Rosids Order: Fabales Family: Fabaceae Subfamily: Faboideae Genus: *Tephrosia*.[3]

More than 350 species belong to the genus *Tephrosia*, which is part of the Paplilionaceae subfamily of the Fabaceae family (Leguminosae). Tropical, subtropical, and dry regions of the world are where this genus of plants is most frequently found. The flora includes erect plants as well as soft or woody bushes.[4] Compound leaves are 7–15 cm long and 0.3–1 cm broad, with inverted lance- or obovate-shaped lobes. Flowers are organized in raceme-like clusters with a few flowers and are pea-shaped, white, purple, or pinkish, and 7 mm long. Self-pollinating plants create linear, long pods that are between 2.5 and 4.0 cm long and 3 to 4 mm wide. Ellipsoidal and deep brown, the seeds. 11 2n chromosomes make up the majority of organisms, which are diploid.[5]

Active constituents of *Tephrosia* genus

The Tephrosia genus has been shown to include chemotaxonomic glucosides, rotenoids, isoflavones, chalcones, flavanones, flavanols, and prenylated flavonoids. We can see that scientists haven't done much research on fixed oil or essential oil, either. Scientists are interested in *Tephrosia purpurea, Tephrosia candida, Tephrosia elata*, and *Tephrosia villosa*.[11] *T. purpurea* contains flavones, flavanones, prenylated flavonoids, chalcones, and rotenoids.[12]

Traditional uses

Many plants belonging to this genus have historically been used as remedies for conditions like rheumatic pains, syphilis, dropsy, stomachaches, diarrhoea, asthma, abortifacients, respiratory illnesses, laxatives, diuretics, and inflammation, among others.[6] The species of *Tephrosia include T. purpurea, T. falciformis*, and *T. leptostachya*. There are several different species of *T.wallichii*, including *T.wallichii, T.subtriflora, T.uniflora, T.villosa*, and *T.strigo*. External wounds and gastro-duodenal conditions have both traditionally been treated with *Tephrosia* purpurea. Chest tightness and coughing are treated with the drug. The spleen, kidney, and liver can all benefit from a root decoction's assistance. uses include the treatment of persistent diarrhoea and dyspepsia. To freshen your breath, gargle with *Tephrosia purpurea*. Aside from inflammation, elephantitis, flactulance, haemmaroid, asthma, bronchitis, and anaemia, root can also be used to treat these conditions.[13]

Pharmacological activity

Sl.no	Plant name	Parts used	Extract type	Activity
01	*Tephrosia purprea*	Whole plant	Ethanolic extract	Anti-inflammatory
			Methanolic extract	Anti- diarrheal
			Methanolic extract	Spasmolytic,Bronchodilator and vasorelaxant
		Leaves	Aqueous and ethanolic extract	Antioxidant
			Ethanolic extract	Antioxidant
			Aqueous extract	Antihyperglycemic & antihyperlipidemic effects in streptozotocin induced diabetes mellitus
			Aqueous and ethanolic extract	Anthelmintic
			Petroleum ether, chloroform, methanol and aqueous extract	Anti-inflammatory
		Leaves and Roots	Methanolic extract	Anti-proliferative
		Roots	Ethanolic extract	Hepatoprotective
			Aqueous extract	Antiulcer
			Ethanolic and aqueous extract	Anti-urolithiatic
			Ethanolic extract	Antioxidant
			Alcoholic extract	Anti-inflammatory
		Roots and Aerial parts	Ethanolic extract	Anti-inflammatory and analgesic
		Aerial parts	Hydro-alchoholic extract	Hepatoprotective
			Ethanolic extract and it's fractions	Anti-oxidant
			Ethanolic extract	Wound healing
		Shoot	Mathanolic extract	Anti-inflammatory and xanthine oxidase inhibitory
		Stem bark	Ethanolic extract	Nephroprotective
02	*Tephroisa bractelata*	Leaves	Methanolic extract	Toxicity and Antipyretic
			n-hexane and ethyl acetate extract	Anti-diabetic, antioxidant ,antimicrobial
03	*Tephrosia pumila*	Aerial parts	Mehanolic extract	Anti-diabetic
		Fresh plant	Ethanolic extract	Anti-depressant ,and Anti-anxiety
04	*Tephrosia vogelli*	Leaves and Roots	Dichloromethane extract	Antimicrobial
		Bark	Ethanolic-aqueous extract	Anti-bacterial
05	*Tephrosia tinctora*	Stem	Petroleum ether, acetone, ethyl acetate extract	Anti-diabetic
06	*Tephrosia cinerea*	Leaves	Aqueous,acetone,petroleum ether ,ethyl acetate extract	Anti-bacterial
			Hydroalcholoic extract	Antileishmanial
07	*Tephrosia maxima*	Fresh plant	Ethanolic extract	Antidepressant and Anti-Anxiety
08	*Tephrosia sinapou*	Roots	Ethyl acetate extract	Antioxidant and Anti-inflammatory
				Antinociceptive

The following includes images of various *Tephrosia* species.

Fig 1: *Tephrosia purpurea*

Fig 2: *Tephrosia vogelli*

Fig 3: *Tephrosia maxima*

Tephrosia purpurea (L.) Pers., also known as sarphuka, is a perennial herb or undershrub that can grow to a height of 30 to 60 cm and can be either upright or decumbent. Stipules are linear-subulate, nerved, erect or infrequently reflexed, and imparipinnately split. Leaflets are 2-2.8 x 0.8-1.2 cm, oblanceolate to obovate, basal slightly curved, and obtuse to emarginated. Flowers are produced in axillary or terminal racemes that are symmetrical, zygomorphic, hypogynous, 5 to 12 cm long, purple to white, and bisexual. The five sepals are connate, and the calyx tube is 4 to 5 mm tall. The petals also feature five pubescent and hairy obovate-orbicular ridges. The staminal tube is 4 mm long and 4 mm wide and has a pink to violet bloom. The linear, compressed, straw-colored, 2.5 to 4.5 cm wide, 2.5–4 x 0.3–0.4 cm long, dry dehiscent pods are linear, compressed, and contain 5–7 seeds. The hilum is marginal with a pithy collar and is a greyish dark brown colour that is spotted with black. The seeds are compressed oval oblong seeds that are 3.0 to.5 cm across and terminated at one end. A macroscopical examination revealed petioles that were 7–12 mm long, with a cuneate base, an aromatic, unique fragrance, and an unappealing bitter taste. In the transverse segment of the leaflet vascular bundle, palisade cells, homogeneous cuticle, and unicellular trichomes were all visible. In a transverse section of the stem and root, sclerenchymatous cells, medullary rays, and lignified xylem were seen. Crystals of calcium oxalate were found in the pith region of the stem portion. Flavonoids, proteins, carbohydrates, steroids/terpenes, and phenolics were among the secondary metabolites found.[7,8]

Tephrosia vogelii Hook's are also known as *"Fish bean", "Fish-poison bean", or "Vogel's Tephrosia"*. A macroscopical examination of the whole leaf reveals that it is in green, with pinnate venation, an entire margin, an apex that seems to be lanceolate, is hairy on the surface, and has a papery texture. When the leaf powder was examined under a microscope, it was found to include a great number of single fibres with two tapering edges and a convoluted lumen, as well as a big number of unicellular covering trichomes with wide lumens, long slits, and broad bases. The transverse view of a lamina fragment revealed that the leaf was a double-palisaded dorsal ventral leaf. The upper epidermis has spiral veins, a spongy mesophyll, and a parenchyma wall, and is thicker and larger than the lower epidermis. It was feasible to distinguish cork cells, calcium oxalate, fibre, parenchymatous walls, and simple starch grains by looking at the histology of the root powder. Alkaloids, saponins, tannins, flavonoids, cardiac glycosides, and steroid-like substances were all found, according to the phytochemical examination.[9]

Tephrosia maxima, also known as *Galega maxima L*, is a prostate herb. Natural legumes that belong to the Fabaceae family. A typical tap root was discovered to be the root. They had tapering ends and were thin in shape. On the surface, there were visible root hairs. The root was a light yellow colour. Little fissures and cracks may be seen. The flavour and aroma were distinctive. Study was done on the 1.5 mm thick root. The root's surface was uneven and fissured. The fissures were deep and broad. They are made up of a core solid cylinder of secondary xylem and a broad periderm continuous cylinder of secondary phloem. It was possible to identify the xylem, or vessels with perforated plates and pits in the lateral walls, using powdered microscopy. The plant's root contains more phytochemicals than other parts of the plant.[10]

Pharmacological activity

Tephrosia purpurea

Anti-inflammatory activity

Smita Shenoy *et al.,* The ethanolic extract of the *Tephrosia purpurea* plant was used to carry out the acute and subacute inflammation in order to test the *Tephrosia purpurea* plant's anti-inflammatory activities in rats using the Carrageenan-induced paw edema and cotton pellet granuloma model. The study's findings showed that *Tephrosia purpurea's* ethanolic extract significantly reduces inflammation in rats with subacute inflammation but not acute inflammation.[14]

Gulecha V.S *et al.,* exhibited *Tephrosia purpurea* leaves' anti-inflammatory properties. Using a carrageenan-induced rat paw edoema method, four distinct extracts—petroleum ether, chloroform, methanolic, and aqueous was tested for their ability to reduce inflammation, and their effectiveness was compared to that of the Ibuprofen placebo when taken orally. The edema inhibition rates for the (600 mg/kg) extracts of petroleum ether, chloroform, methanol, and water were respectively 39.59%, 18.12%, 46.30%, and 10.73%. When Ibuprofen (40 mg/kg, orally) serves as the control drug, petroleum ether and methanolic extract exhibit a percentage of edema inhibition that is comparable to that of the drug.[15]

R. Praveena *et al.,* The anti-inflammatory effect of *Tephrosia purpurea* was investigated utilising a carrageenan-induced model and an alcoholic root extract of the plant. The typical medication was dichlofenac sodium 5 mg/kg body weight. The results showed that Diclofenacsodium (5 mg/Kg B.W.) decreased the paw edoema volume of (73.0%) of Carrageenan injection and the test medicines shown dose-dependent efficacy. The highest percentage of (65.4%) inhibition in edema volume was seen at the dose of 20 mg/Kg B.W.[16]

Gopalakrishnan, S *et al.,* the study an ethanolic extract of *Tephrosia purpurea Linn* and root portions was tested for its

capacity to reduce pain and inflammation. Rats' paw edema from carrageenan and granuloma from cotton pellets were both suppressed by the extract (250, 500 mg/kg, b.w.). Using the tail immersion approach, which was maintained at 55°C, analgesic action was likewise seen at the same doses. The research supports *Tephrosia purpurea's* traditional use in the treatment of painful, inflammatory pathological diseases such fractures and dislocations.[17]

Shivraj H. Nile et al., evaluated the anti-inflammatory and xanthine oxidase inhibitory activities of *Tephrosia purpurea* methanolic extract of shoot was examined. The ability to reduce inflammation was evaluated using the diene-conjugate, HET-CAM, and -glucuronidase techniques. To find out the enzyme's inhibitory activity, tests were conducted on isolated cow milk xanthine oxidase. The Diene-conjugate, HET-CAM, and -glucuronidase test methodologies were used to measure the average anti-inflammatory activity of T. purpurea shoot extract in the responsive system, and the results showed values of 45.4, 10.5, and 70.5%, respectively. While the positive control was 0.21 mM/mL and 0.043 g/min, the inclusion of 25 to 100 g/mL shoot extract resulted in Km and Vmax values of 0.20 mM/mL and 0.035, 0.026, 0.023, and 0.020 g/min, respectively. When the inhibitory action of xanthine oxidase was examined using kinetic parameters, a mixed kind of inhibition was found.[18]

Anti-diarrheal activity

KHALID HUSSAIN JANBAZ et al. assessed the anti-diarrheal activity in mice *in-vivo* using the whole plant of *T. purpurea's* methanolic extract. During the *in-vivo* experiments, mice were given oral dosages of castor oil to induce diarrhoea, and verapamil was employed as a control drug at a concentration of 50 mg/kg. Mice given verapamil had a considerable level of diarrhoea prevention (80%). A limited (40% protection) against diarrhoea was seen in mice at a dosage of 300 mg/kg. However, mice who received 500 mg/kg of *T. purpurea* had 80% less diarrhoea. This result is equivalent to what is seen with the widely used drug verapamil.[19]

Spasmolytic, Bronchodilator and Vasorelaxant activity

KHALID HUSSAIN JANBAZ et al. studied the complete *Tephrosia purpurea* plant's methanolic extract for its spasmolytic, bronchodilator, and vasorelaxant properties. In isolated rabbit jejunum preparations, the extract inhibits spontaneous contractions with a concentration-dependent calming effect (0.003–3.0 mg/mL). Additionally, the extract led to K+ (80 mM)-relaxation that was concentration-dependent. able can be induced into spasm. The extract, like verapamil, shifted the Ca2+ response curves to the right depending on the concentration. The extract displayed a calming effect similar to verapamil when carbachol and high K+ (80 mM) were employed to induce contractions in isolated rabbit tracheal preparations. The non-specific bronchodilator response that has been reported may be mediated by Ca2+ channel blockage. Additionally, the extract demonstrated a verapamil-like dose-dependent relaxant response to phenylephrine (1 M) and K+ (80 mM)-induced contractions. *Tephrosia purpurea* is used to treat gastrointestinal, hypertensive, and asthmatic spasms.[20]

Antioxidant activity

Avani Patel et al., examined the antioxidant potential of several *Tephrosia purpurea* species leaves using aqueous and ethanolic extracts. The flavonoid and total phenolic contents of two extracts were evaluated, along with their values. All extract concentrations were adjusted to fall within the linearity range, and numerous reference standards including tannic acid, gallic acid, quercetin, and ascorbic acid were used to calculate the percentage inhibition of in-vitro antioxidant activity and radical scavenging activity using IC 50 values. The study led to the discovery that ethanolic extract displays more potent activity than aqueous extract.[21]

Avijeet Jain et al., conducted an assessment of the in-vitro antioxidant properties of *T. purpurea* leaf's ethanolic extract through DPPH free radical scavenging and nitric oxide scavenging methods. The findings revealed that the plant extract demonstrated noteworthy antioxidant efficacy employing the mentioned methods, with its effectiveness being associated with the presence of flavonoids.[22]

K. Soni et al., conducted a study to assess the antioxidant potential of an ethanolic extract derived from the aerial parts of *Tephrosia purpurea*. *In-vivo* experiments showed a significant reduction in both lipid peroxidation and superoxide production induced by carbon tetrachloride upon administration of the extract. Furthermore, the researchers investigated the ethyl acetate fraction of the extract for its ability to scavenge free radicals and inhibit lipid peroxidation. In each of these *in-vitro* studies, the IC50 values for the ethyl acetate fraction were considerably lower than those observed for the ethanolic extract of the plant. Additionally, when comparing the *in-vivo* antioxidant activity of the ethanolic extract to its ethyl acetate fraction, the results indicate that the ethanolic extract exhibited lower antioxidant activity than the ethyl acetate fractions. This underscores the superior antioxidant properties of the ethyl acetate fraction.[23]

G.P. Choudhary conducted an assessment of the antioxidant activity of *Tephrosia purpurea* roots using an ethanolic extract, employing two different methods. In the DPPH and nitric acid radical inhibition assays, the ethanolic extract displayed IC50 values of 132.31 ± 8.79 and 405.22 ± 15.09, respectively. It's worth noting that these results showed slightly higher IC50 values compared to those obtained when ascorbic acid and rutin were used as standards in the same assays.[24]

Anti-diabetic activity

P. Pavana *et al.*, The effects of an aqueous extract of *Tephrosia purpurea* leaves on hyperlipidemia and hyperglycemia were assessed in diabetic rats caused by streptozotocin. In diabetic rats, the amounts of lipid, lipoprotein, and glucose were all considerably altered. When diabetic rats were fed the extract orally, it significantly lowered blood glucose levels while increasing plasma insulin levels (600 mg/kg body weight). Normalisation was done to the lipoprotein and cholesterol profiles. In rats with diabetes induced by streptozotocin, the study found that *T. purpurea* dramatically reduced blood sugar and cholesterol levels.[25]

Anthelmintic activity

Avani V Pate *et al*., estimated the three different strengths (25, 50, and 100 mg/ml), an ethanolic and aqueous extract of *Tephrosia purpurea* leaves was examined for anthelmintic efficacy against earthworm and tapeworm. The anthelmintic activity from both fractions was comparable to that of a common medication (Piperazine citrate, 50 mg/ml) at the same concentration. The study found that the ethanolic extract's (100 mg/ml concentration) anthelmintic effect is comparable to that of a common medicine.

The results suggest that the material has the potential to be employed as an anthelmintic. While the aqueous extract also shown the substantial activity.[26]

Anti-proliferative activity

Ramamoorthy Padmapriya *et al.,* examined the methanolic extracts of *T. purpurea's* leaves and roots to see if they may cause cytotoxicity in HepG2 cells. Yet compared to root extract, leaf extract exhibited stronger anti-proliferative properties. The research proved that *T. purpurea* extracts can kill HepG2 cells via caspase-3 in an apoptosis-mediated manner. The results of this study show that *T. purpurea* methanolic leaf and root extracts exhibit anti-cancer action in hepatocellular carcinoma cells. This activity is caused by the stimulation of caspase-3.[27]

Hepatoprotective activity

Rajal Shah *et al.,* evaluated the hepatoprotective activity of *Tephrosia purpurea* root against carbon tetrachloride (CCl4) - induced hepatotoxicity by using ethanolic extract. Oral treatment of EETP significantly decreased total bilirubin, AST, ALT, and ALP in comparison to CCl4-damaged rats. When compared to the group that received CCl4 treatment, a histological analysis of the test group's liver showed almost normal architecture. Similar to silymarin, the results were good. EETP's hepatoprotective activity beat silymarin in some metrics, demonstrating its potential for hepatoprotection.[28]

Ravuri Halley Gora *et al.,* evaluated by administering aerial portions of a hydro-alcohol solution, researchers examined *Tephrosia purpurea's* hepatoprotective efficacy against sodium arsenite (NaAsO2)-induced sub-acute toxicity in rats. Flavonoids found in *Tephrosia purpurea* have antioxidant and free radical-scavenging effects. By reducing the generation of ROS, maintaining antioxidant capacity, and considerably lowering the body's high blood biomarker levels, it lessens the oxidative stress brought on by arsenic. According to our research, supplementing with *Tephrosia purpurea* extract (500 mg/kg) may be able to lessen the liver-damaging effects of arsenic by lowering oxidative stress.[29]

Anti-ulcer activity

S.S. DESHPANDE *et al.,* examine the antiulcer properties of *Tephrosia purpurea* root extract in rat models of gastric and duodenal ulceration. The ulcer index in all models was shown to be considerably reduced in AETP-treated animals when compared to vehicle-control animals. When HCl, Indomethacin, or pyloric ligation were used to cause ulcers in animals, its antiulcer effect was more apparent. Omeprazole (8 mg/kg) significantly reduced the risk of duodenal and stomach ulcers as compared to the control group. Nevertheless, AETP has less anti-ulcer activity than omeprazole. Research came to the conclusion that AETP has potent antiulcer characteristics, which may be brought on by the drug's cytoprotective activity or by fortifying the stomach and duodenal mucosa and thereby enhancing mucosal defence.[30]

Anti-urolithiatic activity

Ajay Shukla *et al.,* carried out Antiurolithiatic activity of species *Tephrosia purpurea* by ethanolic and aqueous extract of roots. The result revealed that ethylene glycol administered to rats caused hypercalciuria, oxaluria, and increased renal phosphate excretion. Urinary calcium, oxalate, and phosphate excretion were dramatically decreased by ethanolic and aqueous root extracts from *T. purpurea*. Antioxidant nephroprotection may be the mediating mechanism for this action. Rats were significantly (0.05) protected from the development of calcium oxalate crystals and the disruption of tubular cells when administered a dose of 300 mg/kg of *T. purpurea* ethanolic extract.[31]

Wound healing activity

Santram Lodhi *et al.,* evaluated the ability of an ethanolic extract of *Tephrosia purpurea* (aerial part) to treat wounds. The results showed that fibroblast cells, collagen fibres, and the growth of blood vessels had risen, indicating a pro-healing activity. This is comparable to the widely used drug Fluticasone propionate.[33]

Nephroprotective activity

N.S.Murali Krishna *et al.,* analysed the nephron-protective effects of an ethanolic extract from the stem bark of *Tephrosia purpurea* in rats with acute renal failure brought on by gentamycin and cisplatin. The findings demonstrated that blood urea and serum creatinine levels enhanced by CP injection were considerably decreased by pretreatment with *Tephrosia purpurea*. In addition, *Tephrosia purpurea* considerably alleviated GT and CP-induced renal tubular necrosis by significantly lowering MDA rises and decreasing GSH, CAT, and SOD activity in renal cortical homogenates. The demonstrates the nephron-protective qualities of *Tephrosia purpurea* stem bark.[33]

Tephroisa bracteolata

Anti-pyretic activity

Onaolapo *et al.,* carried out by subcutaneously injecting 12% yeast suspension at a prescribed dose of I mg/kg body weight, the acute toxicity of *Tephrosia bracteolata* methanolic extract and antipyretic effectiveness in fever-induced rats were investigated. Using a clinical thermometer implanted into the rectum, the rectal temperatures of the rats were measured hourly for six hours. The dose of 600 mg/kg body weight delivered intraperitoneally displayed the most powerful antipyretic activity within the first two hours and the extract was proven to be safe with Lnso>5000 unit. The extract's antipyretic properties were extremely comparable to aspirin, which was administered intraperitoneally at a dose of 50 mg/kg body weight. The extract utilised has significant antipyretic efficacy and is safe.[34]

Antidiabetic,antioxidant and antimicrobial activity

Godshelp Osas Egharevba *et al.,* studied the anti-diabetic, anti-oxidant, and antibacterial effects of *Tephrosia bracteolata* leaves extracted in n-hexane and ethyl acetate. The findings showed that -glucosidase was inhibited by *T. bracteolata* leaf extracts in ethyl acetate, as well as the efficient scavenging of DPPH+ and ABTS+ free radicals and the inhibition of the growth of both Gram positive and Gram negative microorganisms.[35]

Tephrosia pumila

Anti-diabetic activity

C.Ramesh *et al.,* examined the *Tephrosia pumila* aerial parts' methanolic extract's ability to treat rats with alloxan-induced diabetes. When compared to the diabetic control group in the OGTT, glibenclamide and extract at dosages of 200 and 400 mg/kg significantly lowered blood glucose levels. The extract effectively reduced diabetes abnormalities in therapy groups utilising the chronic model. Both -glucosidase and -amylase inhibitor tests revealed significant IC50 values and improved skeletal muscle glucose absorption. The outcome showed that *T. pumila* extract had strong *in-vivo* anti-diabetic efficacy. According to the study,

the antidiabetic effects of *T. pumila* extarct are caused by enhanced insulin secretion and decreased insulin resistance.[36]

Anti-depressant and anti-anxiety activity

Hari Prasad Murthy *et al.*, evaluated the effects of *Tephrosia pumila* ethanolic extract using behavioural tests that are sensitive to the effects of therapeutically effective anxiolytics and antidepressants by utilizing rats. When administered intraperitoneally, the extract (200 and 400 mg/kg) was able to decrease the immobility time of rats when put through the tail suspension and forced swim tests for antidepressant activity as well as the elevated Pluse maze test and actophotometer test for anxiolytic effect. The effects are comparable to those of standard drugs like diazepam (20 mg/kg). Neither *T. pumila* nor Diazepam extracts at the indicated concentrations had a discernible impact on locomotor activity in an open field behavioural test. These results showed that *T. pumila* possesses *in-vivo* antidepressant effects.[37]

Tephrosia vogelli

Antimicrobial activity

B. N. Wanga *et al.*, possessed the antibacterial activity of *Tephrosia vogelii's* root and leaf dichloromethane extract. On *Staphylococcus aureus, Escherichia coli*, and *Fusarium phoseolida*, antimicrobial tests were conducted. For all of the microorganisms that were examined, the minimum inhibitory values ranged from 0.25 to 6.4 gg/ml. Also poisonous to brine shrimps, which were used as toxicity markers, were the crude root and leaf extracts. *Staphylococcus aureus* and *Escherichia coli* had a rotenone MIC of 5.2 and 1.0 gg/ml each, respectively, whereas brine shrimp had an LC50 of 3.20 gg/ml. According to the research, *T. vogelii* extracts include metabolites that have antibacterial properties.[38]

Anthoney Swamy T. and his research team conducted a study to assess the antibacterial properties of *Tephrosia vogelli* bark using both ethanol and aqueous extracts. They employed agar well diffusion methods to compare the inhibition zones produced by the plant extract with those generated by a positive control, aiming to measure antibacterial activity. Subsequently, the data was analyzed using SPSS software. The study investigated the bioactivity of *Tephrosia vogelii* against a range of bacteria, including *Bacillus cereus, Escherichia coli, Salmonella typhi, Streptococcus pyogenes, Serratia marcescens, Serratia liquefaciens, Enterobacter aerogenes, and Staphylococcus epidermidis*. The research findings indicate that *Tephrosia vogelii* effectively inhibited the growth of *B. cereus, S. pyogenes, and S. epidermidis*, with inhibition zones measuring 15.667, 16.666, and 17.667, respectively. Bacteria that were not susceptible to inhibition exhibited zones measuring less than 8 mm. This study's data conclusively demonstrate that an ethanol-water extract of *T. vogelii* bark significantly inhibits pathogenic organisms such as *B. cereus, S. pyogenes, and S. epidermidis*.[39]

Tephrosia tinctoria

Anti-diabetic activity

Rajaram Krishnasamy and his team conducted a study in which they administered *Tephrosia tinctoria* ethyl acetate extract (TTEA) orally to male albino rats at doses of 100 and 200 mg/kg body weight for a duration of 28 days, following the induction of diabetes using alloxan at a dose of 140 mg/kg body weight. The primary focus of their research was to investigate the impact of TTEA on various biochemical parameters. The comprehensive findings from this study revealed that TTEA had a significant corrective effect on the abnormal parameters observed in rats with alloxan-induced diabetes. TTEA effectively controlled the diabetes-related increases in glycogenolysis and gluconeogenesis metabolism. Furthermore, TTEA markedly enhanced the metabolisms of key processes such as the tricarboxylic acid (TCA) cycle, glycolysis, and glycogenesis. In addition to this, the study measured the total non-enzymatic antioxidant capacity in both serum and liver homogenate using the DPPH inhibition assay, revealing that TTEA treatment resulted in significantly elevated levels of both enzymatic and non-enzymatic antioxidants in diabetic rats. In summary, this research highlights the anti-diabetic properties of *Tephrosia tinctoria* ethyl acetate extract (TTEA), suggesting that its beneficial effects are achieved through the regulation of glucose metabolism and enhancement of the antioxidant state in the body.[40]

Tephrosia cinerea

Anti-bacterial activity

Panduranga murthy G. *et al*., determine the anti-bacterial efficacy of *Tephrosia cinerea* leaf extracts in aqueous and organic solvents. Using pathogenic microorganisms like Gramme +ve (E. coli) and Gramme -ve (*Pseudomonas aeruginosa*) bacteria, the antibacterial activity of organic solvent extracts such acetone, ethyl acetate, and petroleum ether extracts was investigated. The results demonstrated that, in compared to petroleum ether extract, acetone and ethyl acetate significantly retarded the growth of *P. aeruginosa* bacteria. Petroleum ether and ethyl acetate extract, however, had little to no impact on the E. coli bacterium. The appropriate expressions were found in the leaf extract under examination at the Minimal Inhibitory Concentration.[41]

Antileishmanial

A.C.S. Dias *et al*., evaluated the anti-leishmanial activity of *Tephrosia cinerea* leaves hydroalcoholic extract was evaluated by calculating the genotoxic, anti-genotoxic, and cytotoxic effects. Human peripheral blood leukocytes were subjected to 22, 44, or 88 g/mL for 3, 24, or 48 hours (comet assay) in an in-vitro genotoxicity test. herbal extract. After receiving 500, 1000, or 2000 mg of extract per kg of body weight intraperitoneally, Swiss mice were observed 24 hours later. In pre and post treatment trials, antigenotoxicity was examined in rats that received the plant extract (2000 mg/kg) 24 hours before or after receiving cyclophosphamide (50 mg/kg). *In vitro* and *in-vivo* tests using the extract showed no genotoxic effects. Despite this, the extract had leishmanicidal activity *in-vitro* at dosages that decreased apoptotic cell death and raised necrotic cell death. Additionally, the extract demonstrated an antigenotoxic effect, reducing by more than 80% the levels of chromosomal damage caused by cyclophosphamide in Swiss mice.[42]

Tephrosia maxima

Antidepressant and Anti-Anxiety

Sunil Junapudi et al., evaluated anti-depressant and anti-anxiety effects of *Tephrosia maxima* fresh plant ethanolic extract in rats. Rats that had undergone forced swim and tail suspension tests for antidepressant efficacy were given the extract intraperitoneally, and the extract (200 and 400 mg/kg) reduced immobility time in a dose-dependent manner. In order to determine the anxiolytic impact, the raised plus maze test and actophotometer test models

were used. The results were comparable to those of common drugs like diazepam (20 mg/kg), which were used to determine its anxiolytic effect. These findings show that *T. maxima* have antidepressant qualities *in vivo*. Finally, it was established that *T. maxima* extracts may have potential antidepressant and anxiolytic effects that could be therapeutically beneficial in the treatment of patients with depressive disorders. [43]

Tephrosia sinapou

Anti-inflammatory and anti-oxidant activity

Renata M. Martinez et al., employing the ethyl acetae extract of *Tephrosia sinapou* roots, researchers in mice were able to test the anti-inflammatory and antioxidant characteristics. The extract effectively suppressed in vitro tests for both iron-dependent and iron-independent lipid peroxidation, iron chelation, DPPH, and ABTS+. It also revealed that these two chemicals were capable of donating hydrogen. It stopped carrageenin, zymosan, glycogen, and lipopolysaccharide from inducing total leukocyte and neutrophil recruitment in vivo in the peritoneal cavity of mice. Two other important cytokines for leukocyte recruitment, tumour necrosis factor and interleukin-1, were also inhibited by the extract: 1) the effect of *T. sinapou* on leukocyte recruitment is mediated by nitric oxide, which was dose-dependently inhibited by treatment with L-NAME (nitric oxide synthase inhibitor). According to the study's results, *T. sinapou* ethyl acetate extract reduces oxidative stress *in-vitro*, inflammation-related leukocyte recruitment through a mechanism involving the reduction of cytokine production, and nitric oxide dependency *in-vivo*.[44]

Antineoceptive activity

Renata M. Martinez *et al*., investigated the antineoceptive activity of an ethyl acetae extract of *T. sinapou* roots was using acetic acid, PBQ, and PBQ-induced writhing, as well as formalin, CFA, and paw flinching and licking models. Acetic acid and phenyl-p-benzoquinone (PBQ)-induced writhing were inhibited by *T. sinapou* extract in a dose-dependent manner (1-100 mg/kg). Additionally effective were oral, subcutaneous, and intraperitoneal administration methods. A 100 mg/kg dose of *T. sinapou* extract stopped animals from licking or flinching in response to formalin and a full Freund's adjuvant. Reduced inflammatory discomfort is seen in response to *T. sinapou* ethyl acetate extract in the acetic acid, PBQ, formalin, and CFA models of overt pain-like behavior.

CONCLUSION

Medical plants have been essential to the growth of human culture. People have resorted to nature for medicines to treat their illnesses since ancient times. In the past, When the rationale behind using a certain herbal plant to cure a particular ailment came to light, the usage of medicinal plants gradually abandoned the imperial framework and was founded on illuminating facts. As a result, the present study reviewed the important research projects done on the *Tephrosia* genus, as well as its pharmacognostical and pharmacological activity, which might be explored further to identify powerful bioactive compounds in quest of newer herbal medications.

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