International Journal of Research in Pharmacology & Pharmacotherapeutics (IJRPP)

ISSN: 2278-2648

IJRPP |Vol.15 | Issue 2 | Apr - Jun -2026

www.ijrpp.com

DOI : https://doi.org/10.61096/ijrpp.v15.iss2.2026.768-778

Neuraopharmacological Insights Into The Anxiolytic And Anti-Depressant Effects Of *Tephrosia Purpurea* Root Extract

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Published by:
25.04.2026

Abstract: Tephrosia purpurea (L.) Pers., an important medicinal plant in Ayurveda, has been widely used for the treatment of various ailments including liver disorders, inflammation, infections, and wound healing. The present study aimed to explore the neuropharmacological potential of the methanolic root extract of Tephrosia purpurea, focusing on its anxiolytic and antidepressant activities. Preliminary phytochemical screening revealed the presence of bioactive constituents such as alkaloids, flavonoids, phenolic compounds, glycosides, and tannins. The anxiolytic activity was evaluated using behavioral models such as the Elevated Plus Maze (EPM), Open Field Test (OFT), and Light–Dark model in Swiss albino mice. Antidepressant activity was assessed using the Forced Swim Test (FST) and Tail Suspension Test (TST). The extract was administered at doses of 125, 250, and 500 mg/kg and compared with standard drugs such as diazepam and imipramine. The results demonstrated a significant increase in time spent in open arms and number of entries in EPM, along with enhanced locomotor activity in OFT and increased time spent in the light compartment, indicating anxiolytic effects. In antidepressant models, the extract significantly reduced immobility time in both FST and TST in a dose-dependent manner. The highest dose (500 mg/kg) exhibited effects comparable to standard drugs. The findings suggest that the methanolic root extract of Tephrosia purpurea possesses significant anxiolytic and antidepressant activities, which may be attributed to its phytochemical constituents and possible interaction with GABAergic and monoaminergic systems. This study supports its traditional use and highlights its potential as a natural therapeutic agent for neurological disorders.

Keywords*:* *Tephrosia purpurea*, Anxiolytic activity, Antidepressant activity, Methanolic root extract, Elevated Plus Maze (EPM), Forced Swim Test (FST)

1. INTRODUCTION

Medicinal plants have long been recognized as valuable sources of therapeutic agents and continue to play a crucial role in both traditional and modern healthcare systems. Due to their accessibility, affordability, and relatively low incidence of adverse effects, herbal medicines are widely used across the globe. The World Health Organization has emphasized the importance of medicinal plants as reliable resources for primary healthcare, particularly in developing countries[1]. Traditional systems such as Ayurveda, Unani, and Siddha have provided a strong foundation for the development of modern pharmaceuticals, with many drugs being derived directly or indirectly from plant sources[2].

Among the numerous medicinal plants, *Tephrosia purpurea* (L.) Pers., belonging to the family Fabaceae, holds significant importance in traditional medicine. It is commonly known as “Sarwawranvishapaka,” indicating its ability to heal various types of wounds [3]. The plant is widely distributed across tropical and subtropical regions and is abundantly found throughout India.

Traditionally, it has been used for the treatment of liver disorders, gastrointestinal ailments, respiratory conditions, inflammation, and infections [4]. Various parts of the plant, particularly the roots and leaves, have been employed in the management of conditions such as asthma, ulcers, diarrhea, and spleen enlargement [5].Phytochemical investigations of *Tephrosia purpurea* have revealed the presence of a diverse range of bioactive constituents, including flavonoids, alkaloids, glycosides, rotenoids, sterols, and phenolic compounds [6]. These phytochemicals are known to contribute to the plant's wide spectrum of pharmacological activities such as antioxidant, antimicrobial, anti-inflammatory, hepatoprotective, and anticancer effects [7]. Compounds such as pongamol, tephrosin, purpurin, and β-sitosterol have been identified as key constituents responsible for its therapeutic potential [8].Neurological disorders, particularly anxiety and depression, have emerged as major public health concerns worldwide. Anxiety disorders are among the most prevalent psychiatric conditions, characterized by excessive fear, nervousness, and behavioral disturbances that significantly impair daily functioning [9]. Similarly, depression is a chronic mental health disorder associated with persistent sadness, loss of interest, and reduced cognitive function, affecting millions of individuals globally [10]. The increasing prevalence of these disorders has created a significant burden on healthcare systems and society.Although several pharmacological treatments are available for anxiety and depression, such as benzodiazepines and antidepressants, their long-term use is often associated with adverse effects including sedation, tolerance, dependence, and withdrawal symptoms [11]. Furthermore, many patients show inadequate response to existing therapies, highlighting the need for safer and more effective alternatives. In this context, medicinal plants have gained considerable attention as potential sources of novel neuropharmacological agents with fewer side effects [12].Experimental models play a crucial role in evaluating the neuropharmacological properties of plant extracts. Behavioral tests such as the Elevated Plus Maze (EPM), Open Field Test (OFT), and Light–Dark model are widely used for assessing anxiolytic activity, while the Forced Swim Test (FST) and Tail Suspension Test (TST) are commonly employed for evaluating antidepressant effects [13]. These models provide reliable and reproducible methods for screening potential therapeutic agents.Despite the extensive traditional use of *Tephrosia purpurea*, scientific studies focusing on its neuropharmacological effects, particularly its anxiolytic and antidepressant activities, remain limited. Therefore, systematic investigation using validated experimental models is essential to establish its efficacy and mechanism of action.The present study aims to evaluate the anxiolytic and antidepressant potential of the methanolic root extract of *Tephrosia purpurea* using established in vivo models in Swiss albino mice. The study also seeks to provide scientific validation for its traditional use and explore its potential as a natural therapeutic agent for the management of neurological disorders.

Tephrosia purpurea

Taxonomical Classification:

Kingdom : Plantae

Subkingdom: Tracheobionta

Division : Magnoliophyta

Class : Magnoliopsida

Subclass : Rosidae

Order : Fabales

Family : Fabaceae

Subfamily : Papilionaceae

Genus : Tephrosia

Species : purpurea

Part used: Root

Aim:

Neuraopharmacological insights into the anxiolytic and anti depressant effects of *Tephrosia purpurea* root extract

Objective:

1. The method includes purifying, drying, and grinding the *Tephrosia purpurea* root Extracts into a fine powder.
2. *Tephrosia purpurea* root Extracts Provide Neuropharmacological: insights into the anxiolytic and anti depressant effects.
3. The research centers on analyzing the studies performed regarding the anxiolytic and anti depressant effects Action of the *Tephrosia purpurea* root Extracts.

2. MATERIALS AND METHODS

2.1 Collection and Preparation of Plant Material

Roots of *Tephrosia purpurea* were collected ,The plant material was cleaned to remove adhering impurities and shade-dried at room temperature. The dried roots were finely powdered using a mechanical grinder and stored in airtight containers for further use.

2.2 Preparation of Methanolic Extract

The powdered root material (250 g) was subjected to extraction using a Soxhlet apparatus with methanol as the solvent. The extraction was carried out at a temperature range of 60–80°C until complete extraction was achieved. The extract was then concentrated by distillation, and the solvent was recovered. The final extract was evaporated to dryness to obtain a greenish-black sticky mass with a yield of approximately 8% w/w. The extract was stored in a desiccator until further use.

2.3 Preliminary Phytochemical Screening

The methanolic extract of *Tephrosia purpurea* roots was subjected to qualitative phytochemical analysis using standard procedures to detect the presence of secondary metabolites such as alkaloids, flavonoids, phenolic compounds, glycosides, tannins, steroids, and saponins. The presence or absence of these constituents was determined based on characteristic color changes and precipitation reactions.

2.4 Experimental Animals

Swiss albino mice (20–30 g) of either sex were used for the study. The animals were obtained from a certified animal house facility and maintained under standard laboratory conditions (12-hour light/dark cycle, controlled temperature, and humidity). They were provided with standard pellet diet and water ad libitum. The animals were acclimatized for one week prior to the experiment. All experimental procedures were conducted in accordance with ethical guidelines for animal care.

2.5 Acute Oral Toxicity Study

Acute toxicity studies were performed according to OECD guideline 423 (acute toxic class method). The methanolic extract was administered orally at different dose levels (5, 50, 300, and 2000 mg/kg body weight). The animals were observed for signs of toxicity such as changes in behavior, skin, fur, eyes, and physiological functions over a period of 14 days. No mortality or significant toxicity was observed, indicating that the extract is safe up to 2000 mg/kg. Based on this, experimental doses of 125, 250, and 500 mg/kg were selected for further studies.

2.6 Evaluation of Anxiolytic Activity

2.6.1 Experimental Design

Animals were divided into five groups (n = 6 per group):

- **Group I:** Control (vehicle, 0.5% CMC)
- **Group II:** Standard (Diazepam, 5 mg/kg)
- **Group III:** Methanolic extract of *Tephrosia purpurea* (125 mg/kg)
- **Group IV :** Methanolic extract of *Tephrosia purpurea* t (250 mg/kg)
- **Group V :** Methanolic extract of *Tephrosia purpurea* (500 mg/kg)

2.6.2 Elevated Plus Maze (EPM) Test

The EPM apparatus consisted of two open arms and two closed arms elevated 50 cm above the floor. Each animal was placed at the center of the maze facing an open arm and observed for 5 minutes. The number of entries into open arms and the time spent in open arms were recorded as indicators of anxiolytic activity.

2.6.3 Light–Dark Model

The apparatus consisted of two compartments: a brightly illuminated chamber and a dark chamber connected by a small opening. Each animal was placed in the light compartment and observed for 5 minutes. Parameters such as time spent in light and dark compartments, number of crossings, and locomotor activity were recorded.

2.6.4 Open Field Test (OFT)

The open field apparatus consisted of a square arena divided into equal squares. Each animal was placed in one corner and observed for 5 minutes. Parameters such as ambulation (number of squares crossed), rearing, and latency were recorded. Increased exploratory behavior was considered indicative of anxiolytic activity.

2.7 Evaluation of Antidepressant Activity

2.7.1 Experimental Design

Animals were divided into five groups (n = 6 per group):

- **Group I:** Control (vehicle)
- **Group II:** Standard (Imipramine, 15 mg/kg)
- **Group III:** Methanolic extract of *Tephrosia purpurea* t (125 mg/kg)
- **Group IV** Methanolic extract of *Tephrosia purpurea* (250 mg/kg)
- **Group V:** Methanolic extract of *Tephrosia purpurea* (500 mg/kg)

2.7.2 Forced Swim Test (FST)

Animals were placed individually in a cylindrical container filled with water maintained at 25°C. After an initial period of activity, the duration of immobility was recorded during a 5-minute test session. A decrease in immobility time was considered indicative of antidepressant activity.

2.7.3 Tail Suspension Test (TST)

Mice were suspended by the tail using adhesive tape, and the duration of immobility was recorded for 5 minutes. Reduced immobility time was considered a sign of antidepressant activity.

2.8 Statistical Analysis

All experimental data were expressed as mean ± standard deviation (SD). Statistical analysis was performed using one-way ANOVA followed by appropriate post hoc tests. A value of $p < 0.05$ was considered statistically significant.

3. PRELIMINARY PHYTOCHEMICALANALYSIS

Methanolic extract of *Tephrosia purpurea* :

The methanolic extracts were collected in the same way as the ethanolic extracts. 250g of powdered sample was weighed in the weighing machine and packed in the soxhlet apparatus with 250ml methanol. As the methanol boiled the extract was slowly collected in the flask below. The temperature here too was adjusted between 60-80 ºC. After that extract was concentrated by distillation and solvent was recovered. The final solution was evaporated to dryness. The colour, consistency and yield of Methanolic extract were noted.

Fig 1: Methanolic root extraction of *Tephrosia purpurea*

Table 1: Name of extract of *Tephrosia purpurea*

S. No.	Name of extract	Colour	Consistency	Yield% W/W
1.	Methanolic extract	Greenish black	Sticky mass	8

Biochemical Assays:

Preliminary screening of biochemical tests of extracts were done for testing various phytochemicals found in plants. The crude extracts were tested for the presence or absence of secondary metabolites such as alkaloids, steroidal compounds, phenolic compound, flavonoids, saponins, tannins and cardiac glycosides. The following biochemical tests has been performed to confirm the presence or absence of the secondary metabolites in the plant extract.

RESULTS

PRELIMINARY PHYTOCHEMICAL STUDIES

Table 2: Percentage Yield of *Tephrosia purpurea*

Name of extract	Yield(%w/w)
Methanol	8

The extract obtained were subjected to qualitative Phytochemical test to find out the active constituents.

Table 3: Qualitative Phytochemical analysis of the extract

S. NO	Phytochemicals	Inference
1	Alkaloids	+
2	Steroids	-
3	Flavanoids	+
4	Phenol	+
5	Saponin	Trace

6	Tannins	Trace
7	Glycosides	+

+, presence of the compound,- indicates absence of the compound

ELEVATED PLUS MAZE

TABLE: 4. Effect of Methanolic extract of *Tephrosia purpurea* on EPM Test

Group	Treatment	Dose	Time spent in open arm (s)	No Entries in open arm
I	Saline	10ml/kg	42.3± 2.1	13.1± 1.5
II	Diazepam	5mg/kg	27.6± 3.6**	8.6± 1.8**
III	TPME	125mg/kg	25.8 ±2.4	5.8± 2.3
IV	TPME	250mg/kg	22.7± 3.2*	7.5± 3.5*
V	TPME	500mg/kg	28.5 ±2.8**	9.2± 1.3**

The data represent the mean ±S.D (n=6) *p<0.01, **p<0.001 significantly different compared to normal control and diazepam.

Table No. 5, Open field Test

Group	Treatment	Dose	Number of square crossed	Number of rearing
I	**Saline**	10ml/kg	50.3± 2.1	12.1± 1.5
II	**Diazepam**	5mg/kg	39.6± 3.6**	8.5± 1.8**
III	**Plant extract**	125mg/kg	32.8± 2.4	5.7± 2.3
IV	**Plant extract**	250mg/kg	33.7 ±3.2*	7.9 ±3.5*
V	**Plant extract**	500mg/kg	36.5± 2.8**	9.8± 1.3**

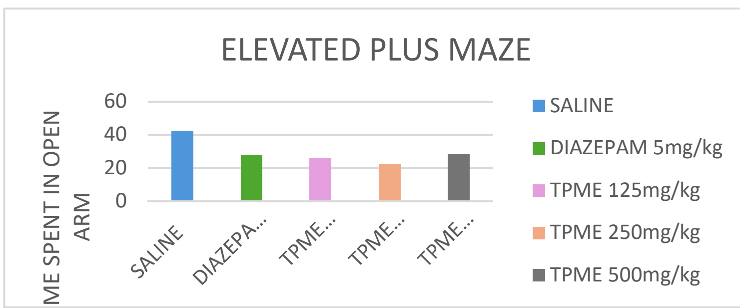


Fig.2. Effect of Methanolic extract of *Tephrosia purpurea* On Time Spent in Open arm in EPM Test

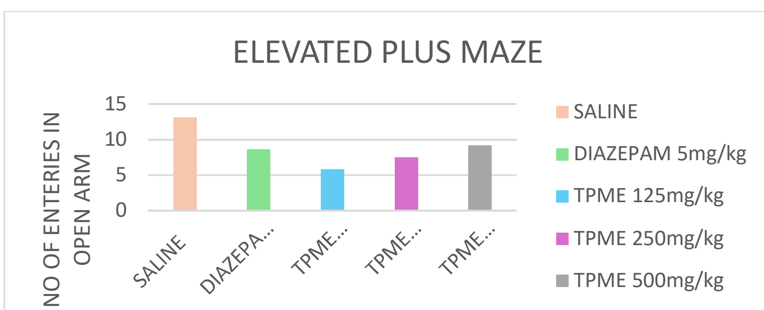


Fig.3 Effect of Methanolic extract of *Tephrosia purpurea*, No of entries in Open arm on EPM Test

The data represent the mean ±S.D (n=6) *p<0.01, **p<0.001 significantly different compared to normal control and diazepam.

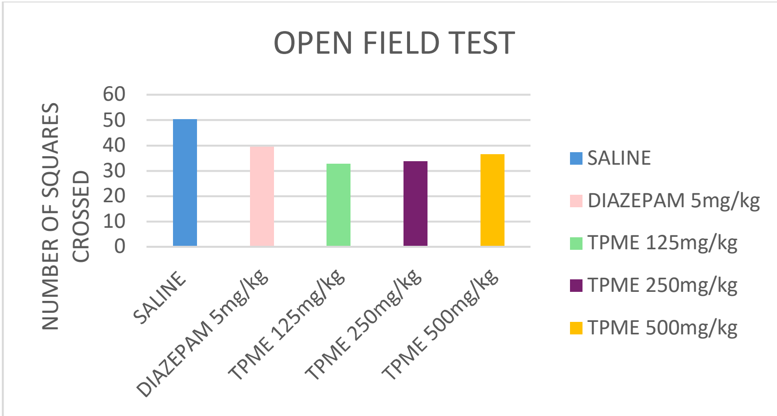


Fig.4. Effect of Methanolic extract of *Tephrosia purpurea* on No of Square crossed in Open Field test in mice

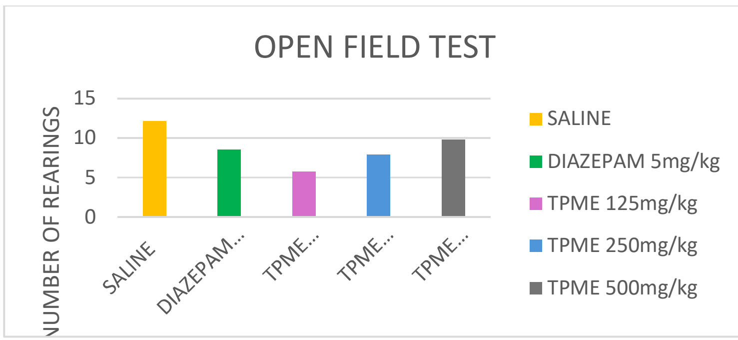
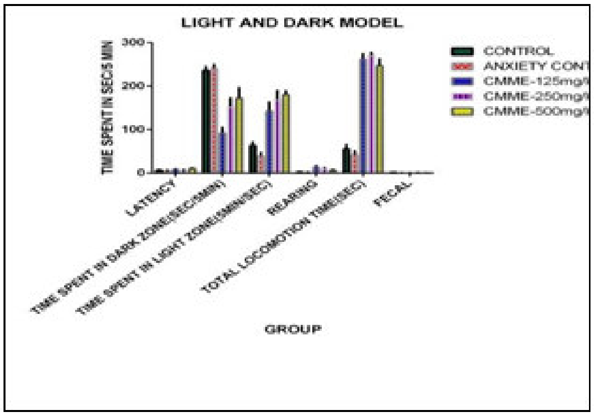


Fig.5.Effect of Methanolic extract of *Tephrosia purpurea* on Number of rearing in OPM TEST in mice

LIGHT AND DARK MODEL

Table 5: Effect of Methanolic extract of *Tephrosia purpurea* on light and dark model

Treatment	Latency	Time spent in dark Zone(5min/sec)	Time spent in light zone(5min/sec)	Rearing	Total Locomotion time(sec)	Fecal
Control (Vehicle)	6.64± 1.01	216± 8.78	73.17 ±8.54	2.38 ±0.75	58.4± 9.35	1.7± 0.22
Methanolic extract of *Tephrosia purpurea* (200mg/kg)	8.26± 0.88	96± 12.50	172.34± 20.43**	13.87± 2.4	242± 11.83***	0.14± 0.17***
Methanolic extract of *Tephrosia purpurea* (400mg/kg)	6.52± 1.35	162.5 ±20.13*	159.17± 20.25	10.14± 2.5	291.34± 6.17***	0.64± 0.49
Standard anxiolytic drug(diazepam m0.5 mg/kg)	14 ±0.35*	183.67 ±23.38	170.5 ±8.59**	6.33±1.22	237.67± 14.88***	0.63± 0.02



Value expressed by are mean SEM, n=6, p<0.05*, p<0.001 as compared to normal group**

IMMOBILITY OF MICE (FST)

Table: 6. Effect of Methanolic extract of *Tephrosia purpurea* on immobility of mice (FST)

S. No	Groups	Dose (mg/kg)	Duration of Immobility(sec)	Duration of immobility(% of activity)
1	Control	0.5% CMC	202.6± 3.03	---------------
2	Positive control	Diazepam 5	37.67 ±3.04	76.66
3	TPME	125	134.4 ±3.88	44.6
4	TPME	250	115± 3.46	56.19
5	TPME	500	59.6± 2.47	72.43

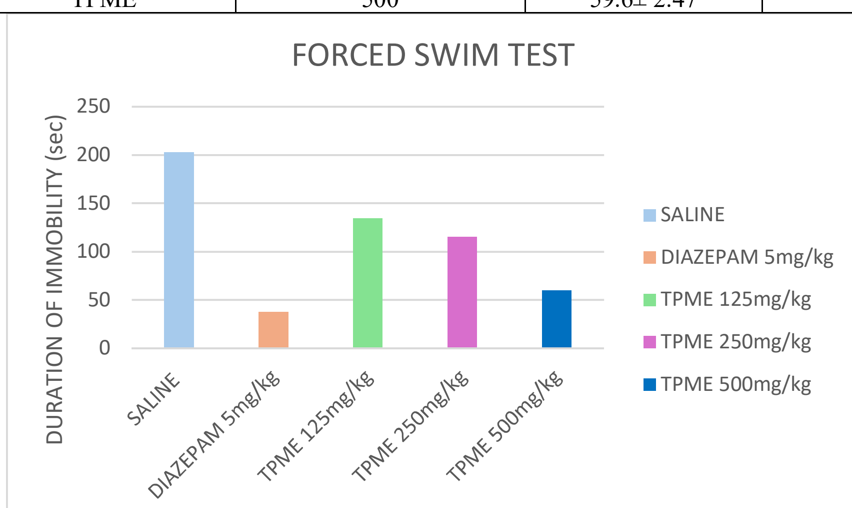
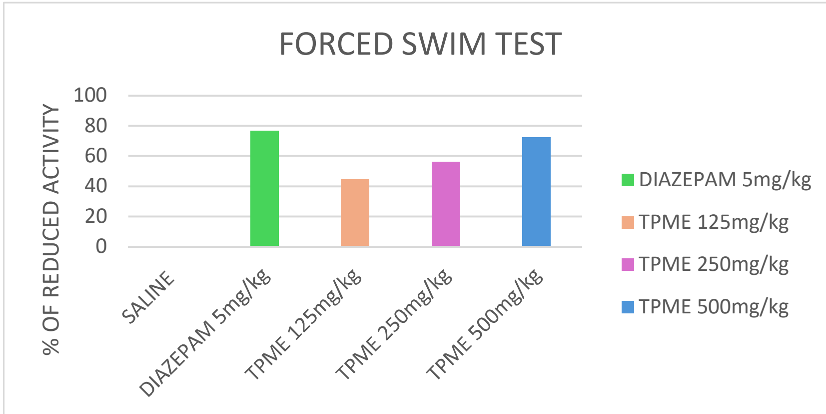


Fig 6 Effect of Methanolic extract of *Tephrosia purpurea* immobility of mice in forced swim test



IMMOBILITY OF MICE (TST)

Table: 7 Effect of Methanolic extract of *Tephrosia purpurea* on Immobility of mice (TST)

S.NO.	Groups	Dose(mg/kg)	Duration of Immobility (sec)
1	Control	0.5% CMC	147.6± 1.03
2	Positive control	Diazepam	46.67± 1.02
3	TPME	125	123.3± 3.01
4	TPME	250	87.5± 2.06
5	TPME	500	65.6 ±2.09

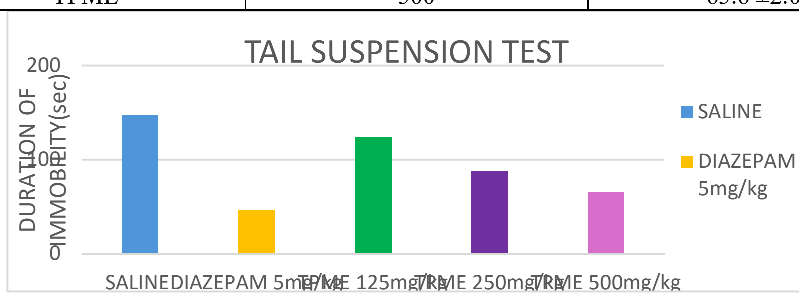


Fig.7 Effect of Methanolic extract of *Tephrosia purpurea*, Duration of immobility in tail suspension test

4. DISCUSSIONS

Anxiety, depression and mental health problems in general and neurological disorder in particular, are widely prevalent in modern fast- placed life with a multitude of stressful conditions. The ***Tephrosia purpurea*** was attributed with varied medicinal properties is Ayurveda and unani. The roots are used for folk-lore medicine in tribal olden days remedies used for neurological disorders (anxiety, Nootropic, Amnesia, Alzheimer disease). Benzodiazepine have been extensively used the treatment of anti-anxiety and antidepressant. But due to their unwanted side effects, so alternative treatment strategies with favourable side effect to reduced and also moderate cost. The EPM test is based on a premise where the exposure to EPM evoked an approach avoidance conflict that was considerably stronger than that evoked the exposure to an enclosed arm. EPM model is a well-established animal model for testing anxiolytic drugs diazepam, a standard anxiolytic drug is used clinically, is also employed in behavioural pharmacology as a reference compound for including anxiolytic effect. The EPM test is based on premises where the exposure to an EPM evoked approach- avoidance conflict that was considerably stronger than that evoked by exposure to an enclosed arm. The decrease in aversion to the open arm is the result of an anxiolytic effect, expressed by the increase in the spent and entries in to the open arm. The methanolic roots extract of *Tephrosia purpurea*, at 125mg, 250 and 500mg/kg, had increased the time spent and percent of entries in to the open arm with percent of entries in to the open arm with percent decrease the in the spent in closed arm. The dose methanolic extracts of *Tephrosia purpurea*125mg, 250 and 500mg/kg had increase percent number of entries in to the open arm as compared with control group. In case of rearing there is no much significant difference has been control group with the dose 125, 250mg and 500mg, the time spent the neutral zone is also reduced compared to control groups. This decrease in number of entry and time spent in dark zone and decrease in the time spent in neutral zone compared to control groups show anxiolytic activity of roots extract of *Tephrosia purpurea* .In light –dark model for the screening of anxiolytic activity, four behavioural events were observed, latency to enter into the dark compartment, number of crossing between light and dark compartment, time spent in light zone and number of rearing in light zone. Diazepam 1mg/kg and shown significant effect with all four parameters. Number of entries in light zone and time spent in light zone increased as compared to control group with 125, 250mg/kg and 500mg/kg dose of both extracts. There is increase in number of rearing and in total locomotion as compared to control group. An increase in locomotion and time spent in light zone indicates anxiolytic activity of the methanolic extract of roots of *Tephrosia purpurea*. In the Open Field Model, the conformation with the situation induces anxiety behaviour in mice. In such mice show the thigmotaxic behaviour identified by spontaneous preference to the periphery of the apparatus and reduced ambulation. The anxiolytic treatment decreases this anxiety- induced inhibition of exploratory behaviour.125, 250mg/kg and 500mg/kg to decrease the time spent in square where it where it was placed and time taken to enter in central compartment as compared to control group. Results obtained from all the doses showed increase the spent in central compartment and increase number of square crossed by the animal which shows decrease in fear of animals, indicates the anxiolytic activity of the methanolic flowers extract of *Tephrosia purpurea*. In the force swim test, the conformation with the situation induced depressant in mice. The methanolic extract 125, 250mg/kg and 500mg/kg showed the significant antidepressant activity in term of responding to the stress in experimental studies that they exposed in force swim test showed decreased the immobility, to the response indicate the antidepressant activity of the methanolic extract of rootsof *Tephrosia purpurea*

Tail suspension test, the conformation with the situation induced depressant in mice. The methanolic extract 125, 250mg/kg and 500mg/kg showed the significant antidepressant activity in term responding to the stress in experimental studies they are exposed in tail suspension test showed the animal struggled to escape and the struggling time was increased, to the response indicate the antidepressant activity of methanolic extract of roots of *Tephrosia purpurea*.

5. CONCLUSION

This study provides evidence that the methanolic root extract of *Tephrosia purpurea* possesses significant pharmacological potential as an anxiolytic and antidepressant agent. Across all tested dosage levels (125, 250, and 500 mg/kg), the extract shows consistent efficacy in standard behavioral models—including the Elevated Plus Maze, Light-Dark model, and Open Field test for anxiety, as well as the Forced Swim and Tail Suspension tests for depression. These findings not only validate the ethnomedicinal application of *T. purpurea* in traditional systems but also highlight its promise as a cost-effective, potentially safer natural alternative to conventional synthetic psychotropic medications. Consequently, further investigation into the specific bioactive phytoconstituents and the neurochemical mechanisms underlying these therapeutic effects is warranted to support its development as a viable candidate for psychiatric pharmacotherapy.

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