

CHAPTER 4

Phytochemical analysis of leaves of *Tephrosia purpurea* (L.) Pers.

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Abstract

Tephrosia purpurea is a common plant in India and is treated as a weed. It is commonly grown near roadsides and wastelands. It has ethnomedicinal uses, but nowadays people ignore it. Keeping this in mind, an attempt has been made to document the bioactive compounds available in the leaves through phytochemical screening. Results showed the presence of saponin, flavonoids, tannin, phenolic compounds, and reducing sugar. The detected compounds could be responsible for the therapeutic values of *T. purpurea* leaves, bringing attention to the importance of roadside plants.

Keywords: Roadside plants, medicinal uses, bioactive compounds

Introduction

Medicinal plants play an important role in human health care systems (Das *et al.*, 2022; Devi *et al.*, 2024a). They also provide nutraceuticals and reduce the cost of medicines. Among them, *Tephrosia purpurea* is a well-known plant (Figures 1-2) in Ayurveda and named "Sarwa wranvishapaka" for its property to heal wounds (Rao *et al.*, 2020). Traditionally, it is practiced for impotency, asthma, dyspepsia, hemorrhoids, syphilis, gonorrhoea, rheumatism, and enlargement of the kidney and spleen (Akanksha *et al.*, 2014). It is an important component of herbal preparations like Tephroli and Yakrifti used to cure liver disorders. Various phytocompounds, including pongamol, purpurin, purpurenone, tephrosin, bulnesol, tephrostachin, β-

sitosterol, and so on, have been reported (Agnihotry *et al.*, 2011). Modern pharmacological studies have shown that the plant has wound healing, antileishmanial, anticarcinogenic, antimicrobial, antioxidant, hepatoprotective, antifertility, antispermatic, anti-diarrheal, diuretic, and insecticidal properties.



Figure 1: Habitat of *Tephrosia purpurea* in wild



Figure 2: Leaves of *Tephrosia purpurea* in wild



Figure 3: Collection of leaves from field for phytochemical analysis

Acetylcholinesterase inhibitory action reported from this plant aids its utilization for the development of drugs for Alzheimer's and dementia neurological disorders (Alam, 2004; Kumar *et al.*, 2012; Bathini *et al.*, 2012; Arriaga *et al.*, 2014; Anbarasi and Vidhya, 2015; Arjun *et al.*, 2016; Babu *et al.*, 2017; Rao *et al.*, 2020). *Tephrosia purpurea* is commonly known as Bano Kuthi. It is under shrubs and suberect. Branches are angled or rounded. The leaf rachis is 5.0–6.2 cm. Leaflets have 5-8 pairs. Flowers are purple. Pods are slightly curved with short, appressed hairs. Seeds are ovoid (Saxena and Brahmam, 1994).

Methodology

Collection of leaves and preparation of extracts

The leaves of *Tephrosia purpurea* were collected from CDA-13 in the in the nearby Mahanadi River area of Cuttack district of Odisha state in July 2024 (Figure 3). The plant was identified by the senior author. The Soxhlet method of extraction was adopted using different solvents for phytochemical analysis (Devi *et al.*, 2023). The

detection of eight secondary metabolites was carried out using standard methods (Devi *et al.*, 2024b; Marndi *et al.*, 2024; Devi *et al.*, 2024c).

Secondary metabolites

Test for tannin

About 1 ml of the filtrate of leaf extract was taken. Added about 3-5 drops of 0.1% lead acetate solution into it. The gelatinous precipitate formation confirmed the presence of tannin (Ankari *et al.*, 2024).

Test for saponin

About 1 ml of the filtrate of leaf extract was taken and mixed with 1 ml of distilled water and allowed to shake it vigorously. The persistent froth formation after shaking confirmed the presence of saponin (Tripathy *et al.*, 2024).

Test for flavonoids

About 1 ml of the filtrate of leaf extract was taken and added 2 ml of 2 % NaOH solution, followed by H₂SO₄ into it. The colour initially turned to an intense yellow colour with the addition of NaOH solution and later became colourless with sulphuric acid. This change in colour confirmed the presence of flavonoids (Soni *et al.*, 2024).

Test for terpenoids

About 2 ml of the filtrate of leaf extract was added with 6 drops of chloroform and placed it in the water bath for few minutes. Then 6 drops of concentrated H₂SO₄ were added. The appearance of reddish-brown interface confirmed the presence of terpenoids (Behera *et al.*, 2024).

Test for phenolic compounds

About 1 ml of the filtrate of leaf extract was taken. Few drops of 5% Ferric chloride solution were added into the filtrate extract. The appearance of bluish black colour provides the positive result of the phenolic compounds (Dimri *et al.*, 2024).

Test for reducing sugar

About 1 ml of the filtrate of leaf extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept it in water bath for few minutes. The presence of red orange precipitate confirmed the positive result of the test for reducing sugar (Landge *et al.*, 2024).

Test for steroids

About 1 ml of the filtrate of leaf extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid was added into it. The appearance of upper red and lower yellow with green fluorescence provide the positive result for the presence of steroids (Tallur *et al.*, 2024).

Test for alkaloids

About 1 ml of the filtrate of leaf extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids (Acharya *et al.*, 2024).

Test for carbonyl compounds

About 1 ml of the filtrate of leaf extract was taken and added 3 to 4 drops of 2,4- Di-nitrophenylhydrazine reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds (Sreedevi *et al.*, 2024).

Results and discussion

The phytochemical analysis showed that in the aqueous extract of *Tephrosia purpurea*, flavonoids were detected, whereas tannin, phenolic compounds, and reducing sugar were present in the ethanol extract (Table 1). It was noticed that only tannin, phenolic compounds, and reducing sugar were observed in acetone extract (Table 1). The presence of tannin in the leaves of *Tephrosia purpurea* showed its antibacterial activities (Tong *et al.*, 2022), and the presence of flavonoids showed its potential to decrease the risk of hypertension (Panche *et al.*, 2016). The presence of phenolic compounds showed their antioxidant activities (Rahman *et al.*, 2021).

Table 1: Secondary metabolites in the leaves of *Tephrosia purpurea*

Secondary metabolites	Aqueous	Ethanol	Acetone
Tannin	Absent	Present	Present
Saponin	Absent	Absent	Absent
Flavonoids	Present	Absent	Absent
Terpenoids	Absent	Absent	Absent
Phenolic compounds	Absent	Present	Present
Reducing sugar	Absent	Present	Present
Steroids	Absent	Absent	Absent
Alkaloids	Absent	Absent	Absent

Conclusion

The present study concludes that leaves can be used as antibacterial agents and can be useful to reduce hypertension. The population of *Tephrosia purpurea* is good and can be extracted in a sustainable way as raw materials for the development of pharmaceuticals.

References

- Acharya, S., Das, K., Soni, P., Kaur, L., Jena, N., Kumar, S., & Ray, P. (2024). Primary and secondary metabolites of Kusum seeds. Zenodo. <https://doi.org/10.5281/zenodo.12792988>
- Agnihotry VK, Sharma SP, Agnihotri N and Saxena RC. (2011). Chemical constituents of *Tephrosia purpurea* family: Leguminosae. International Journal of Chemical Sciences. 9(3): 1045–1052.
- Akanksha B, Avijit M, Chakraborty GS and Seema G. (2014). Phytopharmacological uses of *Tephrosia purpurea*—A review. Pharmacophore. 5(4): 658–665.
- Alam S. (2004). Synthesis and studies of antimicrobial activity of Lanceolatin B. Acta Chimica Slovenica. 51(3): 447–452.
- Anbarasi A and Vidhya R. (2015). Evaluation of in vitro anti-inflammatory activity of *Tephrosia purpurea* (seed). Asian Journal of Pharmaceutical Research. 5(2): 83–89.
- Ankari AB, Mahendru N, Paniyappanayara V, Jena N, Kumar S and Tripathi G. (2024). Evaluation of medicinal values of a fern species [*Thelypteris parasitica* (L.) Tardieu] of India. Zenodo. <https://doi.org/10.5281/zenodo.12736039>.
- Arjun P, Vincent SGP and Kannan RR. (2016). HPLC-PDA isolation and LC-MS/MS detection of an acetylcholinesterase inhibitory flavonoid from *Tephrosia purpurea* (L.) Pers. in zebrafish brain. Indian Journal of Biochemistry and Biophysics. 53: 104–111.
- Arriaga AM, Maria da Conceicao F, da Silva MGR, de Lemos TL, da Silva FRL, Tavares LC and Braz-Filho R. (2014). *Tephrosia purpurea*: A source of Larvicidal compounds against *Aedes aegypti*. Chemistry of Natural Compounds. 50(6): 1125–1127.
- Babu N, Singh A and Singh R. (2017). A review on therapeutic potential and phytochemistry of *Tephrosia purpurea*. Bulletin of Pure & Applied Sciences-Botany, 2 91–104.
- Bathini R, Sathyanarayana K, Thadkala K, Devera R, Thadkapally R and Prasad K D. (2012). Studies on the anti-inflammatory and analgesic activity of the ethanolic fraction of the root extract of *Tephrosia purpurea* (Linn). International Journal of Pharmacy and Pharmaceutical Sciences. 4(1): 275278.
- Behera B, Ray P, Lyngdoh A, Singh B, Kumar S, Jena N and Shara BP. (2024). Phytochemical analysis and scientific validation of ethnomedicinal uses of

- Mucuna monosperma* Roxb. ex Wight: a medicinal climber of India. Biological Archives. APRF Publishers, India. 1: 78-88.
- Das L, Mishra S, Das A, Dimri R and Kumar S. (2022). Some common flora of temple city of Odisha, India: source for ethno-medico-cultural values. Indian Forester. 148(2): 207-212.
- Devi RS, Bihari SK and Kumar S. (2023). Validation of tribal claims for formulation of future drugs through evaluation of ethno-pharmacological values of *Ludwigia adscendens*. Medicinal Plants. 15(4): 691-697.
- Devi RS, Manjula BL, Mukherjee S, Watakhare DN, Satapathy KB and Kumar S. (2024c). Cytotoxicity Analysis of Selected Plants Using *Artemia salina*. Annals of Agri-Bio Research. 29(1): 45-49.
- Devi RS, Satapathy KB and Kumar S. (2024a). Loktak Lake of the state Manipur: A review to educate the intellectuals and awareness on its biowealth. Educational Administration: Theory and Practice, 30(5), 6936–6947. <https://doi.org/10.53555/kuey.v30i5.4064>
- Devi RS, Satapathy KB, Manjula BL, Sharma BP and Kumar S. (2024b). Evaluation of ethnopharmacological potential of *Oenanthe javanica* DC. Annals of Biology. 40(1): 135-139.
- Dimri R, Verma RK, Das A, Soni P, Jena N, Kumar S and Das K. (2024). Qualitative phytochemical analysis of *Pavetta indica* L. flowers: a medicinal plant of India. Plants & Secondary Metabolites. APRF Publishers, India. 1: 1-9.
- Kumar AD, Narayana TV, Vidyasagar, Mazumder UK and Gupta M. (2012). Exploration of diuretic potential and electrolyte excretion of *Tephrosia purpurea* (Fabaceae) in rats. Journal of Dietary Supplements. 9(1): 9–18.
- Landge MM, Basumatary M, Soni P, Tripathi G, Jena N and Sahu LM. (2024). Qualitative phytochemical analysis of *Schleichera oleosa* (Lour.) Oken fruits. Biological Archives. APRF Publishers, India. 1: 1-10.
- Marndi S, Barik M and Kumar S. (2024). Phytochemical and cytotoxicity analysis of *Eulophia explanata* Lindl. (Tuber extracts). African Journal of Biological Sciences. 6(4):2751-2756; DOI: 10.48047/AFJBS.6.Si4.2024.2751-2756.
- Panche AN, Diwan AD and Chandra SR. (2016). Flavonoids: an overview. Journal of Nutritional Science. 5:e47. DOI: 10.1017/jns.2016.41.
- Rahman MM, Rahaman MS, Islam MR, Rahman F, Mithi FM, Alqahtani T, Almikhlaifi MA, Alghamdi SQ, Alruwaili AS, Hossain MS, Ahmed M, Das R, Emran TB and Uddin MS. (2021). Role of Phenolic Compounds in Human Disease: Current Knowledge and Future Prospects. Molecules. 27(1):233. DOI: 10.3390/molecules27010233.

- Rao AS, Yadav SS, Singh P, Nandal A, Singh N, Ganaie SA, Yadav N, Kumar R, Bhandoria MS and Bansal P. (2020). A comprehensive review on ethnomedicine, phytochemistry, pharmacology, and toxicity of *Tephrosia purpurea* (L.) Pers. *Phytotherapy Research*. 34(8): 1902–1925.
- Saxena HO and Brahman M. (1994). The flora of Orissa. Regional Research Laboratory, Bhubaneswar and Orissa Forest Development Corporation Ltd., Bhubaneswar, Orissa, India. Volume 1; pp 600-601.
- Soni P, Mahendru N, Dimri R, Hamdy R, Jena N and Kumar S. (2024). Qualitative phytochemical analysis of *Cascabela thevetia* fruits. *Biological Archives*. APRF Publishers, India. 1: 29-37.
- Sreedevi A, Gurjar ES, Abidi A, Sharma BP, Jena N and Kumar S. (2024). Qualitative phytochemical analysis of *Artabotrys hexapetalus* (L.f.) Bhandari fruits: a medicinal tree of India. *Medico Biowealth of India*. APRF Publishers. 16: 37-46.
- Tallur PN, Verma RK, Limaye P, Jena N and Kumar S. (2024). Qualitative phytochemical analysis of fruits of *Suregada multiflora* (A. Juss.) Baill.: a medicinal tree of India. *Medico Biowealth of India*. APRF Publishers, India. 16: 28-36.
- Tong Z, He W, Fan X and Guo A. (2022). Biological Function of Plant Tannin and Its Application in Animal Health. *Front Vet Sci*. 8:803657. DOI: 10.3389/fvets.2021.803657.