Chapter 5

QUALITATIVE PHYTOCHEMICAL ANALYSIS OF INDIAN CHARCOAL-TREE

DEEPTHI VALIGATLA[1], SK SAHANAWAZ ALAM[2], RANJAN SHAW[3], NIBEDITA JENA[4] AND SANJEET KUMAR[4*]

[1]Dravyaguna Vijnana, Better Life Ayurvedic Hospital, Madanapalli, Andhra Pradesh, India

[2]Department of Botany, Garhbeta College, Garhbeta, Paschim Medinipur, West Bengal, India

[3]Department of Botany, DODL, University of Kalyani, Nadia, West Bengal, India

[4]Ambika Prasad Research Foundation, Cuttack, Odisha, India

*Email-Id: sanjeetaprf@gmail.com

Abstract: The qualitative phytochemical screening of *Trema orientale* (L.) Blume (Indian Charcoal-Tree) was carried out using aqueous extract of different plant parts (leaves, stem, and fruits). The results showed diverse secondary metabolites like tannin, flavonoids, phenolic compounds, reducing sugar, alkaloids etc. in all the three parts while the saponin is present in both leaves and stem but absent in fruit extract. This result gives base line data for future advanced experimental works in pharmacological aspects.

Key words: Phytochemical screening, secondary metabolites, future pharmaceuticals

INTRODUCTION

Trees are of invaluable significance to our environment and to human well-being from which we get air to breathe, food, shelter and ultimately water to drink to live (Elmendorf 2008). The plants function important role in enhancing our quality of life by providing all these essentials. They are also an important source of medicines (Salmond et al. 2016; Das et al. 2022). Since years ago, especially the rural and tribal people completely depend upon the natural forests regarding the food and traditional therapeutic purposes for their health problems because of its easy availability, free of cost and less side effects (Kumar et al. 2021). Gradually the increasing population and urbanisation demand large-scale drug production which

make this culture of using natural resources reduced and drive towards the synthetic pharmaceutical products for health treatments (Behera et al. 2024).



Figure 1: Whole plant of *T. orientale*

As a result, serious environmental implications like biodiversity loss, development of drug-resistant bacteria, large-scale carbon emission, water, and soil pollution (Gruffydd 1973), are arising day by day and affect everyone (Nilsson et al. 2011). Medicinal plants and their folklore uses are best options to combat these negative impacts to the environment (Dimri et al. 2024). Because, the secondary metabolites of plants having defence mechanisms against predation by many microorganisms, insects, herbivores, and other factors (Wolf et al. 2020). With these objectives, an attempt has been made to find out the phytoconstituents present in different plant parts of *Trema orientale* (Figure 1) commonly known as Indian Charcoal-tree using aqueous extract through phytochemical screening, which are responsible for its medicinal activities. Qualitative phytochemical analysis confirmed the presence of various secondary metabolites. The results suggest that the phytochemical properties for curing various ailments and possess potential antioxidant, anti-inflammatory and leads to the isolation of novel compounds.

MORPHOLOGY

T. orientale may grow up to 10-12 m with dense silky branchlets (Figure 1). The bark is smooth and white or pale coloured. The leaves are oblong, ovate-lanceolate, 2-15× 1.8-5.8 cm, acuminate (Figure 2). The male cymes are usually densed about 7.8 to 18 mm long. The tepals are narrow and concave (Figure 3). Female cymes about as long as the males but laxer. The fruits are drupe and globose (Figure 5) (Saxena and Brahmin 1995).



Figure 2: Dorsal side of *T. orientale* leaves with fruits



Figure 3: Ventral side of leaves and inflorescence of *T. orientale*

METHODOLOGY

The leaves, stem, and fruits of *T. orientale* were collected from the roadsides of Mahanadi River area, in Cuttack district of Odisha (Figure 4). The plant was identified by the correspondence author. An herbarium specimen (APRFH-95) is deposited to the Herbarium Unit, Ambika Prasad Research Foundation, Odisha (Figure 6). The Soxhlet method of extraction was adopted for the phytochemical screening of bioactive compounds (Sharma et al. 2024). Detection of nine secondary metabolites were carried out using standard methods (Misra et al. 2012; Kumar et al. 2017; Devi et al. 2023; Plate 1).



Figure 4: Collection of plant parts for phytochemical screening from Cuttack



Figure 5: Fruits of *T. orientale*

Qualitative phytochemical analysis

Test for tannin

1 ml of the filtrate of extract was taken. About 3-5 drops of 10% lead acetate solution was added into it. The gelatinous precipitate formation confirmed the presence of tannins.

Test for saponin

1 ml of the filtrate extract was taken. About 1 ml of distilled water was added into it and allowed to shake well. The persistent froth formation after shaking confirmed the presence of saponin.

Test for flavonoids

1 ml of the filtrate extract was taken and added 2 ml of NaOH solution and 3 drops of dilute HCL. The colour initially turned to an intense yellow colour with NaOH solution and later become colourless. This colour change confirmed the presence of flavonoids.

Test for terpenoids

1 ml of the filtrate extract was added with 6 drops of chloroform and placed it in water bath for few minutes. Added 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the presence of terpenoids.

Test for phenolic groups

1 ml of the filtrate extract was taken. Few drops of 5% Ferric chloride solution were added into it. The bluish black colour formation confirmed the presence of phenolic compounds.

Test for reducing sugars

1 ml of the filtrate extract was taken and added 2 drops of Fehling's solution A followed by Fehling's solution B. The test tube was kept in water bath for some time. The formation of red orange precipitate confirmed the presence of reducing sugars.

Test for steroids

1 ml of the filtrate extract was taken. 1 ml chloroform and 1 ml sulphuric acid were added into it. The appearance of upper red and lower yellow with green fluorescence confirmed the presence of steroids.

Test for alkaloids

1 ml of the filtrate extract was taken. Few drops of Dragendroff's reagent were added into it. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds

1 ml of the filtrate extract was taken. Added 3 to 4 drops of 2,4-Dinitrophenylhydrazine reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

RESULTS AND DISCUSSION

The phytochemical analysis of *T. orientale* revealed that tannin, flavonoids, phenolic compounds, reducing sugars and alkaloids are present in the aqueous extract of all the three plant parts (leaves, stem, and fruits; Plate 1; Table 1). It was also noticed that saponin is present in the aqueous extract of leaves and stem but absent in the fruit extract. *T. orientale* are widely used in traditional medicine system against several health problems such as cough (Katende et al. 1995), fever, pneumonia,

and skin infections (Adinortey et al. 2013). More information on ethnomedicinal uses are discussed in the following.

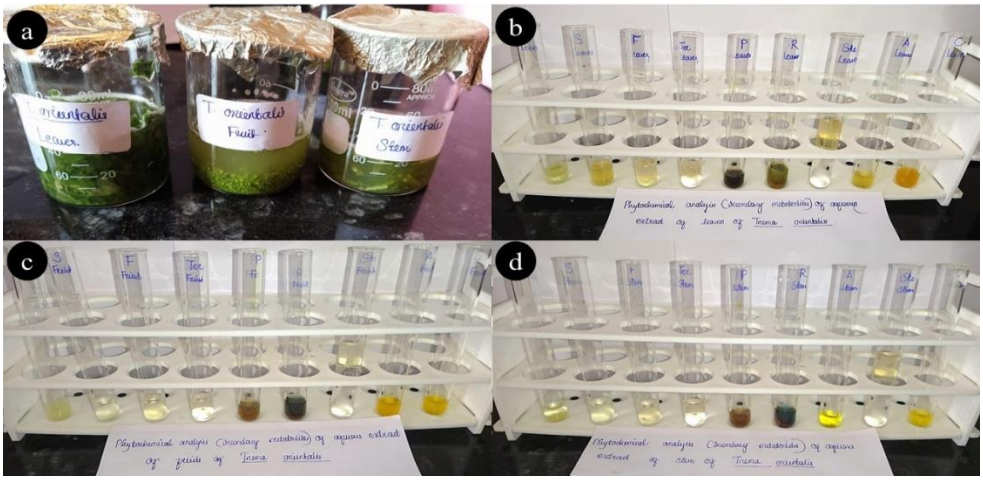


Plate 1: Screening of secondary metabolites using the (a) aqueous extracts of different plant parts; (b) leaves, (c) fruits and (d) stem of *T. orientale*

Table 1: Phytochemical analysis in aqueous extracts of leaves, fruits, and stem of *T. orientale*

Phytochemicals	**Leaves**	**Fruits**	**Stem**
Tannin	+ve	+ve	+ve
Saponin	+ve	-ve	+ve
Flavonoids	+ve	+ve	+ve
Terpenoids	-ve	-ve	-ve
Phenolic compounds	+ve	+ve	+ve
Reducing sugars	+ve	+ve	+ve
Steroids	-ve	-ve	-ve
Alkaloids	+ve	+ve	+ve
Carbonyl compounds	-ve	-ve	-ve

(-ve: negative; +ve: positive)

ETHNOMEDICINAL USES

The different plant parts of *T. orientale* including leaves, stem, bark, fruits, and seeds have been used in traditional medicine system worldwide since long years ago (Adinortey et al. 2013). The maceration of *T. orientale* leaves in lemon juice is a useful remedy for cough (Katende et al. 1995). The decoction of leaves is used as an anti-helminthic medicine against roundworms and hookworms.

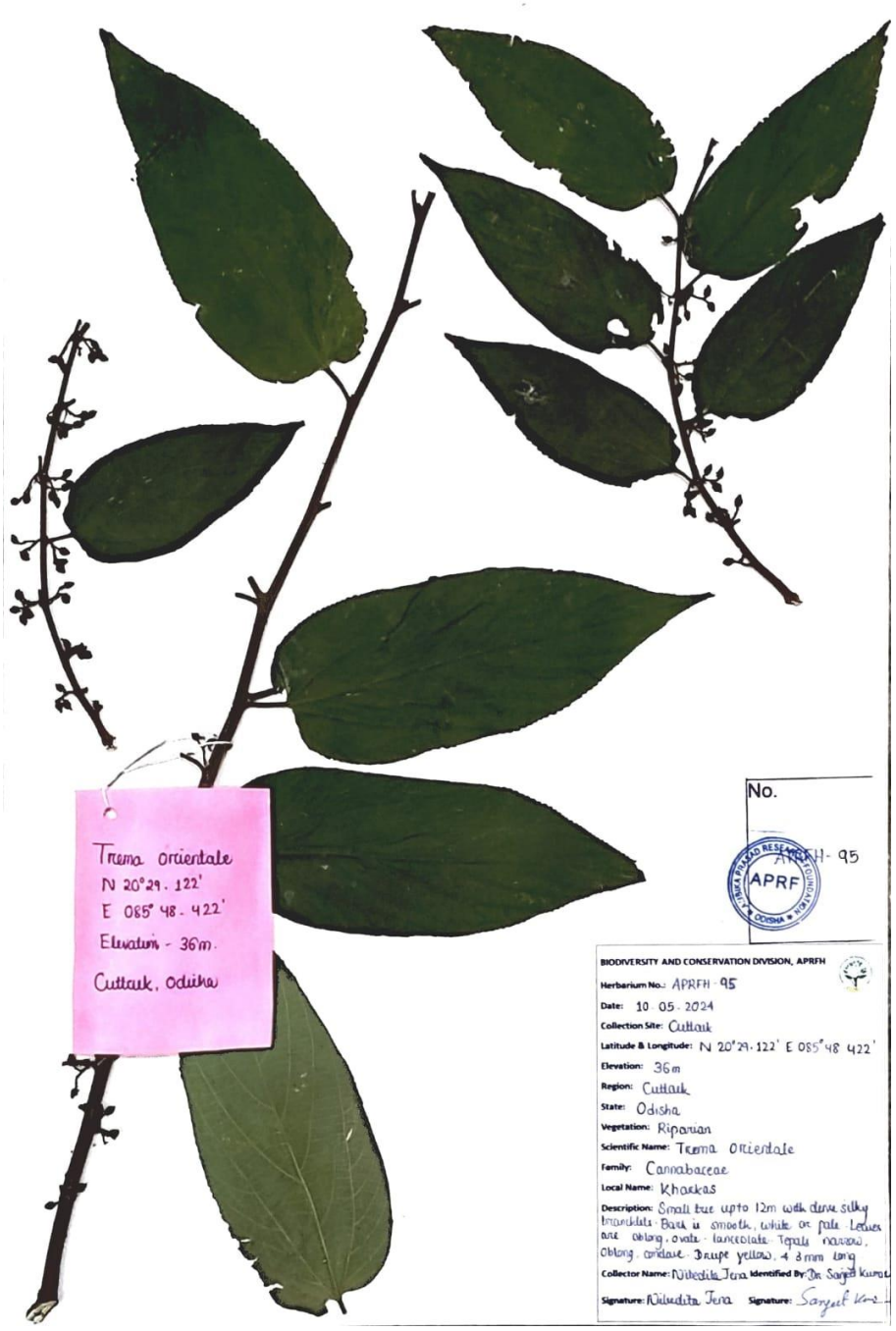


Figure 6: Herbarium specimen of *T. orientale*

The infusion of fruits and flowers of *T. orientale* is introduced to children for the treatment of pneumonia. The twigs and stems infusion are useful against fever (Adinortey et al. 2013). Above reports indicate that there is lack of pharmacological works on *T. orientale.*

CONCLUSION

The different plant parts of *T. orientale* are a rich source of secondary metabolites, which have several advantageous medicinal applications. The results of the trial and research suggest that it may be a valuable herbal treatment for a variety of illnesses. The specific elements causing these biological processes must be identified through additional research; the findings may be helpful for the sustainable use of human well-being.

REFERENCES

Adinortey MB, Galyuon IK and Asamoah NO. (2013). *Trema orientalis* Linn. Blume: a potential for prospecting for drugs for various uses. Pharmacognosy Review. 7(13): 67-72.

Behera B, Karthik K, Marndi S and Kumar S. (2024). Varuna (*Crateva religiosa* G. Forst.): a medicinal tree of India. In: Ethnopharmacology, Volume 1, APRF Publishers, India. DOI: https://doi.org/10.5281/zenodo.11181889.

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.

Dimri R, Sinha MK, Moharana A, Ofoeze MA and Kumar S. (2024). Wild Nutraceutical Plants. APRF Publishers, India. pp 1-69. DOI: https://doi.org/10.5281/zenodo.10574104.

Elmendorf W. (2008). The importance of trees and nature in community: a review of the relative literature. Arboriculture & Urban Forestry. 34(3): 152-156.

Gruffydd J ST B. (1973). The importance of trees. Journal of the Royal Society of Arts. 122(5209): 15-30.

Katende AB, Birnie A and Tengnas B. (1995). Useful trees and shrubs for Uganda. Identification, propagation and Management for agricultural and pastoral communities. Regional Soil Conservation Unit (RSCU). 10: 1-25.

Kumar S, Mahanti P, Singh NR, Rath SK, Jena PK. and Patra JK. (2017). Antioxidant activity, antibacterial potential and characterization of active fraction of *Dioscorea pentaphylla* L. tuber extract collected from Similipal Biosphere Reserve, Odisha, India. Brazilian Journal of Pharmaceutical Sciences. DOI: 10.1590/s2175-97902017000417006.

Kumar SN, Mishra S and Kumar S. (2021). Documentation of Indigenous Traditional Knowledge (ITK) on Commonly Available Plants in Koira Range, Bonai Forest Division, Sundargarh, Odisha, India. Asian Plant Research Journal. 8(4): 83-95.

Misra RC, Kumar S, Pani DR and Bhandari DC. (2012). Empirical tribal claims and correlation with bioactive compounds: a study on *Celastrus paniculata* Willd., a vulnerable medicinal plant of Odisha. Indian Journal of Traditional Knowledge. 11(4): 615-622.

Nilsson K, Sangster M and Konijnendijk CC. (2011). Forests, trees and human health and well-being. Springer, Dordrecht. DOI: https://doi.org/10.1007/978-90-481-9806-1_1.

Salmond JA, Tadaki M, Vardoulakis S, Arbuthnott K, Coutts A, Demuzere M, Dirks KN, Heaviside C, Lim S, Macintyre H, Mclnnes RN and Wheeler BW. (2016). Heath and climate related ecosystem services provided by street trees in the urban environment. Environment Health. 15(S36): 96-111.

Saxena HO and Brahmam M. (1995). Th Flora of Orissa. Regional Research Laboratory, Bhubaneswar & Orissa Forest Development Corporation Ltd. Bhubaneswar. III:1696-1697.

Sharma BP, Jena N and Kumar S. (2024). Medicinal values and phytochemical screening of Torchwood (*Lepisanthes tetraphylla* Radlk.) fruits. Medico Bio-wealth of India. 15: 36-43. DOI: https://doi.org/10.5281/zenodo.11127628.

Wolf KL, Lam ST, Mckeen JK, Richardson GRA, Bosch M and Bardekjian AC. (2020). Urban trees and human heath: a scoping review. International Journal of Environmental Research and Public Health. 17(12). DOI: https://doi.org/10.3390/ijerph17124371.