

Chapter 4

Phytochemical analysis of leaves, stem and root of Punarnava (*Boerhavia diffusa* L.): a medicinal herb of Nyctaginaceae

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Abstract: *Boerhavia diffusa* (Nyctaginaceae) is a medicinal herb traditionally used for various ailments. Present study aimed to investigate the phytochemical composition of different plant parts (leaves, stem, and root) of *B. diffusa* using hydroethanolic extraction. Qualitative phytochemical analysis revealed the presence of various bioactive compounds, including saponins, flavonoids, terpenoids, phenolic compounds, reducing sugars, steroids, alkaloids, and carbonyl compounds. The study found variations in the presence and absence of bioactive compounds across different plant parts. The findings validate the traditional use of *B. diffusa* in medicine and highlight its potential for the development of new drugs.

Keywords: Bioactive compounds, medicinal uses, punarnava

INTRODUCTION

Boerhavia diffusa, commonly known as Punarnava, is a perennial herb belonging to the family Nyctaginaceae (Gour, 2021). *B. diffusa* has been used in traditional medicine for its therapeutic properties, including anti-inflammatory, antioxidant, and diuretic activities (Das et al., 2023). The plant is mentioned in ancient Indian medical texts for curing many health problems (Kaur et al., 2020). In addition, *B. diffusa* has been traditionally used as

ethnomedicinal agent (Bhowmik *et al.*, 2012). Despite its traditional use, there is a need for scientific validation of the phytochemical composition and pharmacological properties of *B. diffusa*. This study aimed to investigate the phytochemical composition of different plant parts (leaves, stem, and root) of *B. diffusa* using hydroethanolic extraction.

MATERIALS AND METHODS

The different parts (Leaves, stem and root) of *B. diffusa* were collected from the nearby Mahanadi area, Cuttack district of Odisha, India (Jena *et al.*, 2025). The plant species was identified by the authors (Figure 1). The Soxhlet extraction method was adopted using hydroethanolic aqueous solvent for phytochemical analysis (Devi *et al.*, 2024; Rani *et al.*, 2024; Marndi *et al.*, 2024). Detection of nine secondary metabolites were conducted using standard methods (Sharma *et al.*, 2024).

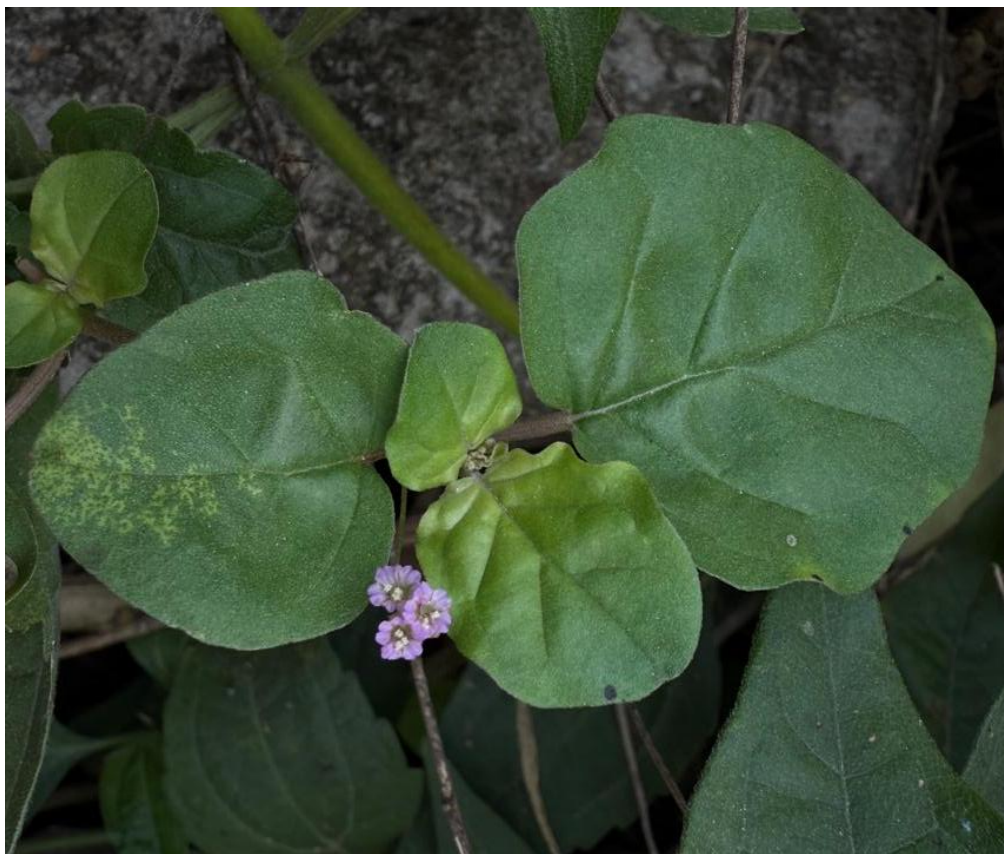


Figure 1: Leaves and flowers of *Boerhavia diffusa*

Test for tannin: About 1 ml of the filtrate extract was taken and 3-5 drops of 10% lead acetate solution was added to it. The gelatinous precipitate formation confirmed the presence of tannin.

Test for saponin: About 1 ml of the filtrate extract was added to 1 ml of distilled water and shaken well. The formation of persistent froth was observed confirming the presence of saponin.

Test for flavonoids: About 1 ml of the extract was taken. Two ml of 2% NaOH solution and 3 to 4 drops of dilute HCl was added to it. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless. This colour change appearance confirmed the presence of flavonoids.

Test for terpenoids: Six drops of chloroform was added to 1 ml of the filtrate and placed in the water bath for a few minutes. Then 6 drops of concentrated sulphuric acid was added. The reddish- brown interface confirmed the presence of terpenoids ([Sreedevi et al., 2024](#)).

Test for phenolic groups: About 1 ml of the filtrate extract was taken. A few drops of 5% ferric chloride solution was added. The dark bluish-black appearance confirmed the presence of phenolic compounds.

Test for reducing sugars: About 1 ml of the extract was taken and 2 drops of Fehling's solution A followed by fehling's solution B were added and kept in the water bath for some time. The presence of red-orange precipitate confirmed the presence of reducing sugar ([Topno et al., 2024](#)).

Test for steroids: About 1 ml of the extract was taken. One ml of chloroform and one ml of concentrated sulphuric acid was added. The appearance of upper red and lower yellow with green fluorescence provides the presence of steroids.

Test for alkaloids: To about 1 ml of the extract, 3 to 4 drops of Dragendroff's reagent was added. The formation of a reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds: About 1 ml of the filtrate extract was taken and added 3 to 4 drops of 2,4- Dinitrophenylhydrazine (DNPH) reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds ([Jena et al., 2024](#)).

RESULTS AND DISCUSSION

The qualitative phytochemical analysis of the hydroethanolic extracts of different plant parts of *B. diffusa* revealed the presence of various bioactive compounds. The results are presented in Table 1. The results of the phytochemical analysis revealed that the leaves, stem, and root of *B. diffusa* contain a variety of bioactive compounds (Figures 2-4). Saponins, terpenoids, phenolic compounds, reducing sugars, and alkaloids were detected in the leaves and stem, while flavonoids were detected only in the root. The presence of these bioactive compounds may contribute to the medicinal properties of *B. diffusa*, including its anti-inflammatory, antioxidant, and diuretic activities. The variation in the presence and absence of bioactive compounds across different plant parts suggests that the plant may have different medicinal properties depending on the part used. The results of this study support the traditional use of *B. diffusa* in medicine and highlight its potential for the development of new drugs. Further studies are needed to isolate and characterize the bioactive compounds present in the plant and to evaluate their pharmacological properties.

Table 1: Qualitative phytochemical screening of different plant parts of *Boerhavia diffusa* using hydroethanolic extract

Bioactive components	Plant parts		
	Leaves	Flower	Root
Tannin	Absent	Present	Absent
Saponin	Present	Present	Present
Flavonoids	Absent	Absent	Present
Terpenoids	Present	Present	Absent
Phenolic compounds	Present	Present	Absent
Reducing sugar	Present	Present	Absent
Steroids	Absent	Absent	Absent
Alkaloids	Present	Present	Present
Carbonyl compounds	Absent	Absent	Absent



Figure 2: Detection of secondary metabolites of *B. diffusa* leaves



Figure 3: Detection of secondary metabolites of *B. diffusa* stem



Figure 4: Detection of secondary metabolites of *B. diffusa* root

CONCLUSION

Present study investigated the phytochemical composition of different plant parts of *Boerhavia diffusa* using hydroethanolic extraction. The qualitative phytochemical analysis revealed a diverse range of bioactive compounds, including saponins, flavonoids, terpenoids, phenolic compounds, reducing sugars, and alkaloids. The findings demonstrate the potential of *B. diffusa* as a rich source of bioactive compounds with medicinal properties. The variation in bioactive compounds across different plant parts suggests part-specific medicinal properties. This study validates the traditional use of *B. diffusa* in medicine and highlights its potential for developing new drugs. Further research is needed to isolate, characterize, and evaluate the pharmacological properties of the bioactive compounds present in the plant. This study contributes to the existing knowledge on the phytochemical composition of *B. diffusa*, providing a foundation for further research on its medicinal properties.

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