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Phytochemical composition and antioxidant potential of leaves of *Butea parviflora* Roxb. ex DC. (Fabaceae): A fodder plant of Asian elephants

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ABSTRACT

Background: *Butea parviflora* is a leguminous plant and leaves are the fodder of many herbivorous wildlife including Asian Elephants. However, information on its phytochemical composition and antioxidant properties is limited. The present study evaluated the primary and secondary metabolites along with antioxidant potential of *B. parviflora* leaves.

Methods: Leaf extracts were prepared using distilled water, ethanol and *n*-hexane solvents. Extracts were subjected to qualitative phytochemical screening for selected primary and secondary metabolites. Quantitative analysis was performed for tannins, saponins, total phenols and total flavonoids. Antioxidant activity of aqueous and ethanol extracts was evaluated using the DPPH radical-scavenging assay.

Results: Aqueous and ethanol extracts showed proteins and carbohydrates. Both aqueous and ethanol extracts tested positive for tannins, saponins, flavonoids and reducing sugars. Quantitative analysis recorded tannins at 90.05 mg/100 mL, saponins at 4.80%, total phenols at 8.07 mg/100 mL and total flavonoids at 0.24 mg/mL. DPPH inhibition increased progressively with extract concentration. At 1.0 mg/mL, ethanol and aqueous extracts showed 51.48% and 50.90% inhibition, respectively.

Significance: The findings demonstrated that *B. parviflora* leaves contain several phytochemicals and exhibit measurable concentration-dependent DPPH radical-scavenging activity. Therefore, it is good to be a nutraceutical fodder for wildlife.

Keywords: Fodder plants, Leaves, Nutraceuticals, Wildlife

Introduction

Plants constitute important biological resources for wildlife, livestock and human communities, providing essential nutrients and a wide range of biologically active compounds (Mbuni *et al.*, 2020; Chen *et al.*, 2024) [2, 1]. Among different plant parts, leaves are an important food resource for herbivorous animals, supplying carbohydrates, proteins, minerals and other nutrients (Lee, 2018; Anoop *et al.*, 2023) [4, 3]. The Asian elephant (*Elephas maximus*) depends extensively on diverse plant species and their foliage for sustenance (Behera *et al.*, 2020; Sharma *et al.*, 2025; Dhamdhare *et al.*, 2026; Mishra *et al.*, 2026) [5, 6, 7, 8]. Therefore, understanding the nutritional quality and biochemical composition of plants utilized as fodder is important for assessing their dietary significance (Capstaff *et al.*, 2018; Navale *et al.*, 2022) [9, 10]. In addition to primary nutrients, leaves contain secondary metabolites which may possess biological activities and make them nutraceutical foods (Shad *et al.*, 2014; Yeshe *et al.*, 2022; Roy *et al.*, 2022; Riaz *et al.*, 2023) [12, 13, 14, 11]. Evaluation of these constituents can consequently provide useful information on the nutritional and nutraceutical value of wildlife fodder plants. In this context, the genus *Butea*, belonging to the family Fabaceae, is of particular interest because its members are woody plants widely distributed in tropical and subtropical regions of Asia (Tandon *et al.*, 2003) [15]. Within this genus, *Butea parviflora* is associated with herbivorous wildlife, and its leaves have been reported as a fodder resource of the Asian elephant (Dhamdhare *et al.*, 2026) [7]. Based on this ecological relevance, *B. parviflora* was selected for the present investigation to evaluate the biochemical characteristics of its leaves. Such evaluation is particularly relevant because the nutritional and phytochemical composition of foliage may influence its value as a natural food resource for herbivorous wildlife. Therefore, the present study was undertaken to assess the nutritional and phytochemical composition of *Butea parviflora* leaves. Nutritional analysis was carried out to determine major constituents contributing to their dietary value, while qualitative phytochemical screening was performed to identify important groups of primary and secondary metabolites. The findings are expected to provide baseline information on the nutritional and nutraceutical characteristics of the leaves and contribute to a bet

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ter understanding of the importance of evaluating wildlife fodder plants for dietary assessment, habitat management and wildlife conservation.

Materials and Methods

To address this objective, leaves of *B. parviflora* were collected from the Mahanadi River areas of Cuttack, Odisha (Figure 2). Leaf extracts were prepared using aqueous, ethanol and *n*-hexane solvents through

a Soxhlet apparatus and subjected to qualitative phytochemical screening (Jena *et al.*, 2025; Rani *et al.*, 2025) [16, 17]. Primary metabolites examined included proteins, carbohydrates, starch, sucrose, lipids and amino acids, while secondary or bioactive compound groups assessed included tannins, saponins, flavonoids, terpenoids, phenolic groups, reducing sugars, steroids and alkaloids (Marndi *et al.*, 2024) [18]. Based on the qualitative screening, selected secondary metabolites were subsequently quantified in the leaves (Kumari *et al.*, 2026) [19]. Finally, the aqueous and ethanol extracts were evaluated for antioxidant activity using the DPPH radical-scavenging assay (Soni *et al.*, 2026) [20].



Figure 1. Leaves of *B. parviflora*

Results and Discussion

The qualitative screening revealed that the aqueous and ethanol extracts contained proteins and carbohydrates (Table 1). Starch, sucrose, lipids and amino acids were not detected in either of these extracts.

The *n*-hexane extract was negative for all six tested primary metabolites (Table 1).

Table 1. Qualitative phytochemical analysis of primary metabolites of *B. parviflora* leaves

Primary metabolites	Aqueous extract	Ethanol extract	<i>n</i> -Hexane extract
Protein	+	+	-
Carbohydrates	+	+	-
Starch	-	-	-
Sucrose	-	-	-
Lipid	-	-	-
Amino acid	-	-	-

(-: Not detected; +: Detected)

The findings indicate that the detectable primary metabolites were associated mainly with the aqueous and ethanol fractions. Four bioactive groups (tannins, saponins, flavonoids and reducing sugars) were detected in both aqueous and ethanol extracts. Terpenoids, phenolic groups, steroids and alkaloids were not detected in either extract. All tested secondary metabolite groups were negative in the *n*-hexane extract (Table 2).

Table 2. Qualitative phytochemical analysis of secondary metabolites of *B. parviflora* leaves

Bioactive compounds	Aqueous extract	Ethanol extract	<i>n</i> -Hexane extract
Tannin	+	+	-
Saponin	+	+	-
Flavonoid	+	+	-
Terpenoid	-	-	-
Phenolic Group	-	-	-
Reducing sugar	+	+	-
Steroids	-	-	-
Alkaloids	-	-	-

(-: Not detected; +: Detected)

(continued on next page)

Thus, the qualitative profile indicates that aqueous and ethanol solvents were more effective than *n*-hexane in extracting the phytochemical groups detected by the applied screening methods. Quantitative analysis showed that tannins were present at 90.05 mg/100 mL, while saponins were recorded at 4.80%. Total phenols were measured at 8.07 mg/100 mL, and total flavonoids at 0.24 mg/mL (Table 3).

Among the results, tannins showed the highest numerical value within their respective reported units. However, because tannins, saponins, total phenols and total flavonoids were expressed in different units, their numerical values should not be directly compared as indicators of absolute abundance. The detection of these phytochemical constituents, particularly phenolic and flavonoid compounds, provided a basis for further evaluating the antioxidant potential of the aqueous and ethanol extracts. Both extracts demonstrated DPPH radical-scavenging activity at all tested concentrations. In the ethanol extract, inhibition increased progressively from 43.42% at 0.0625 mg/mL to 51.48% at 1.0 mg/mL, while in the aqueous extract, inhibition increased from 44.07% to 50.90% over the same concentration range (Table 4; Figure 3).

Table 3. Quantitative phytochemical analysis of *B. parviflora* leaves

Secondary metabolites	Quantity
Tannin	90.05 mg/ 100 mL
Saponin	4.80 %
Total Phenol	8.07 mg/100 mL
Total Flavonoids	0.24 mg/mL

The ethanol extract showed a slightly higher inhibition than the aqueous extract at every tested concentration except the lower concentration range where the aqueous extract also demonstrated comparable activity. At the highest concentration, the ethanol extract produced 51.48% inhibition compared with 50.90% for the aqueous extract, a difference of only 0.58 percentage points (Table 4; Figure 3).

Table 4. Antioxidant assay (DPPH) of *B. parviflora* leaves

Extract	Concentration (mg/mL)	Inhibition Percentage (%)
Ethanol	0.0625	43.42
	0.125	44.90
	0.25	46.62
	0.5	48.93
	1.0	51.48
Aqueous	0.0625	44.07
	0.125	45.88
	0.25	47.94
	0.5	49.34
	1.0	50.90

Conclusion

The present study demonstrates that the leaves of *Butea parviflora* contain important primary and secondary metabolites and exhibit concentration-dependent DPPH radical-scavenging activity. Together, these findings provide baseline information on the biochemical and antioxidant characteristics of a foliage resource reported as fodder for Asian elephants and other herbivorous wildlife. However, the results alone do not establish the overall dietary or nutraceutical value of the plant. Rather, they highlight the importance of scientifically evaluating the nutritional and phytochemical properties of wildlife fodder plants to better understand the quality of their available food resources. In this context, similar investigations involving other important fodder species can generate valuable information on their nutritional and biochemical characteristics and may contribute to evidence-based habitat management, fodder-plant conservation and long-term wildlife conservation planning.



Figure 2. Collection of plant parts for experimental works

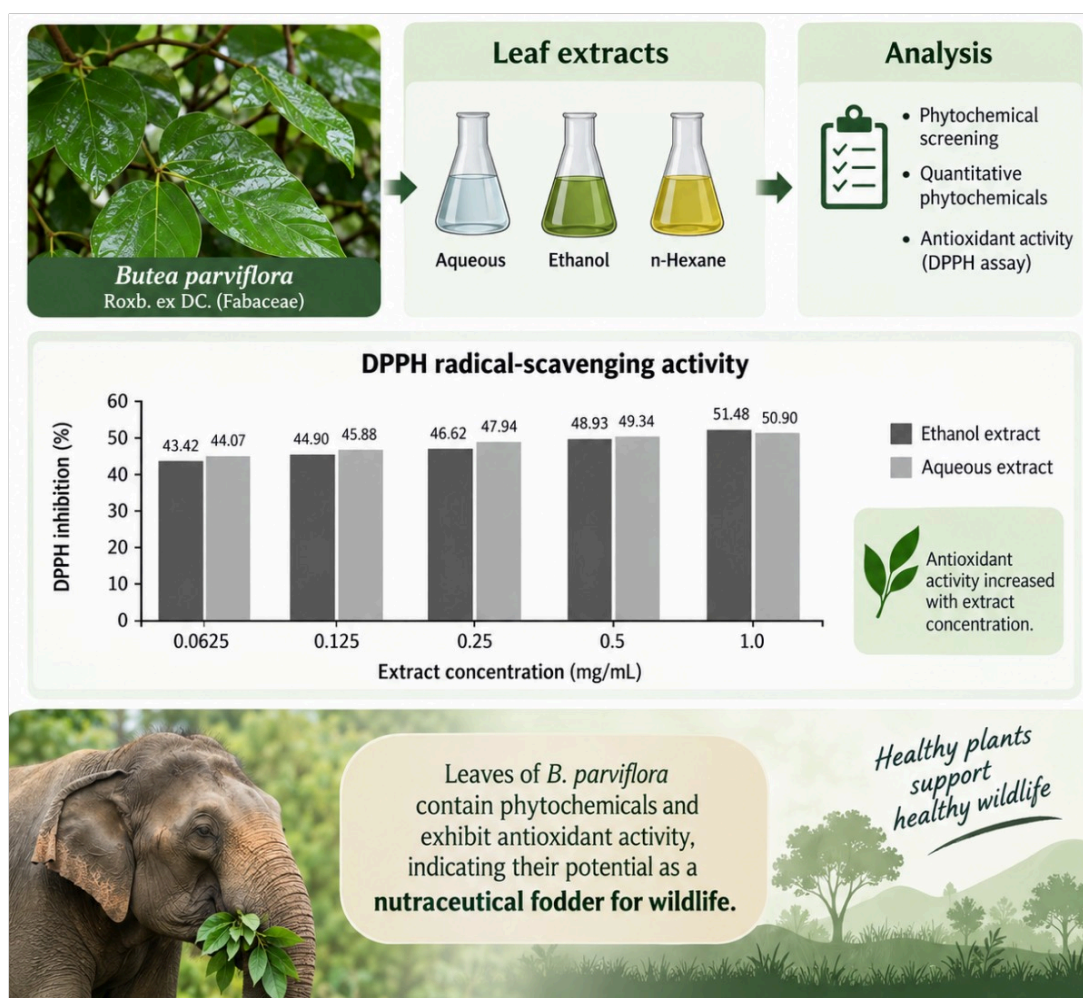


Figure 3. Infographic of the phytochemical and antioxidant potential of *Butea parviflora* leaves

References

- Chen X, Hein PP, Shi M, Yang F, Yang J, Fu Y, Yang X. Diversity and traditional knowledge concerning fodder plants are invaluable assets for enhancing the sustainable management of crop-livestock system of Zhaotong City in the mountainous southwest China. *Plant diversity*. 2024;47(2):311–322.
- Mbuni YM, Wang S, Mwangi BN, Mbari NJ, Musili PM, Walter NO, Hu G, Zhou Y, Wang Q. Medicinal Plants and Their Traditional Uses in Local Communities around Cherangani Hills, Western Kenya. *Plants (Basel, Switzerland)*. 2020;9(3):331.
- Anoop AA, Pillai PKS, Nickerson M, Ragavan KV. Plant leaf proteins for food applications: Opportunities and challenges. *Comprehensive Reviews in food science and food safety*. 2023;22(1):473–501.
- Lee MA. A global comparison of the nutritive values of forage plants grown in contrasting environments. *Journal of plant research*. 2018;131(4):641–654.
- Behera F, Devi RS, Sanghamitra A, Kumar S. Food plants assessment of Asian elephant (*Elephas maximus* Linnaeus, 1758) in Dhenkanal district of Odisha, India: Tools for mitigation of Human-Elephant conflict. *NeBio*. 2020;11(2):117–124.
- Sharma BP, Kumar NA, Kumar N, Kumar S. Elephant, Forest, Human-elephant Conflicts and Fodder Plants: An Ecological View. *Indian Forester*. 2025;151(10):1012–1018.
- Dhamdhare DH, Ramasamy P, Kumar S. Fodder Plants of Asian Elephants in Keonjhar Forest Division, Odisha. Keonjhar Forest Division, Odisha and Ambika Prasad Research Foundation, Odisha, India; 2026.
- Mishra AK, Kumar S. Preferred fodder plants of Asian Elephant (*Elephas maximus*). *Journal of Biodiversity and Conservation*. 2026;10(3):12–19.
- Capstaff NM, Miller AJ. Improving the Yield and Nutritional Quality of Forage Crops. *Frontiers in plant science*. 2018;9:535.
- Navale MR, Bhardwaj DR, Bishist R, Thakur CL, Sharma S, Sharma P, Kumar D, Probo M. Seasonal variations in the nutritive value of fifteen multipurpose fodder tree species: A case study of north-western Himalayan mid-hills. *PloS one*. 2022;17(10):e0276689.
- Riaz M, Khalid R, Afzal M, Anjum F, Fatima H, Zia S, Rasool G, Egbuna C, Mteawa AG, Uche CZ, Aslam MA. Phytobioactive compounds as therapeutic agents for human diseases: A review. *Food science & nutrition*. 2023;11(6):2500–2529.
- Shad AA, Ahmad S, Ullah R, AbdEl-Salam NM, Fouad H, Ur Rehman N, Hussain H, Saeed W. Phytochemical and biological activities of four wild medicinal plants. *TheScientificWorldJournal*. 2014;2014:857363.
- Yeshe K, Crayn D, Ritmejeriyè E, Wangchuk P. Plant Secondary Metabolites Produced in Response to Abiotic Stresses Has Potential Application in Pharmaceutical Product Development. *Molecules (Basel, Switzerland)*. 2022;27(1):313.
- Roy A, Khan A, Ahmad I, Alghamdi S, Rajab BS, Babalghith AO, Alshahrani MY, Islam S, Islam MR. Flavonoids a Bioactive Compound from Medicinal Plants and Its Therapeutic Applications. *BioMed research international*. 2022;2022:5445291.
- Tandon R, Shivanna KR, Mohan Ram HY. Reproductive biology of *Butea monosperma* (Fabaceae). *Annals of botany*. 2003;92(5):715–723.
- Jena N, Vimala VC, Singh B, Patra A, Sharma BP, Hossain E, Kumar S. Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 2025;9(2):87–107.

17. Rani JJ, Das K, Sahu JK, Thakur S, Sharma S, Kumar S. Pharmacological Evaluation and Prediction of Pharmaceutical Potential of *Lasiococca comberi* Haines: A Threatened Medicinal Tree. 2025;28(4):394-404.
18. Marndi S, Barik M, Kumar S. Phytochemical and cytotoxicity analysis of *Eulophia explanata* Lindl. (Tuber extracts). African Journal of Biological Sciences. 2024;6(Si4):2756-6.
19. Kumari S, Chouhan S, Tripathi G, Devi RS, Tudu S, Kumar S, Alam SKS. Ethnopharmacological evaluation of *Dendrocalamus strictus* (Roxb.) Nees. International Journal of Geography, Geology and Environment. 2026;8(9):35-41.
20. Soni PK, Devi RS, Kumar S, Behera B, Kumar S. Evaluation of phytochemical constituents, antioxidant and antimicrobial properties of *Gnetum edule*. Plant Archives. 2026;26(Supplement 2):3316-3321.

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