

Chapter 6

Qualitative phytochemical analysis of bark of *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.: a medicinal tree

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Abstract

Three extracts are used to carry out a qualitative phytochemical analysis on the bark of the Arjun tree (*Terminalia arjuna*), and the findings are tabulated. The findings revealed that three extracts exhibited a number of bioactive compounds like tannin, saponin, reducing sugars, and phenolic compounds in all extracts (aqueous, ethanol, and methanol). The detected compounds showed their pharmacological potential.

Keywords: Bioactive compounds, pharmacological potentials, Arjun tree

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Introduction

Since the origin of traditional therapeutic systems, the barks of different local tree species have played an important role in single and multiple formulations (Nayak and Kumar, 2023). Local traditional healers collect different types of

bark and treat joint pain, diarrhoea, diabetes, high cholesterol, colds, fevers, skin infections, and many other health problems (Kumar *et al.*, 2022). They usually use the bark of tree species. In this contemporary situation, traditional healers are going to be very rare in rural and tribal areas. Therefore, traditional medicinal plants are going to be unexplored, and there is a need to reexplore them (Kumar *et al.*, 2021). In this aspect, the Arjun tree is selected as it is used in different single and multiple formulations by traditional healers and ayurvedic practitioners. The bark of this tree is selected for phytochemical analysis. Botanically, it is known as *Terminalia arjuna*, belonging to the family Combretaceae. It usually grows near rivers and bodies of water (Kumar *et al.*, 2022). The plant parts of this genus are widely used to treat many health problems. The present study highlights the importance of bark and its pharmacological potential. The present study also recommends reexploring the traditional medicinal plants of India to restore their importance among the populace of India.



Figure 1: Bark of *T. arjuna*

Materials and methods

Collection of plant sample and preparation of extracts

The bark of *T. arjuna* were collected from Sundargarh district of Odisha state in April 2024 (Figure 1; 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). Detection of nine secondary metabolites was carried out using standard methods (Sreedevi *et al.*, 2024). An herbarium specimen is deposited to the Herbarium unit, Biodiversity and Conservation lab, APRF, Odisha (Figure 2).

Qualitative phytochemical analysis

Test for tannin

About 1 ml of the filtrate of bark 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 (Kumar *et al.*, 2024).

Test for saponin

About 1 ml of the filtrate of bark 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.

Test for flavonoids

About 1 ml of the filtrate of bark 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 NaOH solution and later become colourless. This change in colour confirmed the presence of flavonoids.

Test for terpenoids

About 2 ml of the filtrate of bark extract was added with 6 drops of chloroform and place 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.

Test for phenolic compounds

About 1 ml of the filtrate of bark extract was taken. Few drops of 5% Ferric chloride solution were added. The bluish black colour provides the positive result of the phenolic compounds (Swain *et al.*, 2020).



Figure 2: Herbarium specimen of *Terminalia arjuna*

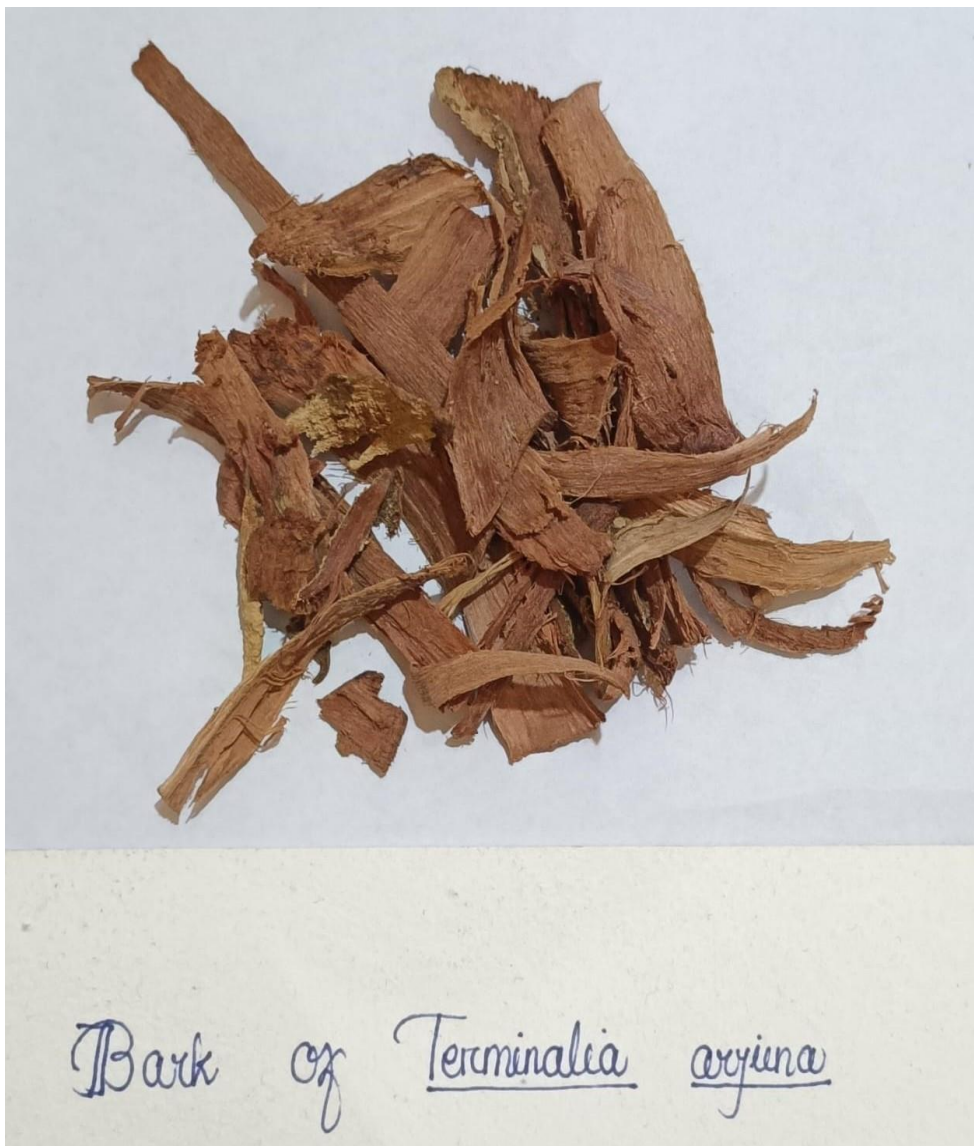


Figure 3: Dried bark of Arjun tree

Test for reducing sugar

About 1 ml of the filtrate of bark 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.

Test for steroids

About 1 ml of the filtrate of bark 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.

Test for alkaloids

About 1 ml of the filtrate of bark extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids (Kumar *et al.*, 2013).

Results and discussion

Qualitative phytochemical analysis of bark extracts of *T. arjuna* revealed that tannin, saponin, terpenoids, phenolic compounds and reducing sugars are present in aqueous extract of bark (Table 1; Figure 4) whereas tannin, saponin, phenolic compounds, reducing sugar and steroids are present in methanol extract (Table 1; Figure 5). It was noticed that tannin, saponin, phenolic compounds, reducing sugar and steroids are present in ethanol extract of bark (Table 1; Figure 6). Several researchers have also worked on the different plant parts of Arjun tree.

Table 1: Phytochemical screening using different extracts of *Terminalia arjuna* bark

Bioactive compounds	Aqueous	Methanol	Ethanol
Tannin	+ve	+ve	+ve
Saponin	+ve	+ve	+ve
Flavonoids	-ve	-ve	-ve
Terpenoids	+ve	-ve	-ve
Phenolic compounds	+ve	+ve	+ve
Reducing sugar	+ve	+ve	+ve
Steroids	-ve	+ve	+ve
Alkaloids	-ve	-ve	-ve
Carbonyl compounds	-ve	-ve	-ve

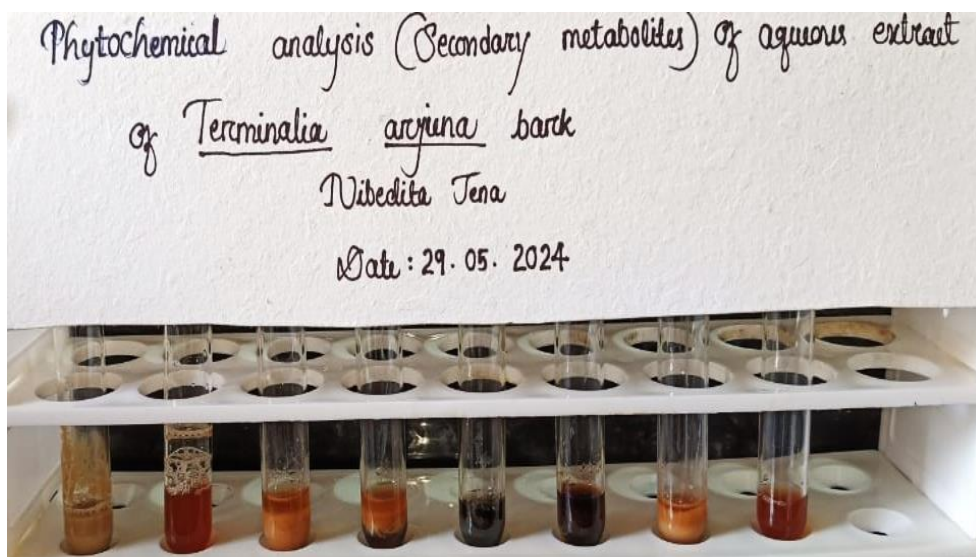


Figure 4: Detection of secondary metabolites of aqueous extract of *Terminalia arjuna* bark

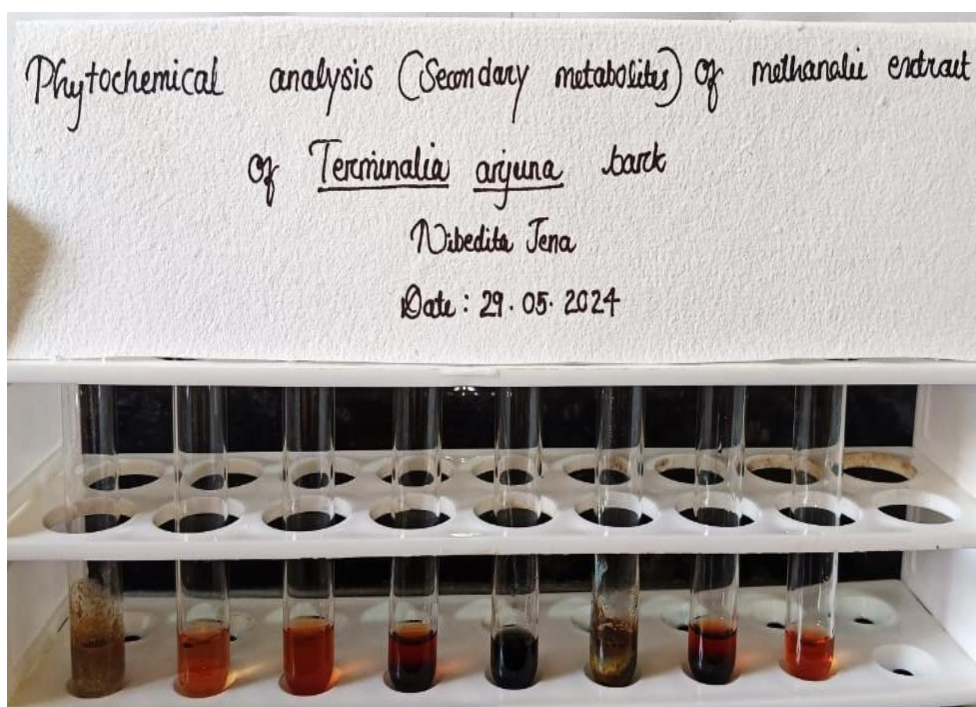


Figure 5: Screening of secondary metabolites of methanolic extract of *Terminalia arjuna* bark

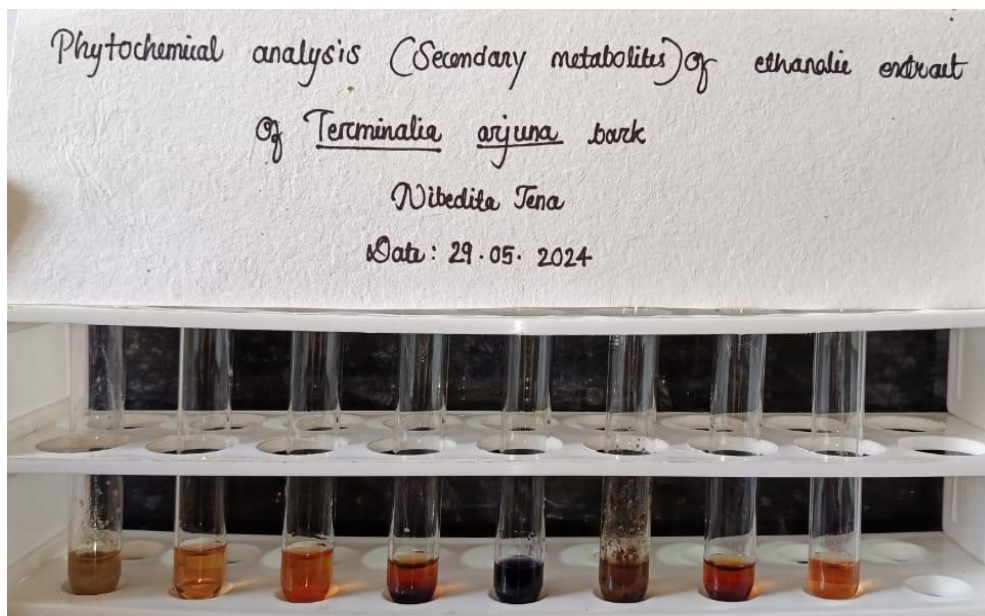


Figure 6: Detection of secondary metabolites of ethanolic extract of *Terminalia arjuna* bark

Arjun tree also contains a high number of polyphenolic compounds (60–70%), including ellagic acid, arjunolone, arjunone, gallic acid, oligomeric, and proanthocyanidins (Bushra *et al.*, 2023). The phytochemical screening by other researchers also showed the presence of active compounds in high concentrations, such as phytosterols, lactones, flavonoids, phenolic compounds, tannins, and glycosides. The antimicrobial activity of the extract showed a greater inhibition zone against Gram-negative bacteria than Gram-positive bacteria (Mandal *et al.*, 2013). An aqueous extract of *Terminalia arjuna* bark was also analyzed for its composition and molecular weight distribution by dialysis. Compositional analysis revealed that it has 44% polyphenols, and a dialysis study showed that 70% of the polyphenols have a molecular weight greater than 3.5 kDa. High-performance liquid chromatography and liquid chromatography-mass spectrometry analysis of *Terminalia arjuna* confirmed that it contains flavon-3-ols such as (+)-catechin, (+)-gallic acid, and (–)-epigallocatechin. Phenolic acids such as gallic acid, ellagic acid, and its derivatives were also found in *Terminalia arjuna* extract. Ellagic acid derivatives were isolated, and their spectral studies indicated that the isolated compounds were 3-O-methyl-ellagic acid. 4-O-β-D-xylopyranoside, ellagic acid, and 3-O-methyl ellagic acid 3-O-rhamnoside

(Saha *et al.*, 2012). The above documentation on Arjun tree indicates the potential of its medicinal uses and validate the present works.

Conclusion

Arjun tree is a common and important medicinal agent for traditional healers and in Ayurveda, including pharmacological research, but the importance of this tree is vanishing from the minds of youth in urban, rural, and tribal areas. Therefore, the present study again highlights the importance of this local medicinal tree, which shows present and future pharmacological potential.

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