Phytochemical screening of fruits and bark of *Cleistanthus collinus*: a wild biopesticide of India

Girishbala Nayak[1], Bidhan Chandra Roy[2], Nibedita Jena[3] and Sanjeet Kumar[3*]

[1]Department of Botany, Naktideul Degree College, Naktideul, Sambalpur, Odisha, India

[2]Department of Botany, Dinabandhu Mahavidyalaya, Bongaon, West Bengal, India

[3]Ambika Prasad Research Foundation, Odisha, India

*Email-Id: sanjeetaprf@gmail.com

Licensed under a Creative Commons Attribution 4.0 International License

Abstract

Cleistanthus collinus, a medicinally important plant, was subjected to qualitative phytochemical screening to identify its bioactive compounds. The results revealed the presence of tannins, saponins, flavonoids, phenolic compounds, reducing sugars, steroids, and alkaloids in various extracts of the plant's fruit and bark. The identified phytoconstituents are associated with various medicinal properties, including antimicrobial, immunomodulatory, anticarcinogenic, antioxidant, and antihyperglycemic activities. This study highlights the potential of *C. collinus* as a valuable source of bioactive compounds for the development of novel therapeutic agents.

Keywords: Fruits, bark, phytochemistry, pharmacology

INTRODUCTION

Cleistanthus collinus (Roxb.) Benth. ex Hook.f., is a medicinally important wild tree species belonging to the family Phyllanthaceae (Nayak and Kumar, 2023). It is widely distributed in the dry deciduous forest of Eastern India. The plant has been used in traditional medicine for various purposes (Mishra *et al.,* 2023). Phytochemical screening is a crucial step in the discovery of novel bioactive compounds from plants (Dimri *et al.,* 2023). It involves the identification and characterization of phytoconstituents present in plant extracts (Jaiswal *et al.,* 2024). Qualitative phytochemical screening provides valuable information on the presence or absence of specific bioactive compounds, such as alkaloids, glycosides, and phenolic compounds (Mohanty *et al.,* 2021). This information can be used to predict the potential medicinal properties of a plant. *C. collinus* has been reported to possess

various medicinal properties. It is known as biopesticide in India and used to repel the pest in paddy fields (Mishra *et al.,* 2023). However, the bioactive compounds responsible for these activities are not well documented for *C. collinus*. Therefore, the present study aimed to conduct a qualitative phytochemical screening of *C. collinus* fruits and bark to identify the secondary metabolites available in this tree species. The present study is expected to provide valuable information on the phytochemical constituents of *C. collinus*, which can be used to predict its potential medicinal properties and to identify leads for the development of novel therapeutic agents.



Fig. 1: Different plant parts of *C. collinus*

MATERIALS AND METHODS

The fruits and bark of *C. collinus* (Fig. 1) were collected from Rourkela Forest Division in September 2024. Aqueous, methanol and ethanol extracts of fruits and

bark of *C. collinus* were obtained and nine different bioactive compounds were detected using standard methods (Devi *et al.,* 2023; Marndi *et al.,* 2024).

Qualitative phytochemical analysis for secondary metabolites

Test for tannin: 2-5 drops of 0.1 % lead acetate solution were added to 1 ml of the filtrate of the extracts. The white gelatinous precipitate provided a positive result for the presence of tannins.

Test for saponin:1 ml of distilled water was added to 1 ml of the filtrate of the extracts and shaken vigorously. The persistent froth formation after shaking indicated the presence of saponin.

Test for flavonoids: 2 ml of 2 % NaOH solution and 3 drops of dilute HCl were added to 1 ml of the filtrate of the extracts. The colour of the filtrate initially turned to an intense yellow colour with NaOH solution and later turned colourless. This colour change confirmed the presence of flavonoids.

Test for terpenoids:1 ml of the filtrate of extracts was added with 6 drops of chloroform and placed in the water bath for a few minutes. Then 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the positive result for the presence of terpenoids.

Test for phenolic compounds:1 ml of the filtrate of extracts was taken and a few drops of 5 % Ferric chloride solution were added. The bluish-black colour provided a positive result of the phenolic compounds.

Test for reducing sugars: 1 ml of the filtrate of extracts 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 a few minutes. The presence of red-orange precipitate confirmed the presence of reducing sugars.

Test for steroids: 1 ml of the filtrate of the extracts was added with 1 ml of chloroform and 1 ml of concentrated H_2SO_4 was added to it. The appearance of

upper red and lower yellow with green fluorescence provided the positive result of the test for steroids.

Test for alkaloids: 1 ml of the filtrate of the extracts was taken and 3-4 drops of Dragendroff's reagent was added to it. The formation of a reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds: 1 ml of the filtrate of the extracts was taken and 3-4 drops of 2,4-Di-nitrophenylhydrazine reagent was added to it. The formation of yellow crystals confirmed the presence of carbonyl compounds.

RESULTS AND DISCUSSION

The qualitative phytochemical screening (Fig. 2-7; Table 1) of *C. collinus* bark revealed the presence of various phytoconstituents, including tannins, saponins, phenolic compounds, reducing sugars, and alkaloids. The results showed that the bark extracts were positive for these phytoconstituents, indicating their potential medicinal uses.



Fig. 2: Detection of secondary metabolites of *C. collinus* fruits by using aqueous extract



Fig. 3: Detection of secondary metabolites of *C. collinus* fruits by using methanolic extract



Fig. 4: Detection of secondary metabolites of *C. collinus* fruits by using ethanolic extract

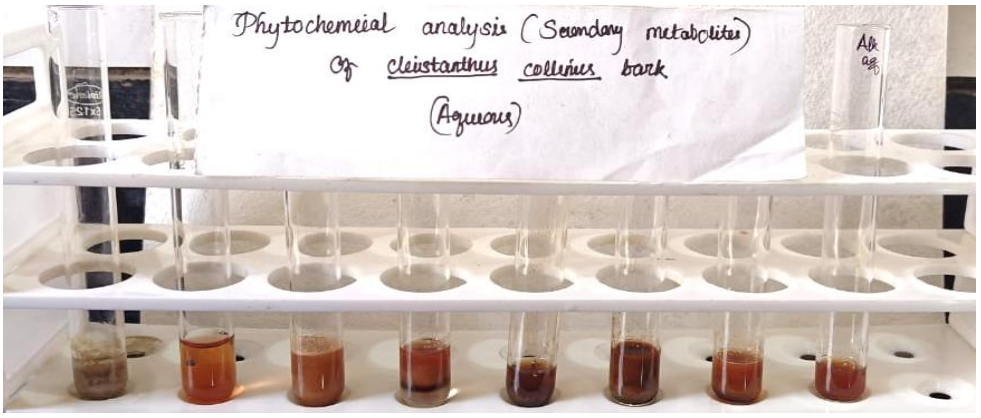


Fig. 5: Detection of secondary metabolites of *C. collinus* bark by using aqueous extract

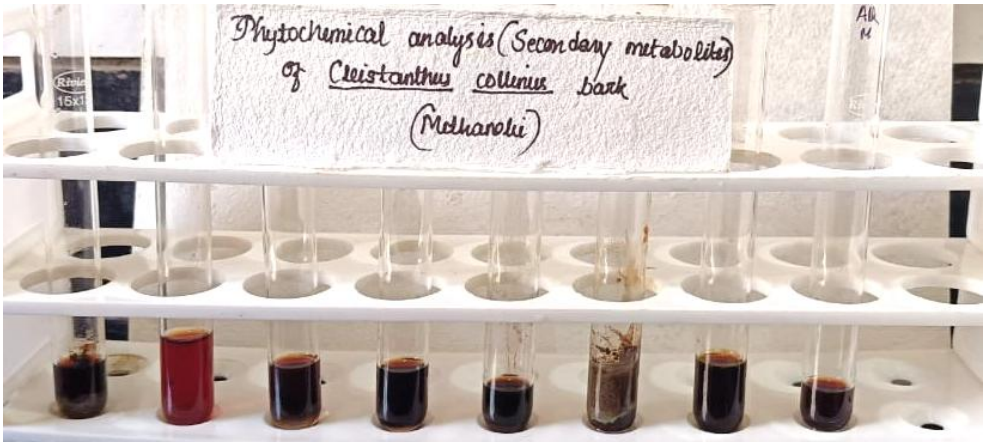


Fig. 6: Detection of secondary metabolites of *C. collinus* bark by using methanolic extract

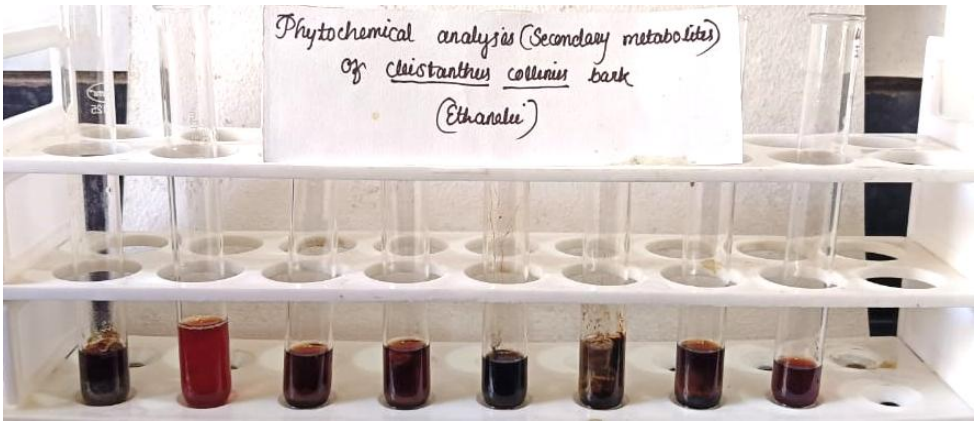


Fig. 7: Detection of secondary metabolites of *C. collinus* bark by using ethanolic extract

The presence of tannins, for instance, suggests antimicrobial activities (Chung *et al.,* 1998) while saponins may have immunomodulatory effects (Juang and Liang, 2020). Phenolic compounds, on the other hand, may be useful in treating rheumatoid arthritis (Rahman *et al.,* 2021). The results also highlighted the potential health benefits of *C. collinus*. The presence of flavonoids, although only detected in the fruit extracts, suggests anticarcinogenic properties (Roy *et al.,* 2022). Reducing sugars, found in both fruit and bark extracts, may have antioxidant effects (Kaneto *et al.,* 1996). Steroids, detected in the bark extracts, may be useful in treating asthma (Ericson-Neilsen and

Kaye, 2014), while alkaloids present in both fruit and bark extracts, may have antihyperglycemic effects (Aryal *et al.,* 2022; Table 2). Overall, the study suggests that *C. collinus* may be a valuable source of bioactive compounds with potential medicinal applications (Fig. 8).

Table 1: Qualitative phytochemical screening of *Cleistanthus collinus* bark using different extracts

Phytoconstituents	**Fruit**			**Bark**		
	Aqueous	**Methanol**	**Ethanol**	**Aqueous**	**Methanol**	**Ethanol**
Tannin	+	+	+	+	+	+
Saponin	+	+	+	+	+	+
Flavonoids	+	-	-	-	-	-
Terpenoids	-	-	-	+	-	-
Phenolic compounds	+	+	+	+	+	+
Reducing sugars	+	+	+	+	+	+
Steroid	+	-	-	-	-	-
Alkaloids	+	+	+	+	+	+
Carbonyl compounds	-	-	-	-	-	-

(+: Positive; -: Negative)

Table 2: Probable medicinal uses of *Cleistanthus collinus* for the presence of different phytoconstituents

Phytoconstituents	**Medicinal uses**	**Source**
Tannin	Antimicrobial activities	Chung *et al.,* (1998)
Saponin	Immunomodulatory effects	Juang and Liang, (2020)
Flavonoids	Anticarcinogenic properties	Roy *et al.,* (2022)
Phenolic compounds	Treat rheumatoid arthritis	Rahman *et al.,* (2021)
Reducing sugars	Antioxidant	Kaneto *et al.,* (1996)
Steroid	Treat asthma	Ericson-Neilsen and Kaye, (2014)
Alkaloids	antihyperglycemic	Aryal *et al.,* (2022)

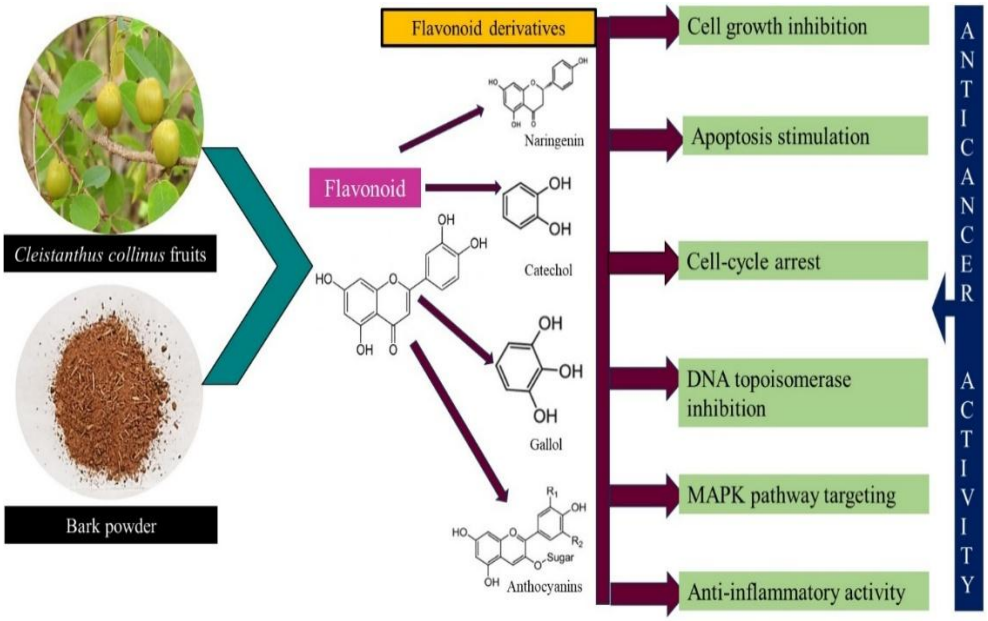


Fig. 8: Pharmacological potentials of *C. collinus* fruits and bark

CONCLUSION

The qualitative phytochemical screening of *Cleistanthus collinus* fruits and bark revealed the presence of various bioactive compounds, including tannins, saponins, flavonoids, and alkaloids. These findings support the traditional uses of the plant in tribal medicine and highlight its potential as a source of novel therapeutic agents. The study demonstrates the importance of scientific validation of tribal claims, which can lead to the discovery of new drugs and therapies. Future studies should focus on the isolation and characterization of the bioactive compounds present in *C. collinus*, as well as their evaluation for specific medicinal activities. Additionally, further research is needed to fully explore the potential of this plant and to validate its traditional uses. The scientific validation of tribal claims can also contribute to the preservation of traditional knowledge and the empowerment of indigenous communities. Ultimately, this approach can lead to the development of new, effective, and culturally acceptable healthcare solutions.

ACKNOWLEDGEMENT

Authors are thankful to the Divisional Forest Officer (DFO), Rourkela Forest Division, Rourkela, Odisha, India.

REFERENCES

Aryal B, Raut BK, Bhattarai S, Bhandari S, Tandan P, Gyawali K, Sharma K, Ranabhat D, Thapa R, Aryal D, Ojha A, Devkota HP and Parajuli N. (2022). Potential therapeutic applications of plant-derived alkaloids against inflammatory and neurodegenerative diseases. Evidence Based Complementary Alternative Medicine. 2022: 7299778. DOI: 10.1155/2022/7299778.

Chung KT, Wong TY, Wei CI, Huang YW and Lin Y. (1998). Tannins and human health: a review. Critical Reviews in Food Science and Nutrition. 38(6): 421-464.

Devi RS, Satapathy KB 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, Sharma BP, Kumar A, Behera B and Kumar S. (2023). Medico Bio-wealth of India, Volume 8. APRF, Odisha, India. https://doi.org/10.5281/zenodo.8022779

Ericson-Neilsen W and Kaye AD. (2014). Steroids: pharmacology, complications, and practice delivery issues. Ochsner Journal. 14(2): 203-207.

Jaiswal A, Hossain E, Kumar N and Kumar S. (2024). Plants & Secondary Metabolites, Volume II. Ambika Prasad Research Foundation, Odisha, India. DOI: https://doi.org/10.5281/zenodo.13995335

Juang YP and Liang PH. (2020). Biological and pharmacological effects of synthetic saponins. Molecules. 25(21): 4974. DOI: 10.3390/molecules25214974.

Kaneto H, Fujii J, Myint T, Miyazawa N, Islam KN, Kawasaki Y, Suzuki K, Nakamura M, Tatsumi H, Yamasaki Y and Taniguchi N. (1996). Reducing sugars trigger oxidative modification and apoptosis in pancreatic beta-cells by provoking oxidative stress through the glycation reaction. Biochemical Journal. 320 (Pt 3)(Pt 3): 855-863.

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

Mickymaray S. (2019). Efficacy and mechanism of traditional medicinal plants and bioactive compounds against clinically important pathogens. Antibiotics (Basel). 8(4): 257-257.

Mishra S, Sethi J and Kumar S. (2023). *Cleistanthus collinus* (Karada): a traditional biopesticide used by rural and tribal farmers of Odisha, India. Journal of Biodiversity and Conservation. 7(3): 45-49.

Mohanty M, Choudhury R, Kumar S and Maggirwar R. (2021). Phytochemical screening and antibacterial activity of *Dioscorea bulbifera* L. fruits. Plant Archive. 21(9): 862-86.

Nayak S and Kumar S. (2023). Medicinal plants used by tribals of Odisha. APRF & SMPB, Odisha; APRF Publishers, India.

Rahman MM, Rahaman MS, Islam MR, Rahman F, Mithi FM, Alqahtani T, Almikhlafi 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): 233-233.

Roy A, Khan A, Ahmad I, Alghamdi S, Rajab BS, Babalghith AO, Alshahrani MY, Islam S and Islam MR. (2022). Flavonoids a bioactive compound from medicinal Plants and its therapeutic applications. Biomedical Research Journal. 2022: 5445291. DOI: 10.1155/2022/5445291.