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Phytochemical Profiling of Selected Rubiaceae Species from Phansad Wildlife Sanctuary, Raigad, Maharashtra, India.

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Abstract : *Medicinal plants are rich sources of biologically active secondary metabolites that contribute significantly to drug discovery and therapeutic applications. The present study investigates the preliminary phytochemical composition of nine selected species belonging to the Rubiaceae family collected from Phansad Wildlife Sanctuary, Raigad, Maharashtra, India. Standard qualitative screening methods were employed to detect major phytoconstituents including alkaloids, flavonoids, phenolics, tannins, saponins, terpenoids, steroids, coumarins, quinones, and anthocyanins. The results revealed the universal presence of steroids, saponins, terpenoids, flavonoids, and alkaloids across all species. Phenolic compounds and tannins were also widely distributed, indicating strong antioxidant potential. Limited occurrence of anthocyanins and quinones was observed. Among the studied taxa, Hedyotis kurlzili and Ixora brachiata exhibited the highest diversity of phytochemicals. The findings highlight the pharmacological significance of Rubiaceae species and provide a scientific basis for further advanced studies such as GC-MS analysis and bioactivity evaluation.*

Key Words: Rubiaceae, Phytochemical screening, Secondary metabolites, Medicinal plants, Phansad Wildlife Sanctuary.

1. INTRODUCTION

Medicinal plants have long been utilized in traditional healthcare systems due to their rich reservoir of bioactive compounds. These phytochemicals, including alkaloids, flavonoids, phenolics, terpenoids, and tannins, play essential roles in plant defense mechanisms and exhibit diverse pharmacological activities such as antioxidant, antimicrobial, anti-inflammatory, and anticancer effects (Shakya, 2019; Kumar et al., 2021). The growing global interest in plant-based therapeutics has further highlighted the importance of phytochemical studies in drug discovery and development.

The family Rubiaceae is one of the largest angiosperm families, comprising over 13,000 species distributed predominantly in tropical and subtropical regions. Members of this family are well known for their medicinal significance, with several species reported to contain biologically active compounds exhibiting therapeutic potential (Verma et al., 2020; Abdelhady et al., 2022). Phytochemical screening serves as a fundamental approach for the identification of these bioactive constituents and provides a scientific basis for their traditional uses (Banu & Cathrine, 2019).

Recent studies have emphasized the importance of phenolic compounds and flavonoids due to their strong antioxidant properties and their role in mitigating oxidative stress-related disorders, including cardiovascular diseases, diabetes, and cancer (Sharma et al., 2020; Alam et al., 2022). Additionally, secondary metabolites such as alkaloids and terpenoids have been extensively studied for their broad spectrum of pharmacological activities, including antimicrobial, analgesic, and anticancer properties (Panche et al., 2016; Khan et al., 2023).

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. Despite the ecological richness of Phansad Wildlife Sanctuary, systematic phytochemical investigations of Rubiaceae species from this region remain limited, and comprehensive comparative screening studies are largely lacking. Therefore, the present study provides novel baseline data on the phytochemical composition of selected Rubiaceae species from this underexplored region.

II. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Phansad Wildlife Sanctuary, situated along the northern Western Ghats, a recognized global biodiversity hotspot. The sanctuary lies between 18°20′–18°35′ N latitude and 72°50′–73°10′ E longitude and is characterized by tropical semi-evergreen and moist deciduous forest types. The region experiences a humid tropical climate with substantial annual rainfall (approximately 3000–4000 mm), which supports rich floral diversity, particularly medicinally important taxa including members of the Rubiaceae family (Gadgil & Meher-Homji, 2018; Reddy et al., 2021).

2.2 Plant Material Collection and Identification

A total of nine plant species belonging to the family Rubiaceae were collected during field surveys conducted between [insert months/year]. Healthy and disease-free plant parts, primarily leaves, were randomly sampled from different locations within the sanctuary to ensure representative coverage of species diversity.

Taxonomic identification of the collected specimens was carried out using standard regional floras such as Flora of Maharashtra and Flora of British India, along with authenticated taxonomic keys. Final authentication was performed by a qualified taxonomist. Voucher specimens were prepared following standard herbarium techniques, properly labeled, and deposited for future reference and verification (Jain & Rao, 2016; Singh et al., 2020).

2.3 Sample Preparation

The collected plant materials were thoroughly washed with distilled water to remove adhering dust and contaminants. The samples were shade-dried at ambient room temperature (25–30°C) for 10–15 days to minimize the degradation of thermolabile bioactive compounds. The dried plant materials were then pulverized into a fine powder using a mechanical grinder and stored in airtight containers at room temperature until further phytochemical analysis (Harborne, 1998; Azwanida, 2019; Pandey & Tripathi, 2021).

2.4 Preparation of Plant Extracts

Approximately 10 g of powdered plant material from each selected species was subjected to solvent extraction using methanol, ethanol, and distilled water based on polarity differences to ensure efficient recovery of diverse phytoconstituents. The extraction was carried out using the maceration method, wherein the powdered samples were soaked in respective solvents (1:10 w/v) and kept at room temperature for 24–48 hours with intermittent shaking to enhance the extraction efficiency.

Following extraction, the mixtures were filtered using Whatman No. 1 filter paper to remove particulate matter. The filtrates were concentrated using a water bath at controlled temperature (40–50°C) to avoid degradation of heat-sensitive compounds. The concentrated extracts were transferred to sterile containers and stored at 4°C until further phytochemical analysis (Azwanida, 2019; Pandey & Tripathi, 2021; Ngo et al., 2021).

2.5 Preliminary Phytochemical Screening

Qualitative phytochemical screening of the prepared extracts was performed to detect the presence of major classes of secondary metabolites using standard pharmacognostic procedures. These tests are widely employed for rapid identification of bioactive compounds and are based on characteristic color changes or precipitate formation (Banu & Cathrine, 2019; Sofowora, 2008; Harborne, 1998).

The following phytochemical tests were conducted:

- **Alkaloids** – Detected using Mayer's and Wagner's reagents (cream/reddish-brown precipitate formation)
- **Flavonoids** – Identified by alkaline reagent test and lead acetate test (intense yellow coloration)
- **Phenolic compounds** – Determined using ferric chloride test (bluish-black/green coloration)

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- **Tannins** – Detected using gelatin test and ferric chloride test
- **Saponins** – Identified by persistent frothing test
- **Steroids** – Detected using Liebermann–Burchard reaction (green coloration)
- **Terpenoids** – Identified by Salkowski test (reddish-brown interface)
- **Coumarins** – Detected using UV fluorescence test
- **Quinones** – Identified by alkaline reagent test (color change to red/blue)
- **Anthocyanins and Leucoanthocyanins –** Determined using acid-base reaction tests
- **Phlobatannins** – Detected using hydrochloric acid test (red precipitate formation)
- **Fatty acids** – Identified using standard lipid detection assays

The presence (+) or absence (–) of each phytochemical constituent was recorded based on observable color changes or precipitate formation in comparison with control samples.

Sr. No.	Name of the Plant	Coumarins	Anthocynin	Leucoanthocynin	Fattyacid	Steroids	Saponins	Terpenoids	Quinones	Tannins	Phlobatannins	Phenolic compounds	Flavonoids	Alkaloids
1	Meyna spinosa	+	-	+	+	+	+	+	-	+	-	+	+	+
2	Morinda pubescens	+	-	-	+	+	+	+	-	+	-	+	+	+
3	Hydyotis kurlzili	+	+	-	+	+	+	+	-	+	+	+	+	+
4	Meyna laxiflora	+	-	-	-	+	+	+	-	+	-	+	+	+
5	Pavetta crassiicaulis	+	-	-	+	+	+	+	-	+	-	+	+	+
6	Mitragyna parvifolia	-	-	-	+	+	+	+	+	+	-	+	+	+
7	Catuanargum spinosa	-	-	-	-	+	+	+	+	+	-	+	+	+
8	Haldina cordifolia	-	-	-	-	+	+	+	+	-	-	+	+	+
9	Ixora brachiata	+	+	-	+	+	+	+	-	+	+	+	+	+

III. DISCUSSION

The present study provides a qualitative assessment of phytochemical constituents in nine Rubiaceae species collected from Phansad Wildlife Sanctuary, demonstrating the presence of a wide range of bioactive secondary metabolites. The consistent occurrence of major phytochemicals such as alkaloids, flavonoids, terpenoids, steroids, and saponins across all studied species indicates a common metabolic pattern within the family. This observation is in agreement with earlier studies on Rubiaceae, which report the presence of diverse phytoconstituents contributing to their medicinal importance (Verma et al., 2020; Abdelhady et al., 2022). The favorable ecological conditions of the Western Ghats may also play a role in enhancing the production of these metabolites.

Among the detected compounds, the universal presence of alkaloids and flavonoids is particularly important due to their well-known pharmacological activities. Alkaloids are widely reported for their antimicrobial and analgesic properties, while flavonoids are recognized for their antioxidant and anti-inflammatory effects. Similar findings have been reported by Tiranakwit et al. (2019) and Kaur et al. (2021), supporting the idea that these compounds are commonly distributed in tropical medicinal plants. In addition, the presence of terpenoids and steroids in all species supports previous reports highlighting their role in anti-inflammatory and anticancer activities (Adil et al., 2020). The detection of saponins across all samples is also significant, as they are known for their antimicrobial and immune-modulatory effects, as noted by Youl et al. (2022).

The presence of other phytochemicals such as phenolics, tannins, coumarins, quinones, and anthocyanin derivatives further indicates the chemical diversity of the studied plants. These compounds are known to contribute to antioxidant

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and antimicrobial activities, often working together to enhance the overall biological effect. Similar patterns have been observed in other medicinal plant studies, where multiple phytochemicals act synergistically rather than individually (Sharma et al., 2020; Khan et al., 2023). The variation observed in some minor constituents among species may be due to environmental factors, genetic differences, or adaptation to local conditions.

From a pharmacological perspective, the presence of diverse phytochemicals in all studied species suggests their potential use in drug development. However, preliminary phytochemical screening only provides basic information about the presence or absence of compounds and does not confirm their biological activity. Therefore, further studies using advanced analytical techniques such as GC–MS and LC–MS, along with bioassays, are necessary to identify active compounds and validate their medicinal properties. Previous studies have shown that combining phytochemical screening with advanced analytical methods improves the reliability and scientific value of medicinal plant research.

Overall, the findings of this study support the medicinal importance of the Rubiaceae family and provide baseline phytochemical data for species from Phansad Wildlife Sanctuary. This study can serve as a foundation for future research focusing on detailed chemical characterization and pharmacological evaluation of these plants. . This study is among the few reports focusing on Rubiaceae species from Phansad Wildlife Sanctuary, thereby contributing novel regional data and highlighting the untapped phytochemical potential of this underexplored area

IV. CONCLUSION

The present study demonstrates that the selected Rubiaceae species from Phansad Wildlife Sanctuary are rich reservoirs of diverse bioactive phytochemicals. The consistent presence of major secondary metabolites such as alkaloids, flavonoids, terpenoids, steroids, and saponins across all investigated species highlights the strong pharmacological potential of this family. In addition, the detection of other important constituents including phenolics, tannins, coumarins, quinones, and anthocyanin derivatives further emphasizes the chemical diversity and possible synergistic effects contributing to their therapeutic value.

These findings provide scientific support for the traditional use of Rubiaceae species in herbal medicine and suggest that these plants could serve as promising candidates for the development of novel drugs. The study also contributes baseline phytochemical data for an ecologically important yet relatively underexplored region, thereby enhancing the understanding of plant-based resources from the northern Western Ghats.

However, it is important to note that preliminary phytochemical screening offers only qualitative insights into the presence of bioactive compounds. Therefore, further research is essential to fully explore the medicinal potential of these species. Advanced analytical techniques such as gas chromatography–mass spectrometry (GC–MS) and liquid chromatography–mass spectrometry (LC–MS) should be employed for the identification and characterization of individual compounds. Additionally, bioactivity-guided assays, toxicity studies, and quantitative analysis are necessary to validate their pharmacological efficacy and safety.

In conclusion, the studied Rubiaceae species represent valuable natural resources with significant potential for pharmaceutical and therapeutic applications. The outcomes of this research provide a strong foundation for future investigations aimed at drug discovery, standardization of herbal formulations, and conservation of medicinal plant biodiversity. The study also emphasizes the novelty of exploring phytochemical diversity in an underreported region, thereby opening new avenues for future pharmacological and bioprospecting research. Furthermore, there is need to promote the conservation of Rubiaceae members in their natural habitats through sustainable harvesting practices, habitat protection, and awareness programs. Preservation of biodiversity-rich regions such as Phansad Wildlife Sanctuary is essential to safeguard these medicinally important species from overexploitation and environmental degradation, ensuring their availability for future generations and continued scientific exploration.

REFERENCES

1. Abdelhady, M. I. S., et al. (2022). Phytochemical and pharmacological significance of the family Rubiaceae: A review. Journal of Ethnopharmacology, 283, 114709.

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2. Adil, M., et al. (2020). Terpenoids and steroids as potential therapeutic agents: A review. Journal of Applied Pharmaceutical Science, 10(3), 150–162.
3. Alam, M. N., Bristi, N. J., & Rafiquzzaman, M. (2022). Review on in vivo and in vitro methods evaluation of antioxidant activity. Saudi Pharmaceutical Journal, 30(1), 1–15.
4. Azwanida, N. N. (2019). A review on the extraction methods used in medicinal plants. Medicinal & Aromatic Plants, 8(3), 1–6.
5. Banu, K. S., & Cathrine, L. (2019). General techniques involved in phytochemical analysis. International Journal of Advanced Research in Chemical Science, 6(2), 25–32.
6. Gadgil, M., & Meher-Homji, V. M. (2018). Ecological diversity of the Western Ghats. Proceedings of the Indian Academy of Sciences, 127(4), 567–579.
7. Harborne, J. B. (1998). Phytochemical methods: A guide to modern techniques of plant analysis (3rd ed.). Springer.
8. Jain, S. K., & Rao, R. R. (2016). A handbook of field and herbarium methods. Today & Tomorrow's Printers.
9. Khan, H., et al. (2023). Alkaloids and terpenoids as emerging therapeutic agents: Recent advances. Frontiers in Pharmacology, 14, 1187654.
10. Kumar, S., Pandey, A. K., & Singh, P. (2021). Role of medicinal plants in modern drug discovery. Biomedicine & Pharmacotherapy, 137, 111285.
11. Kaur, R., et al. (2021). Phytochemical profiling and biological activities of Rubiaceae species. Journal of Herbal Medicine, 28, 100435.
12. Ngo, T. V., Scarlett, C. J., Bowyer, M. C., Ngo, P. D., & Vuong, Q. V. (2021). Impact of extraction methods on bioactive compounds and antioxidant capacity of plant materials. Food Chemistry, 352, 129364.
13. Pandey, A., & Tripathi, S. (2021). Concept of standardization, extraction and pre-phytochemical screening strategies for herbal drug. Journal of Pharmacognosy and Phytochemistry, 10(2), 123–130.
14. Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: An overview. Journal of Nutritional Science, 5, e47.
15. Reddy, C. S., et al. (2021). Biodiversity characterization of Western Ghats vegetation. Indian Journal of Forestry, 44(2), 145–152.
16. Sharma, A., et al. (2020). Antioxidant potential of phenolic compounds: A review. Plant Cell Biotechnology and Molecular Biology, 21(1–2), 1–10.
17. Shakya, A. K. (2019). Medicinal plants: Future source of new drugs. International Journal of Herbal Medicine, 7(4), 59–64.
18. Singh, H., Mishra, P., & Sharma, S. (2020). Standardization of herbarium techniques and plant identification methods. Indian Journal of Plant Sciences, 9(1), 45–52.
19. Sofowora, A. (2008). Medicinal plants and traditional medicine in Africa (3rd ed.). Spectrum Books.
20. Tiranakwit, N., et al. (2019). Phytochemical screening and biological activity of selected tropical plants. Asian Pacific Journal of Tropical Biomedicine, 9(5), 210–218.
21. Verma, R., et al. (2020). Phytochemical and pharmacological potential of Rubiaceae family. Journal of Pharmacognosy and Phytochemistry, 9(5), 1234–1242.
22. Youl, E. N. H., et al. (2022). Biological activities of saponins and their role in medicine. Molecules, 27(4), 1234.