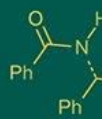


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Preliminary phytochemical screening and HPTLC profiling of *Chloroxylon swietenia* (Roxb.) Leaf extracts

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Abstract

Medicinal plants are a valuable source of bioactive compounds with therapeutic potential. *Chloroxylon swietenia* (Roxb.), commonly known as satinwood, is traditionally used in folk medicine for its antimicrobial, anti-inflammatory, and insecticidal properties. The present study aimed to evaluate the extraction yield, preliminary phytochemical constituents, and chromatographic fingerprint of *C. swietenia* leaf extracts prepared using different solvents. Soxhlet extraction was carried out using hexane, chloroform, acetone, ethanol, and methanol. Preliminary phytochemical screening revealed the presence of carbohydrates, flavonoids, alkaloids, and quinones in varying intensities depending on the solvent used. Methanol extract showed the highest yield (12.31%), followed by ethanol (10.25%). HPTLC analysis using toluene: ethyl acetate (5:1.5, v/v) demonstrated distinct phytochemical profiles under UV light at 254 nm, 366 nm, and after derivatization with vanillin-sulphuric acid. The study confirms that *C. swietenia* leaves are rich in secondary metabolites and may serve as a potential source of bioactive compounds.

Keywords: *Chloroxylon swietenia*, phytochemical screening, HPTLC, medicinal plants, secondary metabolites

Introduction

Medicinal plants play a vital role in traditional healthcare systems and serve as a foundation for modern drug discovery. Phytochemicals such as alkaloids, flavonoids, phenolics, and quinones exhibit diverse biological activities including antioxidant, antimicrobial, anti-inflammatory, insecticidal, and anticancer properties. These bioactive compounds contribute significantly to the therapeutic efficacy of medicinal plants and have attracted considerable attention for their potential pharmaceutical applications.

Chloroxylon swietenia (Roxb.), belonging to the family Rutaceae, is a deciduous tree widely distributed in tropical regions of India and Sri Lanka. The plant is traditionally used in indigenous medicine for treating wounds, skin infections, fever, rheumatism, and inflammatory disorders. Various parts of the plant, especially the leaves and bark, are known to possess medicinal properties due to the presence of secondary metabolites.

Despite its ethnomedicinal importance, systematic studies on the phytochemical composition of *C. swietenia* leaves using different solvent systems remain limited. The nature and concentration of phytochemicals largely depend on the polarity of the extraction solvent, which influences the efficiency of extraction and diversity of compounds recovered. Therefore, preliminary phytochemical screening serves as an essential step in identifying major bioactive constituents and guiding further isolation and pharmacological investigations.

In this context, the present study was undertaken to evaluate the extraction yield, qualitative phytochemical constituents, and High-Performance Thin-Layer Chromatography (HPTLC) fingerprint of *C. swietenia* leaf extracts prepared using solvents of varying polarity. The findings of this study aim to provide a scientific basis for the traditional medicinal use of *C. swietenia* and contribute to the development of plant-based therapeutic agents.

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Materials and Methods

- 1. Processing:** Fresh leaves of *C. swietenia* (table1) were collected, shade-dried, powdered, and extracted using Soxhlet apparatus with hexane, chloroform, acetone, ethanol, and methanol. Extracts were concentrated and stored for analysis.
- 2. Test insect:** The Gmelina semilooper (table.1) was selected as the test insect for the study because it is a major defoliator of *Gmelina arborea* and causes significant damage to plantations. Studying this insect helps in understanding its biology, infestation pattern, and impact on host plants, which is essential for developing effective and sustainable pest management strategies.
- 3. Techniques:** The extracts were subjected to various chromatographic techniques for the separation and

characterisation of active compounds. Thin Layer Chromatography (TLC) was carried out on Merk TLC plates (20x20 cm, Silica Gel 60 F254), using the solvent system Hexane: Diethyl Ether (8:2). Other secondary metabolites were fractionated with the following eluent systems: a) Chloroform/Methanol (7:1 v/v); b) Chloroform/Acetonitrile (7:3 v/v); c) Ethylacetate/2-Propanol (95:5 v/v); d) Methylene Chloride/Tetrahydrofuran (6:2 v/v); e) Methylene Chloride/Methanol/Dimethylformamide (90:9:1 v/v/v). The metabolites were detected using a 1% w/v vanillin/sulfuric acid reagent after gentle heating. Fatty acids were identified using UV light or by placing the TLC plates in a glass chamber saturated with iodine vapors.

Table 1: Test insects selected for the study

S. No.	Insect CN	Insect SN	Plant SN	Plant CN
1	Gmelina semilooper	<i>Achaea janata</i> Family: Lepidoptera: Order: Noctuidae	Chloroxylon swietenia Family: Rutaceae Order: Sapindales	East Indian satinwood

1. Preliminary Phytochemical Screening

Qualitative phytochemical screening was carried out using standard procedures to detect carbohydrates, flavonoids, alkaloids, quinones, steroids, phenols, glycosides, saponins, tannins, and fatty acids.

2. HPTLC Analysis

HPTLC profiling was performed using silica gel 60 F254 plates with toluene: ethyl acetate (5:1.5, v/v) as the mobile phase. Visualization was done at 254 nm, 366 nm, and after derivatization with vanillin-sulphuric acid.

Results and Discussion

Preliminary phytochemical screening of *Chloroxylon swietenia* leaf extracts prepared using solvents of varying polarity revealed the presence of several important primary and secondary metabolites, namely carbohydrates, flavonoids, alkaloids, quinones, cardiac glycosides, and coumarins (Table 2). The qualitative variation in phytochemical constituents among different solvent extracts highlights the significant influence of solvent polarity on extraction efficiency, which is a well-established phenomenon in phytochemical studies (Harborne, 1998; Kokate, 2010) [3, 4].

Carbohydrates were found to be strongly present (+++) in hexane, chloroform, ethyl acetate, and ethanol extracts, whereas only a weak presence (+) was observed in the aqueous extract. This indicates that carbohydrates in *C. swietenia* leaves are more readily extracted by organic solvents than by water. Carbohydrates play an essential role in plant metabolism and are also known to contribute to wound healing and immunomodulatory activities, supporting the traditional medicinal use of the plant (Trease and Evans, 2009) [7].

Flavonoids were moderately present (++) in hexane, chloroform, and ethyl acetate extracts and strongly present (+++) in the ethanol extract, while completely absent in the aqueous extract. Flavonoids are widely reported for their antioxidant, anti-inflammatory, and antimicrobial properties, and their higher extraction in ethanol is consistent with earlier reports indicating better solubility of flavonoids in

polar organic solvents (Middleton *et al.*, 2000; Pandey and Rizvi, 2009) [5, 6]. The presence of flavonoids may therefore contribute to the use of *C. swietenia* in treating inflammatory and infectious conditions.

Alkaloids showed moderate presence (++) in hexane and chloroform extracts, strong presence (+++) in ethyl acetate extract, and moderate presence (++) in ethanol extract, while being absent in the aqueous extract. Alkaloids are pharmacologically active compounds known for antimicrobial, analgesic, and antipyretic activities (Cowan, 1999) [2]. Their effective extraction in ethyl acetate suggests that medium-polarity solvents are particularly suitable for isolating alkaloidal compounds from *C. swietenia* leaves.

Quinones were strongly detected (++++) in hexane, chloroform, and ethyl acetate extracts and moderately present (++) in ethanol extract. Quinones are reported to possess antimicrobial, cytotoxic, and insecticidal properties and play an important role in plant defence mechanisms (Babula *et al.*, 2009) [1]. Their consistent presence across organic solvent extracts further enhances the therapeutic and agricultural relevance of the plant.

Cardiac glycosides exhibited a strong presence (+++) in all organic solvent extracts, including hexane, chloroform, ethyl acetate, and ethanol, but were absent in the aqueous extract. Cardiac glycosides are well known for their cardiogenic and antimicrobial properties and have been reported in several medicinal plants of pharmacological importance (Trease and Evans, 2009) [7]. Coumarins were moderately present (++) in hexane and chloroform extracts and strongly present (+++) in ethyl acetate and ethanol extracts. Coumarins are recognised for their antioxidant, anticoagulant, and antimicrobial activities, further supporting the medicinal potential of *C. swietenia* (Venugopala *et al.*, 2013) [8].

In addition to qualitative phytochemical screening, HPTLC analysis revealed multiple distinct spots under UV light at 254 nm and 366 nm and after derivatisation with vanillin-sulphuric acid, indicating considerable chemical diversity in the leaf extracts. The variation in the number of spots observed at different concentrations suggests differences in compound polarity, concentration, and chromatographic

behaviour. Such HPTLC fingerprints are valuable tools for authentication, quality control, and standardisation of medicinal plant materials (Wagner and Bladt, 2001) [9].

Overall, the combined phytochemical screening and HPTLC profiling demonstrate that *Chloroxylon swietenia* leaves are rich in diverse bioactive constituents. The predominance of phytochemicals in ethanol and ethyl acetate extracts indicates that these solvents are most suitable for extracting medicinally important compounds. The results provide a strong scientific basis for the traditional medicinal use of *C. swietenia* and justify further studies on isolation, characterization, and bioactivity evaluation of individual phytochemicals.

Table 2: Results of Preliminary phytochemical analysis of various solvent extracts of *Chloroxylon swietenia*-Leaf part.

Sl. No	Test Name	Observation for different solvent extract				
		Hexane	Chloroform	Ethyl acetate	Ethanol	Aqueous
1	Carbohydrates	+++	+++	+++	+++	+
2	Flavonoids	++	++	++	+++	-
3	Alkaloids	++	++	+++	++	-
4	Quinones	+++	+++	+++	++	-
5	Cardiac glycosides	+++	+++	+++	+++	-
6	Coumarin	++	++	+++	+++	-

-absent, + present, ++ moderate, +++ strongly present

Conclusion

Chloroxylon swietenia leaves contain diverse phytochemical constituents, with methanol and ethanol being the most effective solvents. The findings support traditional uses and warrant further pharmacological studies.

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