Chapter 4

Phytochemical screening of Umbrella tree (*Terminalia mantaly* H. Perrier) leaves

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Abstract

Terminalia mantaly is an ornamental avenue tree and commonly known as Umbrella tree. The qualitative phytochemical screening of leaves was carried out using three extracts (ethanol, methanol and aqueous). The results showed diverse secondary metabolites like tannin, saponin, phenolic compounds, flavonoids etc which indicates its pharmacological potential. The therapeutic uses and future aspects are discussed here.

Keywords: Avenue plantation, cultivated tree, *Terminalia*

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Introduction

Environmental awareness is an important task for the ecologist and environmentalist in contemporary situations. In this aspect, lot of tree species are planted in city and metro areas to make a green cover and to reduce the pollutants. Always local plants should be planted but in most of

cities, ornamental and invasive tree species are planted for beautification and reduction of pollutants (Das *et al.,* 2022). The most common avenue tree species in India are *Bombax ceiba, Ceiba pentandra, Terminalia mantaly, Pongamia pinnata, Tabebuia rosea, Tabebuia chrysantha, Lagerstroemia speciosa, Polyalthia longifolia, Delonix regia, Peltophorum pterocarpum, Spathodea campanulata, Cassia siamea, Cassia fistula, Cassia javanica, Simarouba glauca, Eucalyptus cladocalyx, Alstonia scholaris, Jacaranda mimosifolia, Leucaena leucocephala, Samanea saman, Pongamia glabra, Pongamia ovalifolia, Mangifera indica, Monoon simiarum, Cascabela thevetia, Averrhoa carambola, Barringtonia acutangular, Kigelia pinnata, Millingtonia hortensis, Adansonia digitata, Casuarina equisetifolia, Calophyllum inophyllum, Terminalia catappa, Dillenia indica, Adenanthera pavonina, Gliricidia sepium, Parkinsonia aculeata, Saraca asoca, Magnolia champaca* etc (Present study; Kumar *et al.,* 2018; Das *et al.,* 2022). The avenue trees have food, medicinal and ecological significances. Medicinal values of ornamental invasive tree species are unexplored and need to evaluate them. Keeping this in view, an attempt has been made to detect the available secondary metabolites in the leaves of *Terminalia mantaly* (Figure 1). It is commonly known as umbrella tree and usually can be seen near road sides in India. It is a fast-growing tree native to Madagascar with large, glossy leaves and symmetrical foliage. It can grow up to 40 meters tall and has smooth, pale grey bark with brownish streaks. The leaves are slightly glossy green, spathulate, and have uneven to crenate margins. The plant has small greenish flowers (Figure 2) with no petals, clustered along erect inflorescence spikes that can be up to 5 cm long. The fruits are smooth, wingless drupes that are green when unripe (https://www.nparks.gov.sg). It looks very beautiful during flowering periods.

Methodology

The leaves of *T. mantaly* were collected (Figure 3) from the Naraj areas of Cuttack district, Odisha state, India. The plant was identified by the authors. The Soxhlet method of extraction using three solvents (aqueous, methanol, and ethanol) was carried out for phytochemical analysis (Kumar *et al.,* 2013; Figure 4-5). The detection of nine secondary metabolites was carried out using standard methods (Kumar *et al.,* 2017; Devi *et al.,* 2023).

Figure 1: Plant parts and canopy of *Terminalia mantaly*

Figure 2: Flowers and leaves of *Terminalia mantaly*

Figure 3: Collection of leaves for phytochemical analysis

Qualitative phytochemical analysis

Test for tannin

1 ml of the filtrate of leaves extract was taken. About 3-5 drops of 10% lead acid solution was added into it. The appearance of gelatinous precipitate confirmed the presence of tannins.

Test for saponins

1 ml of the filtrate of leaves extract of *M. minuta* was taken. About 1 ml of distilled water was added into it and allowed to shake well. The persistent froth formation after shaking provide the evidence of the saponin.

Test for flavonoids

1 ml of the filtrate of the leaves extract was taken and added 2 ml of 2% NaOH solution and 3 drops of dilute HCL. The colour initially turned to an intense yellow colour with NaOH solution and later become colourless. This change in colour confirmed the positive result for the presence of flavonoids.

Test for terpenoids

1 ml of the filtrate of leaves extract was added with 6 drops of chloroform and place it in the water bath for few minutes. Then 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the positive result of the presence of terpenoids.

Figure 4: Dried leaves of *Terminalia mantaly*

Test for phenolic compounds

1 ml of the filtrate of the leaves extract was taken. Few drops of 5% Ferric chloride solution were added. The appearance of dark bluish black colour provides the positive result of the test of phenolic compounds.

Test for reducing sugars

1 ml of the filtrate of leaves extract was taken and added 2 drops of Fehling's solution A followed by Fehling's solution B and kept it in water bath for some time. The presence of red orange precipitate confirmed the positive result of the test reducing sugar.

Test for steroids

1 ml of the filtrate of leaves extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid were added into it. The appearance of upper red and lower yellow with green fluorescence provide the positive result of the test of steroids.

Test for alkaloids

1 l of the filtrate was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds

1 ml of the filtrate of leaves extract was taken and added 3 to 4 drops of 2,4- Dinitrophenylhydrazine reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

Figure 5: Powder of dried leaves of *Terminalia mantaly* for extraction

Results and discussion

Qualitative phytochemical analysis of *T. mantaly* leaves showed that plant has diverse secondary metabolites. Tannin, saponin, flavonoids, steroids and alkaloids are detected in aqueous extract (Table 1; Figure 8) while tannin, saponin, flavonoids, phenolic compounds, reducing sugar and alkaloids are present in methanol extract (Table 1; Figure 6). It was noticed that tannin, saponin, flavonoids, phenolic compounds, reducing sugar and alkaloids are also detected in ethanolic extract (Figure 7). The secondary metabolites available in three leaf extracts showed its medicinal potential and it could be a future pharmaceutical agent.

Table 1: Phytochemical analysis of different extracts of *T. mantaly* leaves

Bioactive compounds	Solvents		
	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 sugars	+ve	+ve	+ve
Steroids	-ve	-ve	-ve
Alkaloids	+ve	+ve	+ve
Carbonyl compounds	-ve	-ve	-ve

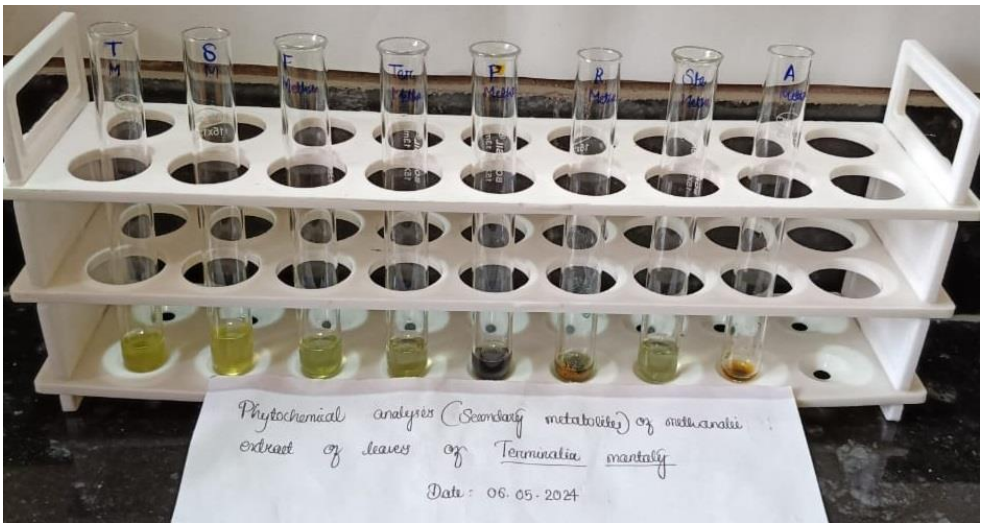

Figure 6: Secondary metabolites detection in methanolic extract

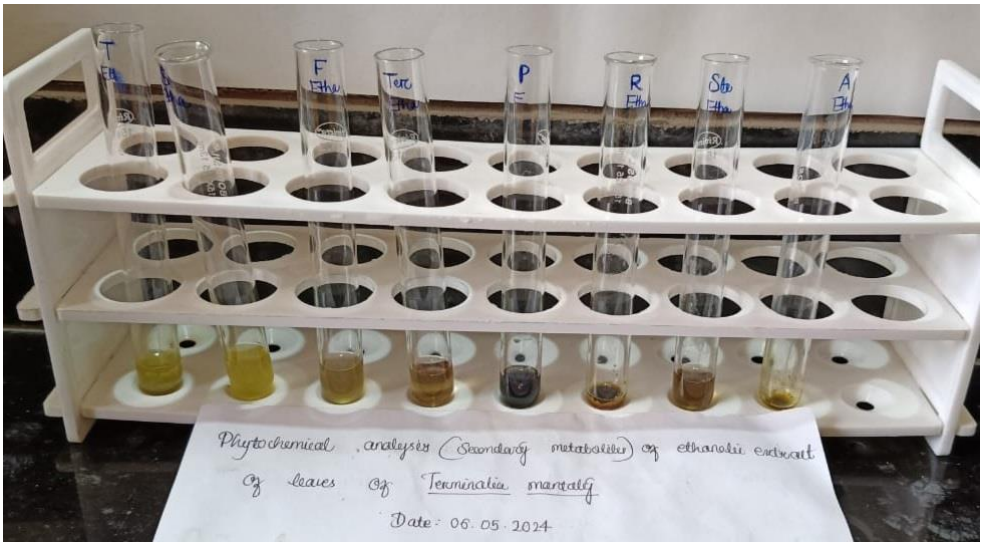

Figure 7: Secondary metabolites detection in ethanoli extract

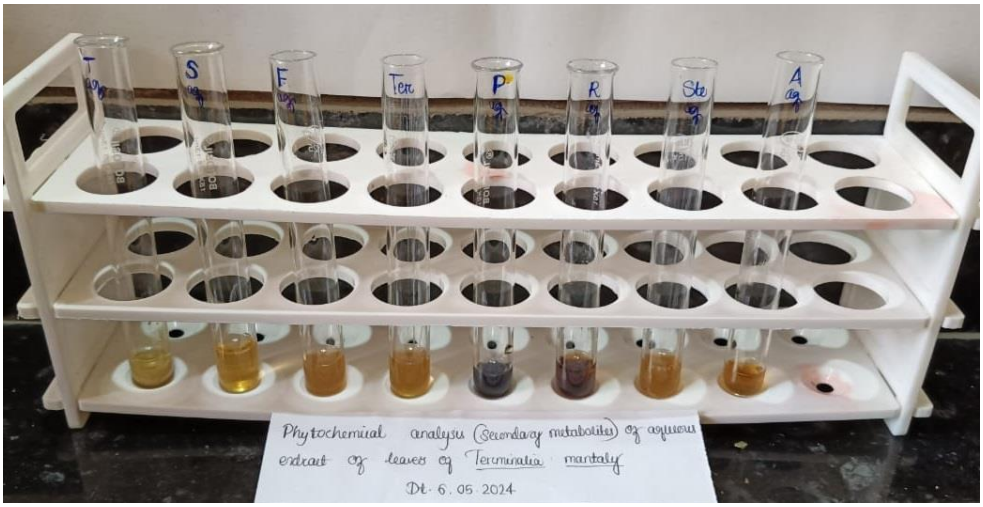

Figure 8: Secondary metabolites detection in aqueous extract

Polycrystalline biogenic AgNPs with anisotropic shapes and diameter range of 11 to 83 nm were also synthesized from the *T. mantaly* (TM) extracts. The biogenic TM-AgNPs showed significant antibacterial activity. The MIC values for TM-AgNPs and extracts were 3 and 125 µg/mL, respectively. Their bactericidal effect was particularly higher against the *Streptococcus pneumoniae* and *Haemophilus influenzae* (Majoumouo *et al.,* 2019). It was noticed that ethanol extract of the *T. mantaly* stems has stronger

antibacterial activity against gram-positive bacteria than against gram-negative bacteria (Majoumouo *et al.,* 2019).

Conclusion

The current study concludes that *T. mantaly* leaves contain several secondary metabolites that may have pharmacological potential in addition to their antibacterial and anticancer properties. As a result, leaves may be employed in more in-depth studies on pharmacological aspects as well as in the purification of active secondary metabolites for future pharmaceutical development.

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