

CHAPTER 7

Bark of *Ficus amplissima* Sm.: - identification of novel bioactive compounds and their therapeutic implications

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Abstract: This chapter focuses on identifying therapeutic compounds from *Ficus amplissima* bark. The tree has a long history in traditional medicine for treating various health problems. However, the full range of its bioactive compounds, especially novel ones, remains largely unexplored. Present chapter aims to fill this gap by evaluating the bioactive compounds, especially in the bark of *F. amplissima*. Therefore, the chapter will analyze its bioactive compounds, which could lead to innovative natural product-based treatments for chronic diseases.

Keywords: Ethnomedicinal, ecological, pharmacological, phytochemical



INTRODUCTION

The enduring legacy of natural products in drug discovery since ancient times, natural products derived from plants, and microorganisms, have served as the keystone of medicine and continue to be an indispensable source for the discovery and development of novel therapeutic agents. Traditional medicine classifications, such as Ayurveda, Siddha, Unani, and traditional Chinese medicine, have accumulated vast empirical knowledge over millennia regarding the medicinal properties of various plant species. This rich ethnopharmacological heritage provides a powerful roadmap for modern scientific inquiry, directing researchers towards promising natural sources that warrant rigorous study for their bioactive constituents. The past few decades have witnessed a resurgence of interest in natural product plant-based for drug discovery, driven by the escalating challenges of drug resistance, the emergence of new diseases, and the growing demand for safe and effective therapies.

The genus *Ficus,* belonging to the Moraceae family, comprises over 880 species of trees, shrubs, and climbers widely distributed across tropical and subtropical regions. Many Ficus species are renowned for their traditional medicinal uses, often attributed to their rich phytochemical constituents **(Smruti et al., 2022; Sasidharan et al., 2023; Chandra et al., 2023; POWO, 2025)**. *Ficus amplissima* Smith, commonly known as "Indian Bat Fig" or "Piparee" in various regional languages. It is a large, spreading tree found extensively in India, Sri Lanka, and parts of Southeast Asia and Northern Australia. In India, it is distributed in the Himalaya, Assam, Sikkim, Kerala, Tamil Nadu, Andhra Pradesh, and Maharashtra **(Arunachalam et al., 2013)**. Figs in the months of September to February. *F. amplissima* bark holds significant therapeutic prominence. It is traditionally used for a diverse range of ailments, including diabetes, inflammatory conditions, and various skin disorders **(Arunachalam et al., 2014)**. The bark's decoction is often employed as an antidiabetic remedy, believed to help regulate blood glucose levels **(Salehi et al., 2019)**. Furthermore, its anti-inflammatory and antioxidant properties have been recognized, leading to its traditional application in wound healing and the management of inflammatory conditions. Other uses, such as leaves and branches, are used for fodder food for cows, goats and sheep. In rural areas, it is used for fuelwood and used as timber. Ripened fruit are used to make pickles **(Reddy et al., 2024)**. Apart



from its medicinal and food value, it also has ecological significance. Mostly the avian species consume the fig of *F. amplissima,* such as the Asian green bee-eater (*Merops orientalis*), rufous treepie (*Dendrocitta vagabunda*), blue -winged parakeet (*Psittacula columboides*), eurasian golden oriole (*Oriolus oriolus*), and common myna (*Acridotheres tristis*). Some faunal species also consumed the figs, such as the lesser short-nosed fruit bat (*Cynopterus brachyotis*), greater short-nosed fruit bat (*Cynopterus sphinx*), leopard (*Panthera pardus*), and Indian moorhen (*Gallinula chloropus*) **(Vanitharani et al., 2009; Mahajan and Das, 2020; Devi et al., 2022)**.

Previous investigations by many researchers on various parts of *Ficus amplissima* and other Ficus species have revealed the presence of a wide array of secondary metabolites. These include flavonoids, phenolic acids, tannins, triterpenoids (such as lupeol, lupenyl acetate, β-amyrin, and α-amyrin), steroids (like β-sitosterol, and ergost-5-en-3-ol), fatty acids (e.g., myristic acid, stearic acid, and linoleic acid), coumarins, alkaloids, and glycosides **(Smruti et al., 2022)**. These compounds are largely responsible for the pharmacological activities of Ficus species. Pharmacological studies on *Ficus amplissima* bark extracts have indeed validated several of its traditional uses. Despite the existing knowledge, the full chemical repertoire of *Ficus amplissima* bark, particularly regarding novel or previously uncharacterized compounds, remains largely unexplored. Many traditional remedies are complex mixtures, and the synergistic effects of multiple compounds may contribute to their overall efficacy. The identification of novel compounds can lead to the discovery of new pharmacophores, providing fresh insights into molecular mechanisms of action and offering unique opportunities for drug development. Aerial roots of *F. amplissima* are used for natural fiber-reinforced polymer composites. In 2029, Kumbhar et al. reported the dyeing of cotton with brown natural dye extracted from the leaves of *F. amplissima* **(Kumbhar et al., 2019; Rameshkannan et al., 2025)**. The current scenario of natural product research increasingly emphasizes the use of advanced analytical techniques to precisely identify and characterize even low-abundance compounds that might possess significant bioactivity. Traditional approaches often focused on known compound classes, potentially overlooking unique chemical entities. Therefore, a systematic and targeted approach is crucial to unlock the complete therapeutic potential of *F. amplissima* bark.

MORPHOLOGY

It is a large spreading tree, often epiphytic when young, usually without aerial roots; bark smooth, white or greenish. Leaves elliptic, oblong, narrowly ovate or ovate, 8-14 x 4-7 cm, apex very bluntly acuminate or acute to obtuse, glabrous (puberulous or pubescent), coriaceous, secondary nerves, 7-13 above the basal ones and not much stronger than the intermediate, basal nerves usually 3 and 2 weaker ones, punctulate, dots translucent when fresh, showing as minute tubercles when dry, base rounded, subtruncate (or cuneate or oblique); petiole 3-5 cm or nearly as long as the blade. Figs globose or globose-pyriform from a broad base, 1-1.5 cm diam., not wrinkled when dry, 1-2 axillary and from the leaf – scars, white or sometimes purplish, often with large not raised dots, sometimes pubescent or puberulous; basal bracts very broadly ovate, 1.2-2.7 mm, unequal, more or less connate, covering only the broad base of the figs **(Saxena and Brahmam, 1995; Figure 1-3)**.



Figure 1: Leaves of *F. amplissima*



Figure 2: Fruit of *F. amplissima*



Figure 3: Syconium of *F. amplissima*



METHODOLOGY

The bark of *F. amplissima* was collected from the State Botanical Garden, Odisha, India **(Figure 4)**. The plant species was identified by the authors. The Soxhlet extraction method was adopted using three solvents for phytochemical analysis **(Marndi et al., 2024; Figure 5-7)**. Detection of nine secondary metabolites was conducted using standard methods **(Kumar et al., 2013)**.

Qualitative phytochemical analysis (Marndi et al., 2024)

Test for tannin: About 1 ml of the bark extract was taken. Three to five drops of 10% lead acetate solution were added. The gelatinous precipitate formation confirmed the presence of tannin.

Test for saponin: About 1 ml of the bark extract was taken and 1 ml of distilled water was added and shaken well. The formation of persistent froth was observed confirming the presence of saponin.

Test for flavonoids: About 1 ml of the bark extract was taken. Two ml of 2% NaOH solution and 3 to 4 drops of dilute HCl were added. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless. This colour change in appearance confirmed the presence of flavonoids.

Test for terpenoids: About 1 ml of the bark extract was added with 5-6 drops of chloroform and placed in the water bath for a few minutes. Then 5-6 drops of concentrated sulphuric acid were added. The reddish-brown interface confirmed the presence of terpenoids.

Test for phenolic groups: About 1 ml of the bark extract was taken. A few drops of 5% ferric chloride solution were added. The dark bluish-black appearance confirmed the presence of phenolic compounds.

Test for reducing sugars: About 1 ml of the bark extract 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 some time. The presence of red-orange precipitate confirmed the presence of reducing sugar.

Test for steroids: About 1 ml of the bark extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid was added to it. The



appearance of upper red and lower yellow color with green fluorescence provided the presence of steroids.

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

Test for carbonyl compounds: About 1 ml of the bark extract was taken and 3 to 4 drops of 2,4- Dinitrophenylhydrazine (DNPH) reagent was added. The formation of yellow crystals confirmed the presence of carbonyl compounds.

RESULTS AND DISCUSSION

During the literature survey it was revealed that the use of fruit, leaves and latex is used to cure various ailments. The preliminary phytochemical screening of the three extracts (N-hexane, methanol and ethanol) revealed the presence of tannin, saponin, reducing sugars and alkaloids **(Table 1; Figure 5-7)**. Tannin, saponin, and alkaloids are present in methanolic and ethanolic extracts. Reducing sugars are present in all three extracts.

Table 1: Phytochemical screening using different extracts of *F. amplissima*

Bioactive Compounds	N- Hexane extract	Methanolic extract	Ethanolic extract
Tannin	-	+	+
Saponin	-	+	+
Flavonoid	-	-	-
Terpenoids	-	-	-
Phenolic compound	-	-	-
Reducing sugars	+	+	+
Steroids	-	-	-
Alkaloids	-	+	+
Carbonyl Compound	-	-	-

(+**ve** – Positive; **-ve** – Negative)



Figure 4: Bark sample for phytochemical screening

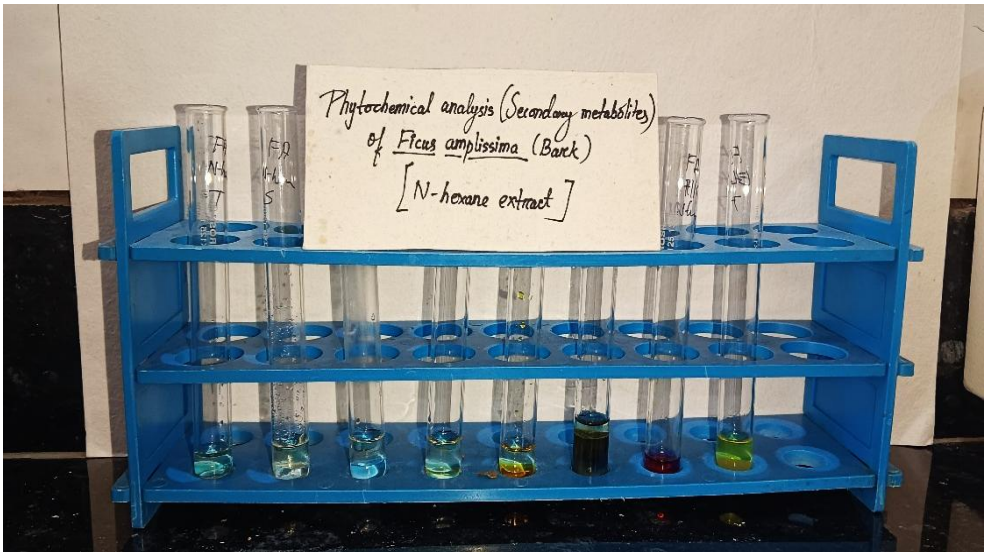


Figure 5: Phytochemical analysis (Secondary metabolites) of *F. amplissima* (Bark) of n- hexane extract

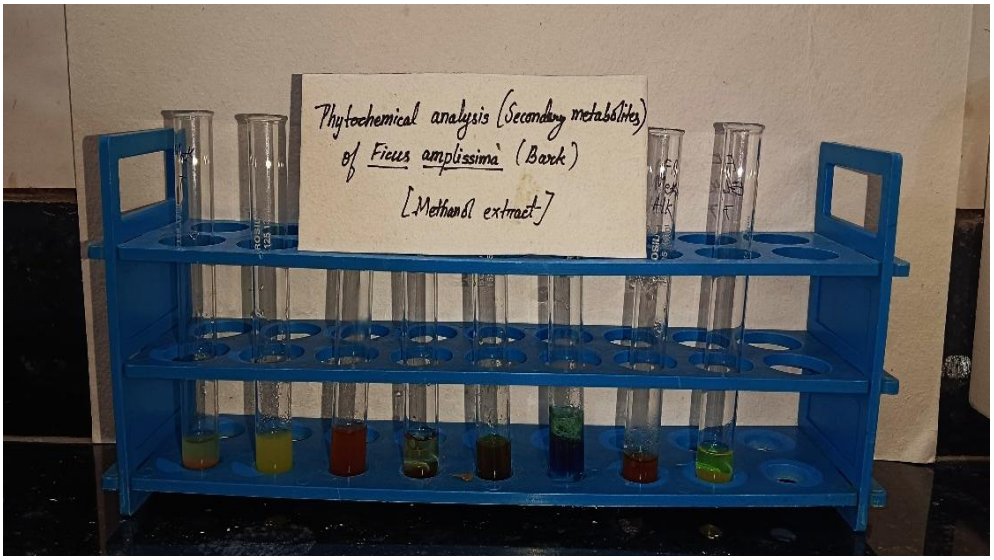


Figure 6: Phytochemical analysis (Secondary metabolites) of *F. amplissima* (Bark) of methanolic extract

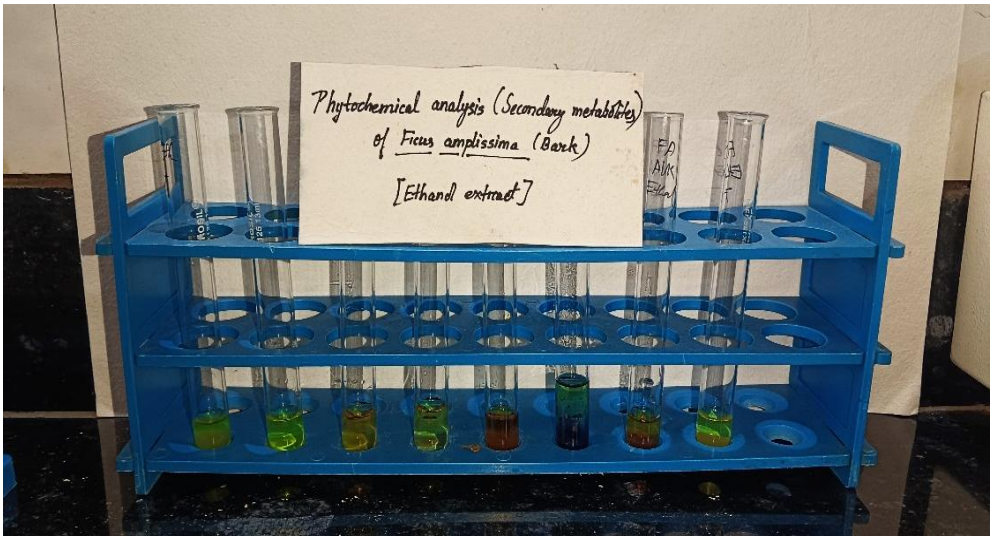


Figure 7: Phytochemical analysis (Secondary metabolites) of *F. amplissima* (Bark) of ethanolic extract

According to Table 2, through tentative literature survey it concluded that bark, figs, fruit, latex and leaves are used to treat diabetes, mouth ulcers, mentally deranged, and wound healing in the form of decoction, raw and paste.



Table 2: Ethnomedicinal uses of *F. amplissima*

Plants parts	Mode of uses	Diseases	Sources
Bark	Decoction	Diabetes	Reddy et al., (2024); Arunachalam et al., (2013)
Figs	Raw	Mouth ulcers	Reddy et al., (2024)
Fruit	Raw	Mentally deranged	Arunachalam et al., (2014)
Latex	paste	Wound	Reddy et al., (2024)
leaves	Paste	Wound healing	Reddy et al., (2024)

Research has demonstrated its significant antidiabetic activity, with studies showing a dose-dependent reduction in fasting blood glucose levels in diabetic models. The mechanisms proposed for its antidiabetic effects include improved insulin sensitivity, inhibition of glucose absorption, and regulation of enzyme activities involved in glucose metabolism **(Salehi et al., 2019)**. Moreover, the bark extracts have exhibited notable anti-inflammatory and antioxidant properties in various in vitro and in vivo assays **(Smruti et al., 2022).** These activities are often attributed to the presence of phenolic compounds and flavonoids, which are known free radical scavengers and modulators of inflammatory pathways. According to Table 3, it concluded that the plant parts such as bark, leaves and fruit possess antidiabetic, antioxidant, anti-inflammatory, anti-hyperglycemic, wound-healing and antibacterial activity. Bark possesses antidiabetic, antioxidant, anti-hyperglycemic and anti-inflammatory properties. Leaves possess anti-inflammatory, wound-healing, and antibacterial activity. Fruit possesses antioxidant activity.



Table 3: Pharmacological aspects of *F. amplissima*

Plant parts	Pharmacological values	Sources
Bark	Antidiabetic and antioxidant	Reddy et al., (2024); Arunachalam and Parimelazhagan, (2013)
Bark	Antioxidant, anti-inflammatory	Murugan et al., (2012)
Bark	Anti-hyperglycemic	Sindhe et al., (2016)
Fruit	Antioxidant	Thangaraj, (2013)
Leaves	Anti-inflammatory	Reddy et al., (2024)
Leaves	Wound healing	Arunachalam and Parimelazhagan, (2013)
Leaves	Antibacterial	Prabu and Johnson, (2015)

CONCLUSION

These widespread traditional applications strongly suggest the presence of potent bioactive compounds within the bark of *Ficus amplissima*. Apparently, the literature survey concluded that there was less documentation of the ethnomedicinal and pharmacological activity of *Ficus amplissima* compared to some other well-studied medicinal plants. The perception is that the sheer diversity within the *Ficus* genus means that research efforts might be fragmented across many species, rather than concentrated on a few, potentially leading to less in-depth documentation for any single lesser-known species. Therefore, keeping this in view, an attempt has been made to put a limelight on the ethnomedicinal and pharmacological activities of



bark *F. amplissima,* which could aid in the development of natural product-derived drugs for chronic disease.

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