

CHAPTER 3

Investigating the bioactive compounds and the therapeutic potential of *Ficus hispida* L.f.

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Abstract: *Ficus hispida*, a species of fig tree group, is widely utilized in traditional medicine for its diverse therapeutic applications. This abstract summarizes investigations into its bioactive compounds and their associated therapeutic potential. Phytochemical analyses revealed that *F. hispida* is rich with diverse secondary metabolites. These compounds collectively contribute to a broad spectrum of pharmacological activities. Literature studies have also reported its significant hepatoprotective, antioxidant, and anti-inflammatory properties, validating its traditional uses for liver ailments and inflammatory conditions. The chapter aims to provide an ethnomedicinal, pharmacological and phytochemical analysis of the bark of *F. hispida*. The wealth of bioactive compounds underscores its considerable therapeutic potential, warranting further research to elucidate specific mechanisms and develop evidence-based phytomedicines.

Keywords: Ethnomedicinal, ecological, pharmacological, phytochemical



INTRODUCTION

The escalating global demand for natural product-derived pharmaceuticals has invigorated research into traditional medicinal plants, which serve as invaluable reservoir of novel bioactive compounds. Among these, *Ficus hispida* L.f., commonly known as the "Hairy Fig", belong to family Moraceae. Name *F. hispida* is derived from the Latin word Fik-us for “Fig” and Hiss-pih- duh for “with bristly hairs”. It is commonly known as devil fig, hairy fig. In India, it is recognised by different names in Odia and "Dimri or baidimri", hindi as “gobla, kagsha, kala umbar belonging to the Moraceae family, stands out as a prominent species with a rich history of ethnomedicinal use **(Ali and Chaudhary, 2010)**. *Ficus hispida* linn. Synonymed as *Covellia hispida* (L.f.) Miq., *Gonosuke hispida* (L.f) Raf., *Ficus glomerata* Roxb. **(POWO, 2025)**. Distributed across tropical and subtropical regions of Asia, including India, China, and Australia, this moderate-sized tree is deeply embedded in various traditional healthcare practices, notably Ayurveda, Siddha, and Unani medicine. Its Fruiting period is November to July. It is found commonly in waste lands near roadisde areas. Historically, different parts of *F. hispida*, including its leaves, fruits, bark, and roots, have been employed by indigenous communities and traditional practitioners to treat a wide array of ailments. These traditional applications span conditions such as inflammatory disorders, liver dysfunctions (e.g., jaundice, hepatitis), gastrointestinal complaints (e.g., diarrhea, dysentery, ulcers), skin diseases (e.g., psoriasis, vitiligo), anemia, diabetes, and even as an anti-hemorrhagic and lactagogue. According to some litrature fruits of *F. hispida* are considered as emetic, demulcent, laxative, purgative and lactagogue properties and is used for jaundice, oedema, anaemia, leucoderma, antihaemorrhagic and vitiligo. **(Ramasamy et al., 2011; Shrikumar et al., 2024)**.

The widespread and diverse therapeutic claims associated with *F. hispida* strongly suggest the presence of a complex array of biologically active chemical constituents. In recent decades, scientific scrutiny has increasingly focused on *F. hispida* to validate its traditional uses and to explore its therapeutic potential through modern pharmacological approaches. Comprehensive phytochemical investigations have revealed a rich profile of secondary metabolites, including alkaloids, terpenoids, flavonoids, phenols, and sterols. Leaves and root contains leanolic acid, bergapten, β-sitosterol, β-



amyrine, hispidin. In another study, a new norisoprenoid, ficustriol, phenanthroindolizidine alkaloid O methyltylophorinidine7, palmitic oil, 9,12-octadecadienoic acid, hexadecanoic acid ethyl ester, linalool, 1-hydroxylinalol,1 hydroxylinalool and benzyl alcohol have been reported **(Ravichandra and Paarakh, 2011)**. The bark was stated in imitation to contain 10-ketotetracosylarachidate, β-amyrine acetate, β-sitosterol lupeol acetate, β-amyrin and triacontanolacetate. The availability on a number of volatiles have been reported from the fruit, which include linalool, linalool oxide, terpeneol, and 2,6-dimethyl-1,7- octadiene-3,6-diol. Plant additionally includes ficus hispimines A and B, ficus hispidine, hispiloscine, N-triacontanyl acetate, ficusin A. Two enormous phenanthroindolizidine alkaloids, 6-Omethyltylophorinidine and 2-demethoxytylophorine and a novel biphenyl hexahydroindolizine hispidine have been reported from stem and leaves **(Markate et al., 2024)**. Amphetamine, piperidine, pyrrolidine, and isoquinoline alkaloids have been reported from this plant previously Amine alkaloids with a rhamnosyl group or with N-oxide moiety were discovered for the frst time from the genus *Ficus*. In 2020, Jia et al., reported Four new alkaloids, ficuhismines A-D (1-4), together with three known ones, were isolated from *F. hispida*. Two new pyrrolidine alkaloids, ficushispimines A and B, a new ω-(dimethylamino)caprophenone alkaloid, ficushispimine C, and a new indolizidine alkaloid, ficushispidine were also reported. In stem, bark and leaves it contains hispidacine, an 8,4'-oxyneolignan featuring incorporation of an unusual 2-hydroxyethylamine moiety at C-7, and hispiloscine, a phenanthroindolizidine alkaloid, **(Sanchez et al., 2002; Yap et al., 2015; Shi et al., 2016; Jia et al., 2020; Choudhury et al., 2021; Shrikumar et al., 2024)**. These compounds are believed to be responsible for the plant's documented pharmacological activities, such as antioxidant, anti-inflammatory, hepatoprotective, antidiabetic, antimicrobial, and significant anticancer properties **(Zhang et al., 2017; Jia et al., 2020; Anvitha et al., 2022)**.

This chapter aims to provide a comprehensive overview of the current scientific understanding of *Ficus hispida*, with a particular focus on its key bioactive compounds and a critical evaluation of their therapeutic potential. By systematically reviewing the existing literature, this study seeks to consolidate the evidence supporting its traditional uses and to highlight for future pharmacological research and potential drug development.

MORPHOLOGY

It is a small tree; branches hispid with hollow or sometimes solid internodes. Leaves mostly opposite, obovate, obovate- oblong or ovate- oblong, 11-36 x 6-23 cm, toothed, rarely entire, obtuse or obtusely acuminate, scabrous above, hispid, especially on the nerves beneath, base obtuse, rounded or cordate, mostly 5 – nerved, secondary nerves 6-8, strong and raised beneath, looping close to the margin; petiole 1.3-7 cm. Figs numerous, fascicled on both the trunk and branches, often on leafless drooping branches, also sometimes axillary, globose, 2-2.6 cm diam., yellowish when ripe, tomentose or closely shortly hairy, umbo prominent, base narrowed to a slender or very short stalk with scattered bracts. Style hispid; stigma tubular. Male flowers very few. There are usually four oval, spear shaped bumps and they appear on leafless fruit trees. The inflorescence is of the syconium type, clustered in tubules on the main stem, older branches and sometimes on pendulous leafless branches **(Saxena and Brahmam, 1995; Figure 1-4).**



Figure 1: Leaves of *F. Hispida*



Figure 2: Bark of *F. hispida*



Figure 3: Fruit of *F. hispida*



Figure 4: Syconium of *F. hispida*

METHODOLOGY

The bark of *F. hispida* was collected from the nearby Mahanadi River area of Cuttack district of Odisha, India. The plant species was identified by the authors **(Figure 5; Nayak and Kumar, 2023)**. The Soxhlet extraction method was adopted using three extracts n-hexane, methanol and ethanolic extract for phytochemical analysis **(Marndi et al., 2024)**. Detection of nine secondary metabolites was conducted using standard methods **(Kumar et al., 2013; Marndi et al., 2024)**.

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 changes 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 were added. The formation of yellow crystals confirmed the presence of carbonyl compounds.

RESULTS AND DISCUSSION

The phytochemical analysis concerning a variety of section over plant *F. hispida* revealed the availability of tannins, saponin, terpenoids, reducing sugars (**Figure 6-8**), alkaloids and many more bioactive compounds through literature aspects, which act as a palliative of pain, inflammation, fever, diarrhoeal, neuro-pharmacological disorders, antioxidants and diabetes etc. Tannin and saponin are present in ethanol and methanol extract. Terpenoid is

present in n-hexane extract. Alkaloids are present in ethanol extract. Reducing sugars is present in all three extracts **(Table 1)**.

Table 1: Phytochemical analysis of bark of *F. hispida*

Bioactive compounds	N- Hexane extract	Ethanol extract	Methanol extract
Tannin	-	+	+
Saponin	-	+	+
Flavonoid	-	-	-
Terpenoids	+	-	-
Phenolic compounds	-	-	-
Reducing sugars	+	+	+
Steroids	-	-	-
Alkaloids	-	+	-
Carbonyl compound	-	-	-

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



Figure 5: Bark sample for photochemical analysis

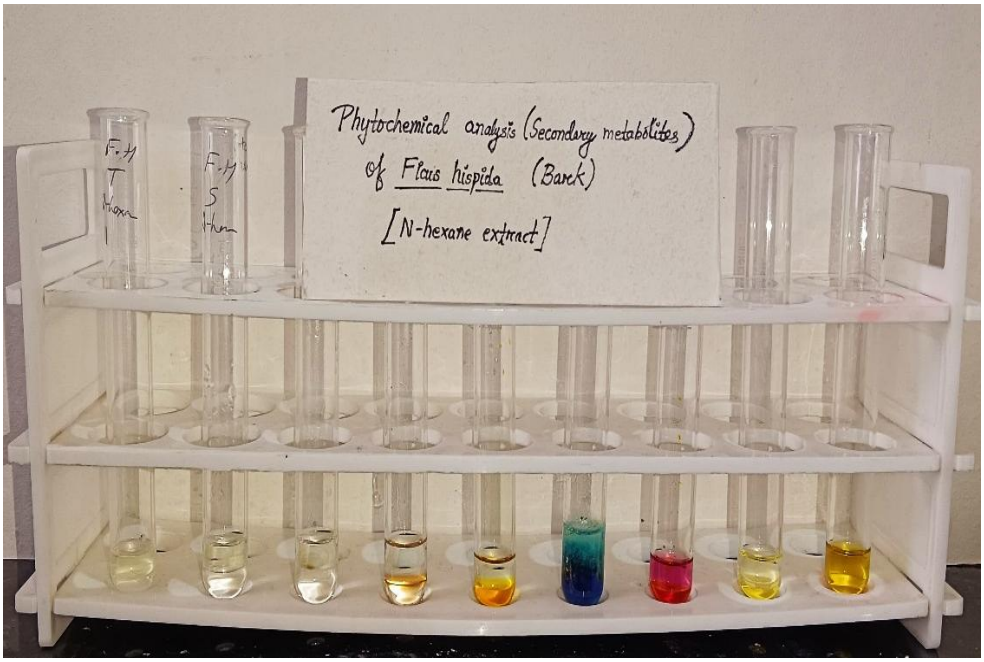


Figure 6: Phytochemical analysis (Secondary metabolites) of *F. hispida* (Bark) of n-hexane extract

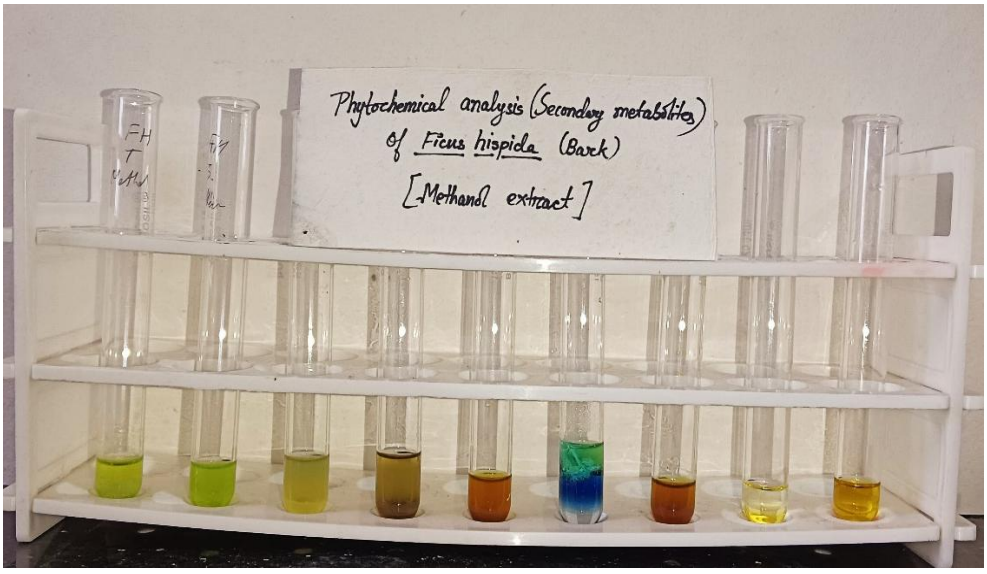


Figure 7: Phytochemical analysis (Secondary metabolites) of *F. hispida* (Bark) of methanolic extract

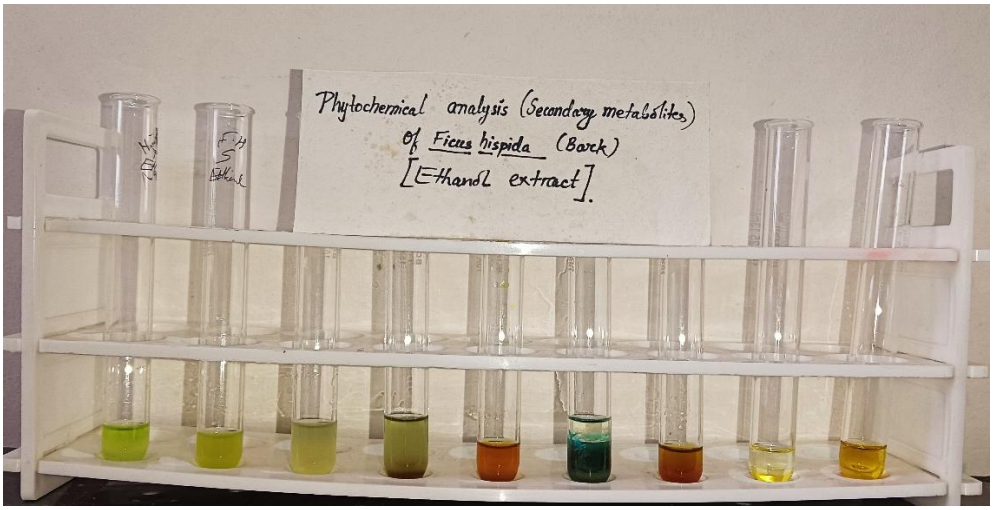


Figure 8: Phytochemical analysis (Secondary metabolites) of *F. hispida* (Bark) of ethanolic extract

Historically, *F. hispida* has been used for back in dates to the times of Charaka. The tribals of Meghalaya use the unripe fruit for preparation of curry. In village of Khatra, Bankura, west Bengal in India, people chew the leaves is used to treat diarrhea **(Ali and Chaudhary, 2010)**. From Table 2, it is concluded that mostly the leaves and fruits are used to treat various ailments such as coolant agent, diarrhea, hemorrhage, dysentery, ringworm, earache and purgative.

Table 2: Ethnomedicinal uses of *F. hispida*

Plant parts	Mode of uses	Diseases	Sources
Fig	Juice	Mild purgative	Chatterjee et al., (2015)
Fig	Juice	Hemorrhage	Chatterjee et al., (2015); Salvi et al., (2013)
Fruit	Juice	Tonic	Choudhury et al., (2021)
Latex	Paste	Ringworm	Salvi et al., (2013)
Leaves	Raw	Diarrhea	Shrikumar et al., (2024)



Leaves	Decoction	Cough	Salvi et al., (2013)
Leaves	Juice	Ear-ache	Salvi et al., (2013)
Leaves and bark	Decoction	Dysentery and diarrhoea	Li, (2021)
Ripe fruit	Paste	Goitre	Salvi et al., (2013)
Root	Decoction	Leukoderma	Salvi et al., (2013)
Root and bark	Decoction	Blood purifier	Salvi et al., (2013)

Literature survey revealed that various plant parts of *F. hispida* contain various pharmacological activities. In Table 3, it concluded that leaves, root, bark and fruit have various pharmacological activities such as antihemorrhagic, anti-diarrheal, anti-inflammatory, antitumor, antioxidant, anti-corrosive, antioxidant, and hypoglycemic activity.

Table 3: Pharmacological activities of *F. hispida*

Part used	Pharmacological activities	Sources
Bark	Hypoglycemic activity	Shrikumar et al., (2024)
Fig	Anti-obesity	Sharma et al., (2024)
Fruit	Anti-hemorrhagic activity	Choudhury et al., (2021)
Fruits	Anticancer	Zhang et al., (2018)
Leaves	Anti-diarrheal activity	Choudhury et al., (2021); Shrikumar et al., (2024)
Leaves	Anti-inflammatory activity	Choudhury et al., (2021); Ali and Chaudhary, (2010); Jia



		et al., (2020); Smruti et al., (2022)
Leaves	Anti-corrosive activity	Choudhury et al., (2021)
Leaves	Antioxidant activity	Shrikumar et al., (2024); Chatterjee et al., (2015)
Leaves	Neuropharmacological activity	Shrikumar et al., (2024)
Leaves	Antimicrobial activity	Chatterjee et al., (2015)
Leaves	Cardioprotective effect	Ali and Chaudhary, (2010)
Leaves	Anticonvulsant effect	Ali and Chaudhary, (2010)
Root	Antiulcerogenic effect	Ali and Chaudhary, (2010)
Roots	Wound healing	Choudhury et al., (2021)
Stem	Antitumor activity	Shrikumar et al., (2024)

ECOLOGICAL SIGNIFICANCES

The selected plant of present study has ecological values. Figs are consumed by bats and palm civets (Shrikumar et al., 2024). *F. hispida* engages in an obligate, species-specific mutualism with pollinating fig wasps (e.g., *Ceratosolen solmsi*). The fig syconium serves as a nursery for the fig wasp larvae, in return, the female wasps pollinate the enclosed flowers **(Pereira et al., 2000; Rong et al., 2002)**. The ripe figs are a vital food source for a diverse range of frugivorous animals, including birds, bats and various mammals **(Borges et al., 2008; Dev et al., 2010)**.

CONCLUSION

Ficus hispida, is a medicinally significant tree with a rich ethnomedicinal history, particularly in Asian traditional practices. Scientific investigations



have largely validated its traditional uses, revealing a diverse phytochemical profile responsible for its broad therapeutic potential for pharmacological factors. Present chapter highlights the bioactive compounds especially present in its bark through phytochemical screening. The finding provide valuable insights into its food, medicinal, ecological uses and rigorous clinical trials is essential to translate its traditional wisdom into evidence-based modern therapeutics.

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