



CHAPTER 1

Comprehensive Analysis of *Streblus asper* Lour.- Ethnobotanical Relevance, Pharmacological Potential, and Bark Phytochemistry

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Abstract: *Streblus asper* Lour., commonly known as the “toothbrush tree”, holds significant ethnobotanical, pharmacological, and ecological importance. Ayurvedic and local medicinal practices traditionally utilize it for dental hygiene, skin ailments, and gastrointestinal disorders. The plant exhibits diverse pharmacological activities. Phytochemical investigation reveals the presence of cardiac glycosides, flavonoids, tannins, and saponins in the bark, contributing to its antimicrobial, anti-inflammatory, antioxidant, anticancer, and antidiabetic properties. Present work summarizes the current understanding of *S. asper*, particularly emphasizing the bark’s chemical constituents and their therapeutic potential. The chapter aims to provide a phytochemical analysis of the bark of *S. asper*, which is a crucial source of bioactive compounds.

Keywords: Ethnomedicinal, ecological, pharmacological, phytochemical

INTRODUCTION

According to POWO, a total of 880 accepted *Ficus* species were recorded (POWO, 2025). *Ficus* were originally split into several genera in the mid–



1800s, providing the basis for a subgeneric classification when reunited into one genus in 1867. In 1965, E.J.H. Corner reorganized the genus based on the breeding system, uniting these four dioecious subgenera into a single dioecious subgenus, *Ficus*. Monoecious figs were classified within the subgenera *Urostigma*, *Pharmacosycea* and *Sycomorus*. **(Weiblen, 2000; Corner, 1965)**. King (1887-88) provided the first systematic account of the Indian *Ficus*, recording 113 species and 47 infraspecific taxa across British India. Of these, only 75 species and 16 infraspecific taxa were reported from India. More recently, based on morphological features and distributional patterns, the genus has been reclassified into six genera, 19 sections, and 27 subsections **(Lepcha and Sharma, 2021)**. The genus *Streblus* Lour., a captivating member of the 'Fig' family (Moraceae), encompasses approximately 25 species **(Mabberley, 2008; Berg, Corner & Jarrett, 2006)** distributed primarily throughout tropical and subtropical Asia **(Singh et al., 2012)**. In China, the genus is represented by seven species, viz., *S. taxoides* (Roth) Kurz, *S. tonkinensis* (Dubard & Eberhardt) Corner, *S. asper* Lour., *S. indicus* (Bureau) Corner, *S. zeylanicus* (Thwaites) Kurz, *S. ilicifolius* (S. Vidal) Corner and *S. macrophyllus* Blume (Singh et al., 2012). In India, the genus is represented by five species **(Roy et al., 2013)**. *S. asper* Lour., *S. ilicifolius* (S. Vidal) Corner, *S. indicus* (Bureau) Corner, *S. taxoides* (Roth) Kurz, and *S. zeylanicus* (Thwaites) Kurz. Literature review indicated that four *Streblus* species are recorded from Northeast India; *S. asper*, which is distributed throughout the regions; *S. ilicifolius*, found in Mizoram; *S. indicus*, occurring in Assam and Meghalaya; and *S. zeylanicus*, reported from Assam **(Kanjilal et al., 1940; Roy et al., 2013)**. *Streblus asper* Lour., a member of the Moraceae family, stands as a plant of significant historical and contemporary relevance, particularly within the traditional medicinal systems of South and Southeast Asia. Commonly known as the “toothbrush tree”, this species has been employed for centuries in ethnobotanical practices, addressing a diverse spectrum of ailments. Flowering January to March, and fruiting April to May. It is distributed in several countries throughout India, Sri Lanka, Thailand, China, Malaysia, Philippines and Vietnam. In India, it is found in Assam, Andaman Islands, Maharashtra, Odisha, Tamil Nadu, and Uttar Pradesh **(Sen and Behera, 2024)**. Its widespread use in traditional medicine has spurred scientific interest in its pharmacological potential, leading to investigations into its chemical constituents. Among the various parts of the plant, the bark has emerged as a



particularly valuable source of bioactive compounds. Apart from the medicinal value it possesses cultural values, as it is recognized as ‘Sthalavriksha’ or sacred plant in Tamil Nadu (**Sen and Behera, 2024**).



Figure 1: Flowers of *S. asper* in natural habitat

The root and bark of *S. asper* possess rich compounds such as cardiac glycosides, kamloside, asperoside, strebloside, indroside, canno-dimemoside, strophalloside, strophanolloside, 16-O-acetyl-glucogitomethoside, glucogitodimethoside, glucokamloside, sarmethoside and glucostrebloside. Many researchers reported on root containing b-sitosterol-3-O-b-d-arabino-furanosyl-O-a-l-rhamnopyranosyl-O-b-d-glucopyranoside, and lupanol-3-O-b-d-glucopyranosyl-[1-5] -O-b-d-xylofura-noside and vijalosite, i.e., periplogenin-3-O-b-d-gluco-pyranosyl-1-5] -O-b-d-xylopyranoside. The root contains lupeololeate, sterblusteryl palmitate, lupeollinoleate, cerotic acid, stigmasterol palmitate, and octacosanoic acid (**Aeri et al., 2015; Figure 6**). It mainly focuses on comprehensively exploring the ethnomedicinal, pharmacological and ecological significance of *S. asper*, with a focused investigation of the phytochemical profile of its bark. Present study highlighted the therapeutic potential of the bark's constituents and their contributions to the plant's



overall medicinal efficacy, while also acknowledging the ecological role of this important plant.

MORPHOLOGY

It is a rigid, much branched shrub or small tree; bark is rough, stringy, and light grey. Leaves very shortly petioled, obovate or rhombic-elliptic, obscurely toothed, acute, subacute or acuminate, stiff, scabrid on both sides, secondary nerves 7-9, nervules raised beneath; petiole 2-3mm; stipules 2.5 mm long. Male heads 5.9-7.3 mm diam., on 1-3 nate peduncles, nearly as long, or up to 1.2 cm; bracts very small, ovate, under 1.2 mm long, outer involucre. Flowers peduncles are 7.5-10 mm; bracts are 2-3, 1.8-2 mm long at the top supporting the flower. Tepals are free but closely wrapping round the ovary, 2-2.5 mm. Style 1.8 mm, excluding the 7.5 mm long arms. Fruits yellow, succulent, globose, 3.7 mm diam. (Saxena and Brahmam, 1995; Figures 1-3).

METHODOLOGY

The bark of *S. asper* was collected from the nearby Mahanadi River area of Cuttack district of Odisha, India. The plant species was identified by the authors (Figure 4; Nayak and Kumar, 2023). The Soxhlet extraction method was adopted using three solvents for phytochemical analysis (Kumar et al., 2013; Marndi et al., 2025). Detection of nine secondary metabolites was conducted using standard methods (Devi et al., 2023; Jena et al., 2024; Marndi et al., 2024; Mehra et al., 2025).

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.



Figure 2: Habit and leaves of *S. asper*



Figure 3: Fruit of *S. asper*

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 field survey, it was noticed that tribal communities of Odisha use the plant parts of *S. asper* for medicinal purposes, as the leaves are used to treat cuts and wounds. For some avifaunal species, it is also one of the sources of food (Figure 6).

Table 1: Phytochemical screening using different extracts of *S. asper* bark

Bioactive compounds	Hydro-ethanolic extract
Tannin	+
Saponin	-
Flavonoid	-
Terpenoids	-
Phenols	+
Reducing sugars	+
Steroids	-
Alkaloids	+

(+ve – Positive; -ve – Negative)

Mostly the frugivorous avifaunal species consume the tender flowers and ripen fruits. Since all parts of *S. asper* show medicinal values but less documentation on its bark. Keeping this in mind, their medicinal uses and biochemical studies were carried out in the bark to identify qualitative secondary metabolites which could exhibit pharmacological activity. It was observed that tannin, phenols, reducing sugars and alkaloids are detected in hydro-ethanolic extracts of *S. asper* (Table 1; Figures 4-5).



Figure 4: Bark of *S. asper* for phytochemical analysis

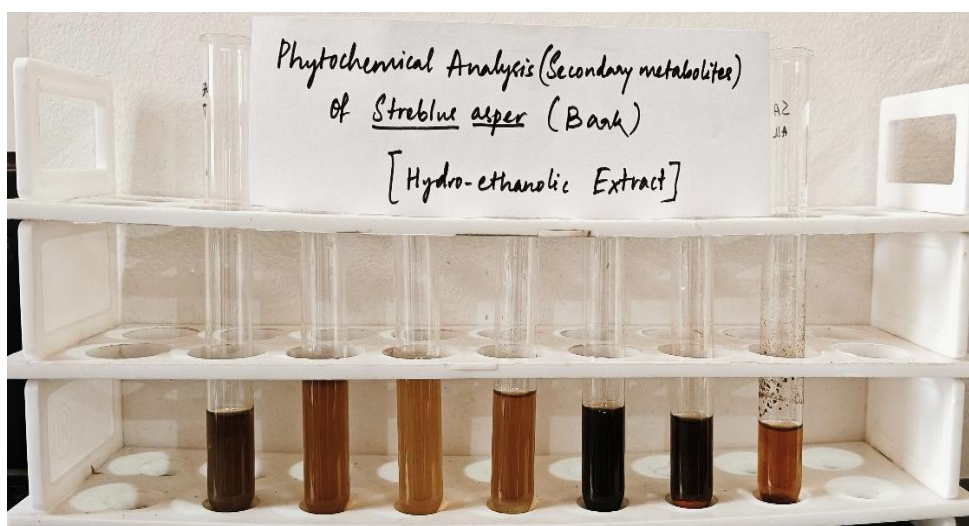


Figure 5: Screening of secondary metabolites using hydro-ethanolic extract

The presence of tannin may be responsible for astringent effects, anti-inflammation activity, antidiarrheal activity, hemostatic activity, antioxidant activity, antimicrobial activity, and anti-ageing (Makkar et al., 1987; Cosme et al., 2025; Lin et al., 2001; Czerkas et al., 2024). Phenols can exhibit antioxidant, anti-inflammatory, antimicrobial, antidiabetic, anticancer activity and neuroprotective effects (Platzer et al., 2022; Kauffmann and Castro, 2023; Chimento et al., 2023; Williamson and Sheedy, 2020). Alkaloids may be responsible for analgesic, antibacterial, antimalarial, and anticancer effects (Heinrich et al., 2021; Dey et al., 2020). Other researchers



are also reported the medicinal uses. As per the literature review, it concludes that mostly leaves and roots are considered for treating different diseases such as toothache, diabetes, dysentery, piles, ulcers, and fever as modes of decoction, infusion, paste, and powder (**Table 2**).

Table 2: Ethnomedicinal uses of *S. asper*

Plant parts	Mode of uses	Diseases	Sources
Bark and stem	Powder	Toothache	Pandey and Rastogi, (2022); Aeri et al., (2015)
Bark	Infusion	Digestive system disorders	Pandey and Rastogi, (2022)
Bark	Paste	Acne	Sen and Behera, (2024)
Leaves	Paste	Cuts and wounds	Present study
Leaves	Decoction	Diabetes	Pandey and Rastogi, (2022); Rahman et al., (2021)
Leaves	Juice	Dysentery	Pandey and Rastogi, (2022); Kumar and Saravanan, (2022)
Leaves	Decoction	Piles	Sen and Behera, (2024)
Root	Juice	Ulcers	Rastogi et al., (2006)
Root	Juice	Fever	Pandey and Rastogi, (2022)



Root	Paste	Menorrhoea	Sen and Behera, (2024); Neekhra et al., (2017)
Seed	Powder	Ringworm	Sen and Behera, (2024)
Stem	Decoction	Constipation	Sen and Behera, (2024)

Traditional uses are being investigated by modern science, with studies showing potential for antimicrobial, anti-inflammatory, antioxidant, anticancer and other pharmacological activities. Through literature data, it concludes that mostly in leaves, bark, and stems possess various pharmacological activities (**Table 3**).

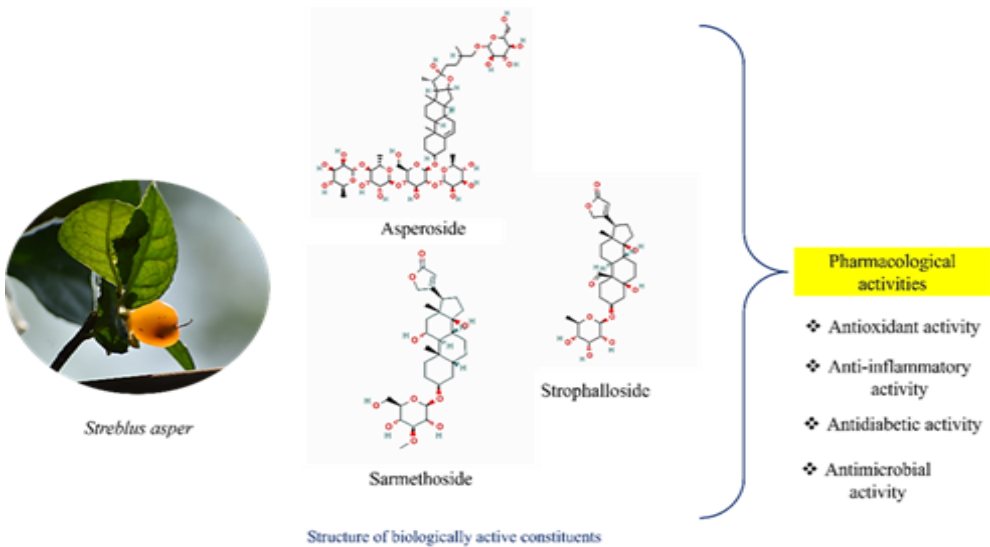


Figure 6: Structure of biologically active constituents in *S. asper*

Table 3: Pharmacological values of *S. asper*

Plants parts	Pharmacological values	Sources
Leaves	Antioxidant activity	Pandey and Rastogi, (2022)



Leaves	Anti-inflammation activity	Pandey and Rastogi, (2022)
Leaves	Antimicrobial activity	Pandey and Rastogi, (2022); Rastogi et al., (2006)
Leaves, stem, bark and root	Antidiabetic activity	Pandey and Rastogi, (2022)
Root bark	Cardiotonic activity	Neekhra et al., (2017); Madhavan et al., (2009)
Stem bark	Anticancer activity	Rastogi et al., (2006)
Stem bark	Antifilarial activity	Neekhra et al., (2017)



Figure 7: Ecological services of *S. asper* many bird's species consume the flowers and fruits



ECOLOGICAL FACTORS

The present field survey provides a glimpse of *S. asper* in an ecological factor (**Figure 7**). At the time of the flowering and fruiting period, in the months of January to March and April to May, many frugivorous birds are active. The fruits are consumed by various birds (e.g., Bulbuls, Mynas) which act as an important seed disperser for the species. Apart from bird's other small animals consume it (**Aruna and Balasubramanian, 2014**).

CONCLUSION

Streblus asper, a wild edible fruiting plant, has been found to possess significant medicinal, pharmacological, and ecological importance. Present study highlights the bioactive compounds present in its bark through phytochemical screening. The findings provide valuable insights into its food, medicinal, and ecological uses, emphasizing the need for advanced research and conservation efforts to harness its potential.

REFERENCES

- Aeri V, Alam P, Ali M, and Naquvi KJ. (2015). Lupene- type triterpenic and steroidal constituents from the roots of *Streblus asper* Lour. Journal of Scientific & Innovative Research. 4(3): 142-145.
- Aruna R, and Balasubramanian P. (2014). Fruiting phenology and avian frugivory of *Streblus asper* Lour. In a mixed dry deciduous forest, Western Ghats, India. International Letters of Natural Sciences.
- Chimento A, Luca AD, D'Amico M, Amicis FD, and Pezzi V. (2023). The involvement of Natural polyphenols in molecular mechanisms inducing apoptosis in tumor cells: a promising adjuvant in Cancer therapy. International Journal of Molecular Sciences. 24(2): 1680.
- Corner EJH. (1965). Check-list of *Ficus* in Asia and Australasia with keys to identification. The Gardens' Bulletin Singapore. 21 (1): 1–186.
- Cosme F, Aires A, Pinto T, Oliveira I, Vilela A, and Goncalves B. (2025). A comprehensive review of bioactive tannins in foods and beverages: functional properties, health benefits, and sensory qualities. Molecules. 30(4): 800.



- Czerkas K, Grabarek EO, Lomanowska M, Abdulladjanova N, and Sekowski S. (2024). Antibacterial activity of plant polyphenols belonging to the tannins against *Streptococcus mutans* – potential against dental caries. *Molecules*. 29(4): 879.
- Dey P, Kundu A, Kumar A, Gupta M, Lee BM, Bhakta T, Dash S, Kim HS. (2020). Analysis of alkaloids (indole alkaloids, isoquinoline alkaloids, tropane alkaloids). *Recent Advances in Natural Products Analysis*. 20: 505-567.
- Heinrich M, Mah J, and Amirkia V. (2021). Alkaloids used as medicines: Structural phytochemistry meets biodiversity – an update and forward look. *Molecules*. 26(7): 1836.
- Kauffmann AC and Castro VS. (2023). Phenolic compounds in bacterial inactivation: a perspective from Brazil. *Antibiotics (Basel)*. 12(4): 645.
- Kumar A and Saravanan. (2022). Physiochemical evaluation and phytochemical screening of *Streblus asper* leaves. *International Journal of Research and Analytical Reviews*. 9(3): 285- 292.
- Kumar A and Saravanan. (2022). Physiochemical evaluation and phytochemical screening of *Streblus asper* leaves. *International Journal of Research and Analytical Reviews*.
- Kumar S, Behera SP and Jena PK. (2013). Validation of tribal claims on *Dioscorea pentaphylla* through phytochemical screening and evaluation of antibacterial activity. *Plant Science Research*. 35: 55-61.
- Lepcha C and Sharma BK. (2021). Diversity of *Ficus* L. (Moraceae) and its uses in Sikkim Himalayas (India). *International Journal of Botany*. 11(2): 39-56.



- Lin CC, Hsu YF, Lin Tc. (2001). Antioxidant and free radical scavenging effects of the tannins of *Terminalia catappa* L. Anticancer Research. 21(1A): 237-43.
- Makkar HP, Dawra RK, Singh B. (1987). Protein precipitation assay for quantitation of tannins: determination of protein in tannin – protein complex. Anal Biochem. 166(2): 435-9.
- Marndi S, Barik M, and Kumar S. (2024). Phytochemical and cytotoxicity analysis of *Eulophia explanata* Lindl. (Tuber extracts). African Journal of Biological Sciences. 6(Si4): 2756-6.
- Neekhra S, Awasthi H, and Singh DCP. (2017). Potential therapeutic use of *Streblus asper*: a review. International Journal of Research and development in Pharmacy and Life Science. 6(7): 2845-2849.
- Pandey MM and Rastogi S. (2022). *Streblus asper*: a phytochemical, ethnopharmacological and pharmacological research update. Journal of Pharmacognosy and Phytochemistry. 11(3): 07-18.
- Platzer M, Kiese S, Tybussek T, Herfellner T, Schneider F, Weisz US, Eisner P. (2022). Radical scavenging mechanisms of phenolic compounds: a quantitative structure- property relationship (QSPR) study. Frontiers in Nutrition. 9: 882458.
- POWO (2025). Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew.
- Rahman MO, Alqahtani AS, Huda SB, Siddiqui SA, Noman OM, Nasr F, Hassan MA, Islam SN. (2021). *Streblus asper* attenuates alloxan-induced diabetes in rats and demonstrates antioxidant and cytotoxic effects. Pharmaceutical Biology. 59(1): 1056-1062.
- Rastogi S, Kulshreshtha DK, and Rawat AKS. (2006). *Streblus asper* Lour. (Shakhotaka): a review of its chemical, pharmacological and ethnomedicinal properties. Advance Access Publication. 3(2): 217-222.



- Roy DK, Panday S, Sinha BK, and Sawmliana. (2013). Taxonomic note on *Streblus* Lour. (Moraceae) in Northeast India. *NeBio*. 4(2): 50-54.
- Saxena HO and Brahman M. (1995). The Flora of Orissa. Orissa Forest Department Corporation Ltd., Bhubaneswar & Regional Research Laboratory, Bhubaneswar, Odisha.
- Sen SK and Behera LM. (2024). Ethnomedicinal usages of *Streblus asper* Lour. By the tribals of Bargarh district in Odisha. *World Journal of Pharmaceutical and Medical Research*. 10(3): 109-111.
- Singh B, Chettri A, Adhikari D, and Barik SK. (2012). Taxonomic history, rediscovery, and assessment of threat status of *Streblus ilicifolius* (Moraceae) from India. *Journal of the Botanical Research Institute of Texas*. 6(2): 611-614.
- Weiblen GD. (2000). Phylogenetic relationships of functionally dioecious *Ficus* (Moraceae) based on ribosomal DNA sequences and morphology. *American Journal of Botany*. 87(9): 1342-1357.
- Williamson G and Sheedy K. (2020). Effects of polyphenols on insulin resistance. *Nutrients*. 12(10): 3135.