CHAPTER 02

Therapeutic applications of *Pterospermum xylocarpum* (Gaertn.) Oken

Divya Jain[1], Vivek Kumar[2], Amrik Singh Lohia[3], Akshaya Kumar Sahoo[4], Sanjeet Kumar[5] and Sweta Mishra[5*]

[1]Department of Botany, Sanatan Dharma College, Ambala Cantt, Haryana, India
[2]Department of Botany, Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India
[3]Nathi Bai Ramsingh Chawl, Nivlekar Marg, Ghatkopar West, Mumbai, Maharashtra, India
[4]Department of Botany, Maharaja Sriram Chandra Bhanja Deo University, Baripada, Odisha, India
[5]Ambika Prasad Research Foundation, Odisha, India
***Email ID:** swetamishra.rdwu@gmail.com

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ABSTRACT

Pterospermum xylocarpum, an evergreen tree belonging to the family Malvaceae, is traditionally valued in Indian ethnomedicine for its diverse therapeutic properties. Various parts of the plant have been utilized in indigenous healing systems. Phytochemical investigations revealed that plant parts are rich with diverse secondary metabolites like flavonoids, alkaloids, saponins, tannins, steroids, and phenolic compounds. Despite its traditional usage, comprehensive pharmacological validation and standardization are still needed to establish its efficacy and safety for modern therapeutic applications. This review aims to consolidate the existing ethnobotanical and pharmacological knowledge of *P. xylocarpum* and highlight its potential in herbal medicine and pharmaceutical development.

KEYWORDS: Malvaceae, therapeutic applications, ethnomedicine, phytochemicals, medicinal plant

INTRODUCTION

Malvaceae represents about 6100 species belonging to about 350–370 genera worldwide, and the order Malvales ranks among the top 20 in vascular plants concerning occurrence records and species richness worldwide (Colli-Silva et al. 2025). According to the APG IV (2016) classification, all the genera from the earlier families of Malvaceae- namely, Bombacaceae, Tiliaceae, and Sterculiaceae- have been merged into a single family, Malvaceae, which comprises nine subfamilies: Byttnerioideae, Grewioideae, Tilioideae, Brownlioideae, Helicteroideae, Sterculioideae, Dombeyoideae, Bombacoideae, and Malvoideae. In India, the family Malvaceae includes about 219 species across 52 genera, with an additional 32 species cultivated (Paul and Das 2024). Some wild plants from this family, such as *Sida acuta, Sida cordifolia, Abutilon indicum, Urena lobata*, are recognized for their medicinal importance and are used in traditional systems of medicine.

Pterospermum xylocarpum is a large evergreen tree from this family, having significant therapeutic potential. It is a woody tree species, distributed throughout India and Southeast Asia, and known for its medicinal properties (Narendra et al. 2013). It is commonly known as Woody-Fruit Bayur Tree (English), Giringa (Odia), Kesali (Kannada), Masapoondi (Tamil), Tada (Telugu), Kanaka champaka (Sanskrit), Palaka-unam (Malayalam), and Muchkunda (Bengali). The plant is rich in bioactive compounds, such as alkaloids, steroids, saponins, triterpenoids, flavonoids, polyphenols, tannins, and glycosides (Singh et al. 2023). It is known for its potential use in haughtiness, gout, dyspepsia, cough, digestive problems, gout, rheumatism, arthritis, diarrhoea, and dysentery (Das et al. 2003; Jhansi et al. 2018). This review provides a comprehensive overview of the morphology, therapeutic potential, and modern pharmacological findings of *P. xylocarpum*.

MORPHOLOGY

It is a medium to large evergreen tree, growing up to 20–30 meters in height, with a straight or slightly fluted trunk and a dense, spreading crown. The bark is greyish to dark brown and rough, with a fibrous, yellowish-brown inner layer. Leaves are simple, alternate, large (15–30 cm long), ovate to oblong with an asymmetrical, often cordate base and an acuminate apex. The upper surface is dark green and smooth, while the underside is velvety with dense brownish or whitish hairs. The petioles are stout and hairy, measuring 2–5 cm long. The tree bears large, fragrant, creamy-white to pale yellow bisexual flowers, usually solitary or in small axillary cymes. Each flower has five

leathery, persistent calyx lobes and five oblong, crumpled petals, with numerous stamens arranged in five bundles surrounding a superior ovary. The fruit is a large, woody, ellipsoid capsule (up to 20 cm long) that splits into five valves to release numerous flat, brown seeds with membranous wings. It is typically found in deciduous forests, particularly in well-drained soils, and flowers from January to April, with fruiting occurring from April to July (Kumar et al. 2022; Singh et al. 2023; Figure 1- 2).

TRADITIONAL MEDICINAL USES

Several studies have highlighted the ethnomedicinal significance of *P. xylocarpum* across various regions in India. The leaves of *P. xylocarpum*, combined with seeds of *Cassia lanceolata, Helicteres isora*, and *Butea frondosa*, and palm sugar, are made into a paste. This paste is externally administered to relieve symptoms of haughtiness, gout, and dyspepsia (Reddy et al. 2009; Vishnuvardhan et al. 2018). In another practice, a combination of leaf pastes and honey is used as a natural treatment for leucorrhea (Jhansi et al. 2018). It is also potentially effective in curing gout, rheumatism, and arthritis. Decoction of bark, leaves, and a few black peppers is used in treating asthma. Flower with Cinnamon bark paste is applied on the forehead to treat head-ache. Flower and root paste is useful in menstrual disorders. Flower powder is given to children to cure digestive problems. Stem bark decoction drunk once daily for treating menorrhagia (Das et al. 2003; Singh et al. 2023). Leaf extraction of *P. xylocarpum* is used in treating asthma, infertility in female, labor pain, and menstruation disturbances (Vishnuvardhan et al. 2018). The leaf decoction of the plant has been traditionally consumed to manage diabetes, while leaf paste is applied topically to reduce inflammation (Narendra et al. 2013). In Hukumpeta Mandal of Andhra Pradesh, the fruits are used to treat digestive ailments. Moreover, a mixture made from the stem and bark is consumed orally for a few days as a remedy for cough. A blend of tender leaf and flower juice is traditionally given over three days to address symptoms of diarrhoea and dysentery (Singh et al. 2023; Table 1).

BIOACTIVE COMPOUNDS

P. xylocarpum showed the presence of various bioactive compounds in different extracts. Methanol crude extracts revealed the presence of alkaloids, steroids, phenols, and cardiac glycosides. The qualitative phytochemical analysis of *P. xylocarpum* fruits demonstrated solvent-specific profiles of secondary metabolites. Tannins were identified in the aqueous and ethanol extracts, whereas saponins were consistently detected across all three



Figure 1: Vegetative parts of *P. xylocarpum*, A) Fruits, B) Leaves with flower, C) Leaves and bud, D) Bark, E) Longitudinal section of fruit, F) Flower



Figure 2: Whole plant of *P. xylocarpum*

solvents aqueous, ethanol, and n-hexane. Alkaloids were observed in both aqueous and ethanol extracts but were absent in the n-hexane fraction. Reducing sugars were detected solely in the ethanol extract. In contrast, no presence of flavonoids, terpenoids, phenols, steroids, or carbonyl compounds was reported in any of the extracts. These findings suggest the therapeutic potential of *P. xylocarpum* fruits based on the presence of key phytoconstituents (Kshirsagar et al. 2025). Reducing sugars were consistently detected in all the extracts. Alkaloids were found in the methanol extract, while phenolic compounds were present in methanol, hexane, and acetone extracts. Flavonoids were detected in both water and chloroform extracts but were absent in the methanol extract. Steroids were also found in the crude methanolic extract. Certain compounds, such as fatty acids, tannins, saponins, anthocyanins, leucoanthocyanins, coumarins, and emodins, were absent in all five solvent extracts (Narendra et al. 2013).

Table 1: Ethnomedicinal uses of *P. xylocarpum*

Plant part(s) used	**Mode of preparation**	**Ethnomedicinal uses**	**Source (s)**
Leaves + seeds of *Cassia lanceolata*, *Helicteres isora*, *Butea frondosa* + palm sugar	Paste applied externally	Haughtiness, gout, dyspepsia	Reddy et al. 2009; Vishnuvardhan et al. 2018
Leaves + honey	Paste applied externally	Leucorrhea	Jhansi et al. 2018
Leaves	Extract / paste	Gout, rheumatism, arthritis	Singh et al. 2023
Bark + leaves + black pepper	Decoction	Asthma	Vishnuvardhan et al. 2018
Flowers + *Cinnamomum* bark	Paste applied on forehead	Headache	Vishnuvardhan et al. 2018

Flowers + roots	Paste	Menstrual disorders	Reddy et al. 2009
Flower powder	Orally administered to children	Digestive problems	Reddy et al. 2009
Stem bark	Decoction (drunk once daily)	Menorrhagia	Das et al. 2003; Singh et al. 2023
Leaves	Extract/ decoction	Asthma, female infertility, labor pain, and menstruation issues	Vishnuvardhan et al. 2018
Leaves	Decoction	Diabetes	Narendra et al. 2013
Leaves	Paste (topical)	Inflammation	Narendra et al. 2013
Fruits	Consumed	Digestive ailments	Singh et al. 2023
Stem + bark	Oral consumption for a few days	Cough	Singh et al. 2023
Tender leaves + flower juice	Orally given for 3 days	Diarrhoea and dysentery	Singh et al. 2023

PHARMACOLOGICAL USES

Antidiabetic potential

Several ethnopharmacological studies have reported the antidiabetic potential of *P. xylocarpum*. A decoction of its leaves has traditionally been used to lower blood sugar levels. Experimental evidence suggests that the bioactive compounds in the leaves, particularly saponins and alkaloids, may help regulate glucose metabolism and improve insulin sensitivity, making it a promising natural remedy for managing diabetes (Narendra et al. 2013).

Antimicrobial properties

Preliminary screenings have indicated that extracts of *P. xylocarpum* possess antimicrobial properties. The presence of alkaloids and saponins in the plant may contribute to its ability to inhibit the growth of certain bacteria and fungi. The methanol leaf extracts showed moderate activity against *E. coli, Staphylococcus aureus, Enterococcus faecalis, Bacillus megaterium*. (Narendra et al. 2013).

Anti-oxidant potential

Hexane, Acetone, Methanol, and Aqueous were evaluated using DPPH and FRAP assays. In the DPPH assay, all four extracts exhibited dose-dependent radical scavenging activity. Among them, the methanol extract showed the highest antioxidant activity. The acetone and hexane extracts exhibited moderate to low activity. In the FRAP assay, a similar dose-dependent pattern was observed. Methanol extracts again demonstrated the strongest antioxidant activity. Acetone and hexane extracts showed lower activity (Jaber et al. 2019).

Anti-inflammatory activity

For anti-inflammatory activity, with lipoxygenase inhibition assay, methanol extract exhibited the highest potential, which was closest to the standard drug, while the acetone and hexane extracts showed lesser activity. Overall, the methanol extracts consistently demonstrated the highest antioxidant and anti-inflammatory activities among all extracts tested (Jaber et al. 2019).

CONCLUSION

P. xylocarpum possesses notable therapeutic potential, as supported by traditional uses and recent phytochemical findings. Its extracts exhibit various pharmacological properties, likely due to the presence of bioactive compounds such as tannins, saponins, and alkaloids. These medicinal attributes highlight the importance of this plant in herbal medicine and suggest its potential for further pharmacological research and development.

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