

CHAPTER 03

Ethnobotanical properties of *Sterculia urens* Roxb.

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ABSTRACT

Sterculia urens, commonly known as the Karaya tree or gum karaya tree, is a medium-sized deciduous tree widely found in dry deciduous forests of India. It holds significant ethnobotanical value among tribal and rural communities. Various parts of the plant, especially the gum, bark, and leaves, are traditionally used for treating ailments such as constipation, wounds, cough, inflammation, dysentery, joint pain, and digestive issues. The gum exudate, known as gum karaya, is widely used in traditional medicine and has applications in the food and pharmaceutical industries. This investigation emphasizes the traditional knowledge and applications of *S. urens*, as well as its pharmacological and morphological significance.

KEYWORDS: Gum karaya, traditional knowledge, medicinal importance, secondary metabolites, pharmacological uses

INTRODUCTION

The genus *Sterculia* (Malvaceae), consisting of 200 species, is widespread throughout the tropical and subtropical parts of the world. Among these *Sterculia urens* Roxb., is one of the commercially important Non-timber Forest Produces (NTFP) species that is used in food, pharmaceutical industries, and medicinal purposes (El-Sherei et al. 2016; Rathod et al. 2021). It is commonly known as: Indian Tragacanth in English; kadaya, gular, karaya in Hindi; Genduli in Odia; kandol, kadai, kadayo in Gujarati; kavili, kavalam in Tamil (Rathod et al. 2021). The tree is native to India, Sri Lanka and was introduced to Burma later (Sivaraj et al. 2017). The species is widely distributed throughout the tropical Himalayas, as well as in central and western India, and across the Eastern and Western Ghats. It is found on steep, rock-strewn slopes at an altitude between 400-800 meters (Galla and Rao 2010). In India, the species is found in the tropical Himalayas as well as in various regions of western and central India. It is present throughout the Eastern and Western Ghats, including the states of Andhra Pradesh, Assam, Maharashtra, Gujarat, Odisha, Rajasthan, Madhya Pradesh, Karnataka, Bihar, Chhattisgarh, and Kerala etc. (Shukla and Agnihotri 2022; Bohra et al. 2024). It is a deciduous tree with leaf shedding, flowering, and leaf flushing occurring in succession from November to August (Solomon et al. 2021).

S. urens, commonly known as Karaya, holds immense medicinal and economic importance, especially among tribal communities. The gum exuded from its bark is a major source of livelihood and is widely used in pharmaceuticals, cosmetics, textiles, paper, and food industries as a thickener, emulsifier, and tablet binder (Nath and Nath 2013; Dhiman et al. 2019). It is also used as a dental adhesive and in textile printing paste. Traditionally, tribal people use the gum for treating dysentery, ulcers, joint pain, snake bites, and menstrual issues (Lujan-Medina et al. 2013; Shukla and Agnihotri 2022). Bark decoctions are used to aid labor, treat ulcers, diarrhea, and rheumatoid arthritis (Jagtap et al. 2006; Rao et al. 2016). The root, leaf, and seeds help reduce swelling, heal wounds, and treat throat infections (Vaidyanathan et al. 2013; Oak et al. 2015). The tree also produces edible seeds, fibers, toothbrush sticks, and timber that are utilized for various household products (Padal and Vijayakumar 2013; Sivaraj et al. 2017). It is used as an ingredient in the preparation of emulsions, lotions, denture fixative powders and bulk laxatives (Nanadagopalan et al. 2015). It contains several bioactive compounds like phenols, tannins, flavonoids, steroids, terpenoids, alkaloids, saponins,

glycosides, and coumarins, which are responsible for various pharmacological activities (Meena et al. 2024).

MORPHOLOGY

It is a medium-sized deciduous tree, reaching a height of 15 to 20 meters. The tree has a short, often crooked trunk that supports a much-branched, rounded crown formed by twisted branches, making it appear enormously bushy. The bark exfoliates in transparent, papery flakes, revealing a smooth, creamy-white under bark that stands out vividly against the darker surroundings. The leaves are large, measuring 23 to 30 cm in both length and width, and are palmately lobed with five pointed segments, closely resembling a maple leaf. These leaves are clustered at the tips of the branches. With the onset of the dry season, they transition in color from green to yellow before eventually falling, leaving the branches bare and exposed. The flowers are small, greenish-white to creamy-yellow, and typically appear in axillary or terminal panicles. The species is monoecious, bearing both male and female flowers on the same tree. The flowers lack petals and possess a bell-shaped calyx made up of five sepals that are fused at the base and slightly hairy on the inner surface. In male and bisexual flowers, the stamens are united into a column bearing ten anthers, while the female flowers contain five free carpels, each with a superior ovary and a short style. The fruit is a large, woody, follicular structure usually composed of up to five follicles radiating from a central point, though not all may develop fully. These follicles are boat-shaped, thick, and covered with a dense mat of irritant reddish-brown hairs. When mature, they split open along one side to release the seeds. The seeds are smooth, shiny, black, and ovoid in shape, embedded in a yellowish pulp. They are non-endospermic and contain two large cotyledons (Kumar et al. 2022; Shukla and Agnihotri 2022; Meena et al. 2024; Figure 1).

TRADITIONAL MEDICINAL USES

Various parts of the plant, especially the gum, bark, and leaves, are traditionally used for treating diverse diseases and disorders (Figure 2).

Gum and Resin

The gum exuded from the bark of *S. urens*, commonly known as Karaya gum, is highly valued for its wide-ranging medicinal and industrial uses. Traditionally, it is used in pharmaceuticals, tanneries, and for making agarbati (Omkar et al. 2012). Medicinally, it is employed to treat blisters, blood dysentery, joint pain, stomach disorders, and throat infections (Lujan-Medina

et al. 2013). The gum extract is applied locally to remove spines from the skin, and it is known to treat leucoderma, peptic ulcers, and to regulate menstrual disorders (Jain et al. 2005). Gum with wheat flour and jaggery is given to women for nourishment and to treat menstrual and abdominal

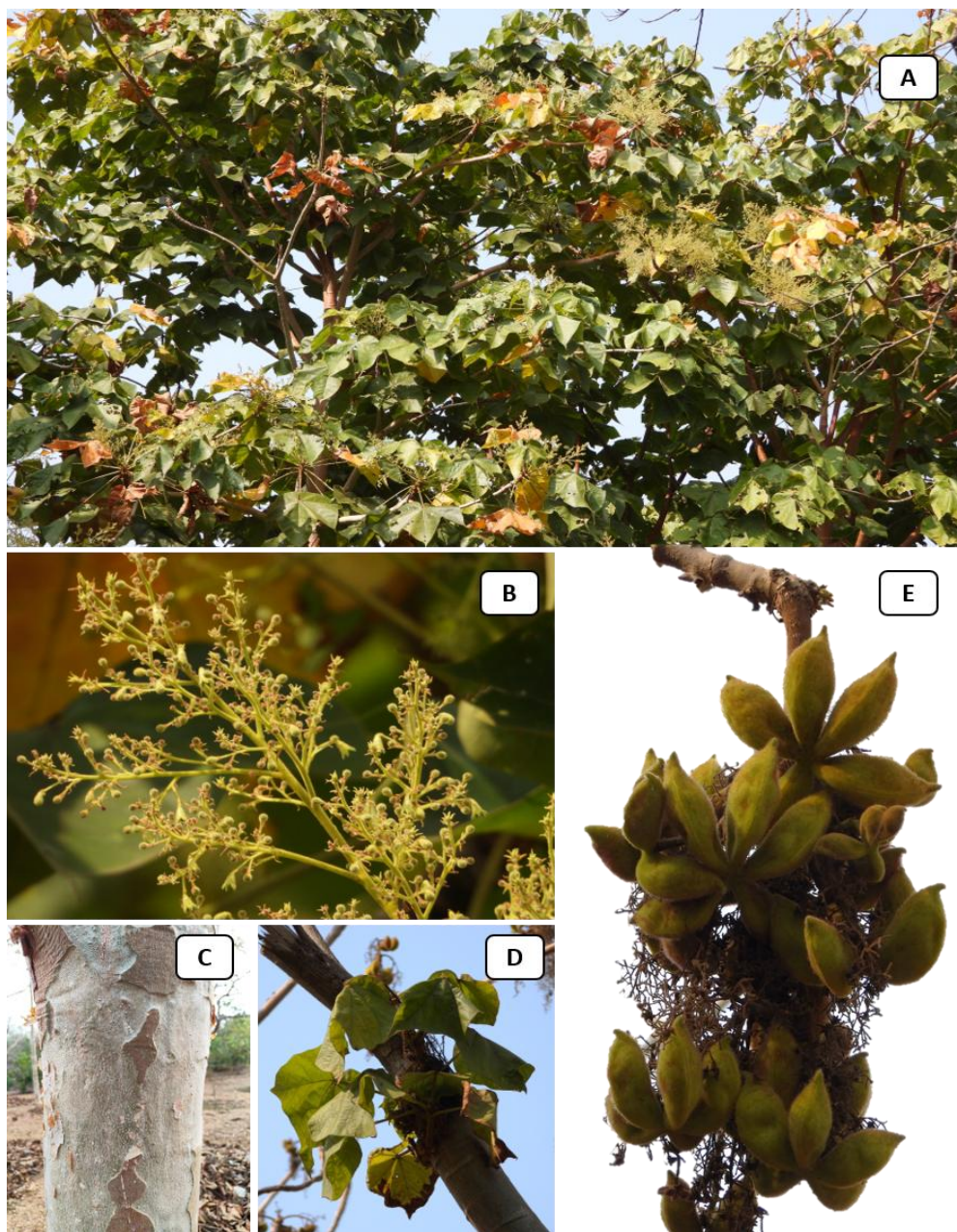


Figure 1: Vegetative parts of *S. urens*, A) Canopy, B) Inflorescences, C) Bark, D) Leaf, E) Fruits

disorders (Kala 2011; Dhiman et al. 2019). It is believed to help with burning sensations and bone fractures (Meena and Rao 2010).

Bark

Decoctions made from the bark are used to manage delayed labor, regulate menstrual cycles, and clear the uterus post-delivery (Jagtap et al. 2006; Panduranga et al. 2011). A mixture of stem bark with *Haldinia cordifolia* and pepper is orally administered for nine days to treat leucorrhoea among tribes of the Eastern Ghats (Ratnam and Raju 2005). The bark is also applied externally to treat wounds and throat infections (Oak et al. 2015). Rubbing feet on the bark helps heal cracked skin, and regular intake of decoction clears the uterus (Jagtap et al. 2006). For joint inflammation, a filtrate of stem bark ground with turmeric is mildly heated and taken twice daily for five days to relieve symptoms of rheumatoid arthritis (Rao et al. 2016). The bark is used to alleviate diarrhea and dysentery (Meena et al. 2024).

Root

The Korku tribe of Maharashtra prepares a decoction by mixing root powder of *S. urens* with bark powder of *Ailanthus excelsa*, *Madhuca longifolia* and leaf powder of *Vitex negundo*. This mixture is boiled in water and used for bathing, while 10 grams of the mixture is consumed to reduce body swelling (Jagtap et al. 2006).

Seed

The seeds are used to treat wounds and throat infections. They are often roasted before consumption (Oak et al. 2015).

Leaf

Leaves, along with gum and bark of *S. urens*, are traditionally used to treat wounds and throat infections (Oak et al. 2015). Leaf juice is applied externally for healing wound fractures, treating cracked skin, and is also used in the treatment of leukemia by tribes in the Kollihills of the Eastern Ghats in Tamil Nadu (Vaidyanathan et al. 2013).

Tree Branches

The branches of *Sterculia urens* are utilized in tribal medicine to assist in childbirth. They are believed to ease labor and are used as a tonic after delivery

(Kala 2016). Additionally, the leaves are used as livestock fodder by tribal communities (Omkar et al. 2012).

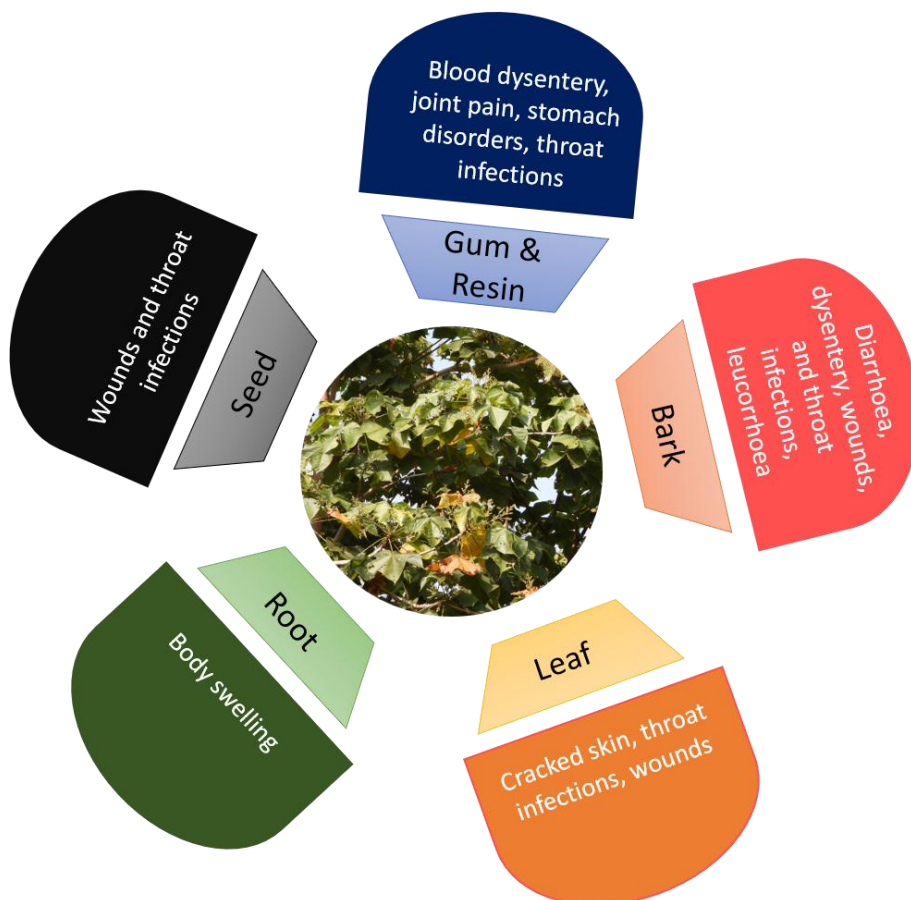


Figure 2: Medicinal uses of *S. urens*

BIOACTIVE COMPOUNDS

S. urens is known to contain a wide array of bioactive compounds that contribute to its medicinal and pharmacological properties. The most prominent compound is gum karaya, a complex acidic polysaccharide composed mainly of galactose, rhamnose, and galacturonic acid, which imparts its demulcent and laxative properties (Silva et al. 2021). It also contains bioactive compounds like 2,4-dihydroxy-2, 5-dimethyl-3(2H)-furan-3-one, an acetyl formoin intermediate. Additionally, it contains 2,5-dimethyl-2,4-dihydroxy-3(2H)-furanone and 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one, among others (Chukwu 2017). Phytochemical analyses have also revealed the presence of flavonoids, tannins, saponins, and phenolic

compounds, which are responsible for the plant's antioxidant, anti-inflammatory, and antimicrobial activities (Silva et al. 2020). Phytochemical screening of the bark of Karaya showed the presence tannin, saponin, phenolic compounds and reducing sugar. In methanol extract, tannin, saponin and phenolic compounds were found whereas tannin, saponin, phenolic compounds and reducing sugar were observed in ethanol extract of bark of Karaya (Mety et al. 2024).

PHARMACOLOGICAL USES

S. urens has shown notable pharmacological potential due to the presence of bioactive constituents in its gum and other plant parts. The gum karaya, a natural exudate from its bark, is extensively used as a demulcent and laxative in pharmaceutical formulations owing to its swelling properties and ability to form mucilage (Darapureddy et al. 2022). It exhibits antidiabetic activity, as experimental studies have reported its capacity to reduce blood glucose levels and improve lipid profiles in diabetic models (Sukla et al. 2020). Additionally, *S. urens* exhibits antimicrobial properties, with its extracts demonstrating inhibitory effects against a range of bacterial and fungal strains (Meena and Rao 2019; Haji et al. 2024). The gum is also recognized for its anti-inflammatory and wound healing activities, attributed to the presence of flavonoids and polysaccharides, which aid in tissue repair and reducing inflammation (Sukla et al. 2020; Darapureddy et al. 2021). Furthermore, due to its biocompatibility and nontoxic nature, *S. urens* gum is employed in drug delivery systems and dietary formulations as a natural stabilizer and emulsifier (Mety et al. 2024).

CONCLUSION

S. urens is an important ethnobotanical species with multiple traditional uses among indigenous communities, particularly for its gum and medicinal bark. It has a wide range of applications for treating various diseases and disorders and possesses antimicrobial, antioxidant, antifungal, and antidiabetic activities. Documentation and scientific validation of its traditional uses can help in conserving indigenous knowledge and promoting the sustainable use of this valuable forest resource.

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