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The Multifaceted Role of Zanthoxylum armatum DC.: From Folk Remedies to Modern Pharmacology"

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Abstract

India's rich ethnobotanical heritage and biodiversity have long supported the use of medicinal plants in traditional healthcare, with *Zanthoxylum armatum DC.* (commonly known as Timur or Toothache Tree) emerging as a plant of significant pharmacological, ecological, and cultural importance. Distributed across the Indian Himalayan Region and parts of the Eastern Ghats, this aromatic, spiny shrub holds a crucial place in indigenous medicinal systems such as Ayurveda and Unani. Nearly all parts of the plant—including fruits, seeds, bark, leaves, and twigs—are utilized for a wide range of therapeutic applications, from treating fever, asthma, and digestive disorders to acting as natural toothbrushes and insect repellents.

Extensive phytochemical and pharmacological studies reveal the plant's antioxidant, anti-inflammatory, antibacterial, antifungal, analgesic, antitumor, and hepatoprotective properties, attributed to its diverse array of bioactive compounds such as essential oils, alkaloids, flavonoids, and terpenoids. Its uses extend beyond medicine into culinary, ecological, and artisanal domains. With a strong foundation in traditional knowledge and growing scientific validation, *Z. armatum* presents significant potential for sustainable utilization and further pharmacological exploration.

Key words: *Z. armatum, Medicinal plants and Traditional medicine.*

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Introduction

India possesses one of the most ancient and diverse plant-based medicinal traditions in the world, largely attributed to its rich and varied biodiversity. In many developing nations, including India, medicinal plants continue to play a significant role in primary healthcare systems. These herbal remedies are often preferred due to their affordability, therapeutic effectiveness, and relatively low incidence of side effects **(Sekar *et al.*, 2010).** As a result, the pharmaceutical industry relies heavily—both directly and indirectly—on plant-derived materials for the development of medicinal products. The Indian Himalayan Region (IHR), identified as one of the 34 global biodiversity hotspots, is especially noteworthy in this context. This ecologically rich area supports approximately 1,748 species of medicinal plants **(Samant *et al.*, 1998).** Among these, the genus *Zanthoxylum* (family: Rutaceae) stands out for its medicinal, ecological, and economic value. Globally, the genus comprises around 250 species, with 11 species recorded in India. One such species, *Zanthoxylum armatum* DC., is a deciduous shrub or small tree commonly known as Timur, Toothache Tree, or Winged Prickly Ash. It typically thrives in well-drained alluvial and black soils and is distributed across the warmer valleys of the Himalayas, from Jammu and Kashmir to Assam and the Khasi Hills, as well as parts of the Eastern Ghats in Odisha and Andhra Pradesh at altitudes ranging from 1,000 to 2,100 meters above sea level **(Kala *et al.*, 2005).**

Zanthoxylum armatum DC. is an aromatic, spiny shrub or small tree that can grow up to 6 meters tall and is botanically distinguished by its compound, aromatic leaves (about 20 cm long), small greenish-yellow flowers, reddish fruits around 5 mm in diameter, and bitter, shiny seeds **(Verma *et al.*, 2021).** Various parts of the plant—particularly the fruits, seeds and bark are extensively used in traditional medicine to treat ailments such as dyspepsia, fever, dental disorders, toothache, gum bleeding, asthma and digestive issues **(Verma *et al.*, 2021).** The fruit is also known for its water-purifying and insect-repelling properties, while the plant's strong and durable wood is commonly used to make walking sticks. Due to its antiseptic and antimicrobial properties, *Z. armatum* is often included in

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the formulation of dental pastes and powders **(Verma *et al.*, 2021).** Pharmacological research has identified a wide spectrum of bioactivities in the plant, including antioxidant, antinociceptive, antifungal, anti-inflammatory, hepatoprotective, pesticidal, anthelmintic and antiproliferative effects **(Sati *et al.*, 2011; Ramanujam and Ratha, 2008; Mehta *et al.*, 1981; Baquar, 1989).** Given its rich therapeutic profile, traditional significance and ecological adaptability, *Z. armatum* holds significant potential for future pharmacological research and sustainable application in the medicinal plant industry.

Table 1. Regional Distribution, Altitudinal Range, and Natural Habitats of *Z. armatum* DC. in India.

Region	Altitude Range (masl)	Common Habitat
Jammu & Kashmir to Arunachal Pradesh	900–2,500	Forest margins, subtropical slopes
Assam, Manipur, Meghalaya, Nagaland	1,000–2,400	Forested valleys and village outskirts
Uttarakhand & Himachal Pradesh	1,200–2,200	Temperate forests, slopes
Sikkim & Bhutan	1,000–2,500	Moist forest ridges and slopes
Eastern Ghats (Odisha, Andhra Pradesh)	500–1,000	Hill ranges, scattered rural forests

Taxonomic classification of *Zanthoxylum armatum* (Annappan *et al.*, 2015)

Z. armatum is systematically classified under

- **Kingdom**: Plantae
- **Sub-kingdom**: Viridaeplantae
- **Domain**: Eukaryote
- **Phylum**: Tracheophyta
- **Sub-phylum**: Euphyllophytin
- **Infra-phylum**: Radiatopses
- **Class**: Magnoliopsida
- **Sub-class**: Rosidae
- **Super Order**: Rutanae
- **Order**: Spindale

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- **Sub-order**: Rutineae
- **Family**: Rutaceae
- **Genus**: *Zanthoxylum*
- **Species**: *Zanthoxylum armatum* DC.

The Rutaceae family is also known for other economically important plants like citrus species and *Z. armatum* shares many biochemical and ecological features with its citrus relatives.

Traditional / folk uses

Timur is recognized as a significant medicinal plant due to the therapeutic properties found in nearly all its parts. These components are commonly utilized in traditional medicine systems such as Ayurveda and Unani to treat a range of ailments. In countries like Nepal and China, timur has been traditionally used for generations, particularly by local communities often women for various health purposes. The traditional medical system extensively utilizes the bark, fruits and seeds of *Z. armatum* for their anthelmintic, stomachic and carminative properties. The fruits and seeds are employed as aromatic tonics to treat fever and indigestion and fruit extracts are believed to be effective in expelling roundworms. Due to their deodorizing, disinfectant and antiseptic properties, the fruits are also used in managing dental problems and a lotion made from them is applied to treat sores. Additionally, the fruits are known to repel houseflies **(Gaur, 1999).** Owing to its medicinal attributes, *Z. armatum* holds a valued place in indigenous healthcare practices. Its seeds are a key component of *Zuroor-e-Qula*, a powdered Unani polyherbal formulation known for its antibacterial and anti-inflammatory effects **(Paridhavi and Agarwal, 2007).** In culinary traditions, the fruits are commonly used as spices and flavoring agents, while the young twigs serve as natural toothbrushes. Moreover, the bark has traditionally been used in dye-making **(Gaur, 2008; Sharma and Subedi, 2022).** In Uttarakhand, the Bhotiya tribal community is known to use timur more extensively than other ethnic groups, largely due to the plant's accessibility near their winter settlements. They incorporate the fruit into their diet as a spice, condiment and remedy. During the cold months,

families drink a warming soup made from dried timur fruit, locally referred to as *hag*. Another favored preparation is *dunkcha*, a traditional chutney. Additionally, the community brews a form of liquor from timur, though it is typically consumed only by individuals with a strong tolerance due to its intense taste. For the Bhotiya, timur holds both spiritual and magical significance **(Kumar and Gupta, 2020).**

Table 2: The traditional uses of different parts of *Zanthoxylum armatum* DC. (Paul *et al.*, 2018).

S. No.	Part used	Traditional use
1.	Leaves	The leaves are primarily used for catching fish due to their mild toxicity when crushed and spread in water. Medicinally, they help relieve indigestion and cholera. Rich in essential oils and flavonoids, the leaves also exhibit antimicrobial and anti-inflammatory properties.
2.	Seeds	Traditionally used to treat fever, dyspepsia, cholera, flatulence, and depression. They are aromatic in nature and often used as a tonic to improve digestion. Seeds contain compounds like limonene and linalool, which contribute to their digestive and mood-enhancing effects.
3.	Bark	The bark serves as a powerful carminative, stomachic, and anthelmintic. It is often applied to gums for toothache relief, hence called the "toothache tree." It contains active alkaloids such as berberine and xanthoxylin, known for their analgesic and antimicrobial action.
4.	Fruit	The juice of the fruit is used to expel roundworms and relieve gastrointestinal issues. It has strong deodorant, antiseptic, and disinfectant properties, making it ideal for dental care. Fruits are also pickled and used to treat colds, coughs, abdominal discomfort, and limb numbness. Fruit powder, when mixed with warm water, helps manage dysentery and diarrhea. The fruits are rich in volatile oils, tannins, and flavonoids that provide anti-parasitic and immune-boosting effects.
5.	Berries	Berries are known for their carminative and antispasmodic properties. They are used topically and internally to treat skin diseases such as eczema and fungal infections. The presence of essential oils and polyphenols enhances their antimicrobial and skin-soothing activities.

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6.	Whole plant	The entire plant is utilized for treating scabies and for removing worms from infected ears. It has broad-spectrum antimicrobial and anti-parasitic effects due to its complex mix of bioactive compounds including alkaloids, saponins, and terpenes.

Medicinal properties

Research has shown that the fruits of Timur are the most commonly utilized part of the plant, followed by young twigs and seeds. The leaves have carminative properties and are traditionally used to treat indigestion and stomach pain. Twigs are often employed as natural toothbrushes to alleviate toothaches. Additionally, Timur seeds are used to manage fever and cholera and are known to stimulate saliva production **(Kanwal *et al.*, 2015).** Another study reported that leaf extracts from Timur can induce apoptosis in cancer cells and enhance their sensitivity to chemotherapy drugs **(Singh *et al.*, 2015).** The plant's extracts are also effective in treating pneumonia and tick infestations. A mixture of powdered Timur fruit, table salt, and Mentha species is used to relieve chest infections and digestive issues. The dried fruits exhibit antiseptic, antifungal, and antibacterial effects.

Timur is associated with various medicinal applications **(Paul *et al.*, 2018),** such as:

- **Asthma and breathing difficulties** – chewing a few seeds is beneficial.
- **Arthritis, joint pain, skin diseases, eczema, and blood impurities** – boiling 5–10 grams of fresh leaves in a glass of water until it reduces to one-fourth and consuming the decoction once or twice daily can help.
- **Boils** – applying a fine paste made from the roots externally is effective.
- **Cough** – drinking a seed-based decoction once or twice a day provides relief.
- **Cholera** – bark decoction is used for treatment.
- **.Earache** – ear drops made from a mixture of Timur, dry ginger (Sonth), and asafoetida (Hing) are effective.

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- **Bleeding gums** – massaging bark powder mixed with honey onto the gums helps.
- **Mouth freshener** – chewing the fruits freshens the mouth.
- **Swelling** – applying a poultice of warm leaves topically reduces inflammation.
- **Stomatitis** – gargling with a leaf decoction helps soothe the condition.
- **Roundworms** – consuming the seeds in any form assists in expelling roundworms.

Pharmacological and Therapeutic Applications

It is used to treat diseases viz; Asthma, Bronchitis, Cholera, Fever, Fibrosis's, Indigestion, Rheumatism, Skin diseases, Toothache, Varicose veins. Prickly Ash is used in many chronic problems such a rheumatism and skin diseases; cramp in the leg, ulcers. It is also used for low blood pressure, fever, and inflammation. Externally it may be used as stimulation for rheumatism and fibrositis. It has a stimulating effect upon the lymphatic system, circulation and mucous membranes. The fruit and seeds are used to cure in fever dyspepsia and cholera and the bark used for intoxicating fishes. The bark, fruits and seeds are widely used in indigenous system of medicine as a carminative, stomachic and anthelmintic and antifungal. The bark is pungent and used to clean teeth. The fruits and seeds are employed as an aromatic tonic in fever and dyspepsia **(Paul *et al.*, 2018).** *Z. armatum* exhibits a diverse range of pharmacological properties attributed to its rich phytochemical composition, as supported by various studies. Its ethanolic and methanolic fruit extracts demonstrate strong antioxidant potential through DPPH radical scavenging activity, highlighting its usefulness as a natural antioxidant source **(Batool *et al.*, 2010; Upadhyaya and Ashok, 2010).** The plant also possesses significant anti-inflammatory effects; the ethanolic stem bark extract reduces paw edema in male Wistar rats by inhibiting cyclooxygenase activity **(Sati *et al.*, 2011)**

and the fruit extract inhibits carrageenan-induced paw inflammation in rats, with lignan components contributing to its analgesic action **(Mehta *et al.*, 2011; Kaur *et al.*, 2011; Guot *et al.*, 2010).** Antimicrobial activity has also been documented, with the extract showing a large zone of inhibition (23 mm) against *Bacillus subtilis* and a minimum bactericidal concentration (MBC) of 2.5 mg/L **(Joshi *et al.*, 2009),** while its essential oils have demonstrated fungitoxicity against *Alternaria brassicicola* **(Parajuli *et al.*, 2005).** Insecticidal and larvicidal activities are evidenced by the effectiveness of seed oil, especially when combined with vanillin and *Z. piperitum* fruit oil, in repelling female *Aedes aegypti*, with efficacy comparable to DEET **(Kwon, 2011).** Additionally, its essential seed oil exhibits larvicidal effects against multiple mosquito species including *Culex quinquefasciatus*, *Aedes aegypti*, *Anopheles stephensi*, *Aedes albopictus*, and *C. pipiens* **(Tiwary *et al.*, 2007; Yun *et al.*, 2010).** The fruit extract also demonstrates piscicidal activity, acting as a non-competitive inhibitor of Mg^{2+}-ATPase and Na^{+}, K^{+}-ATPase in various tissues of the air-breathing catfish *Heteropneustes fossilis*, indicating its utility in fish nursery management **(Ramanujam and Ratha, 2008).** Its hepatoprotective capacity is evident from studies showing that ethanolic leaf extract protects the liver in mice against CCl_4-induced toxicity and inflammation **(Verma and Khosa, 2010)**, while bark extract enhances antioxidant enzyme levels and regulates serum enzymes, thereby contributing to liver protection **(Ranawat *et al.*, 2009).** Furthermore, the plant shows antitumor potential, as crude extracts of leaves and fruits exhibit cytotoxic activity **(Barkat *et al.*, 2011),** likely due to the presence of lupeol, a monoterpene known for its chemo preventive and anti-inflammatory properties. Lastly, *Z. armatum* also demonstrates immunomodulatory effects, stimulating the lymphatic system, mucous membranes and circulation, and acting as a liniment for rheumatism and fibrositis, with its crude extract also influencing gastrointestinal, respiratory, and cardiovascular functions through modulation of K^{+} and Ca^{2+} channels **(Gilani *et al.*, 2010).**

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Culinary, Ecological and Other Uses

Aside from its medicinal benefits, *Z. armatum* is integral to several culinary traditions**.** The fruits are used as spices and condiments in chutneys, soups, and pickles. Twigs are employed as natural toothbrushes, especially in rural regions, due to their strong antibacterial properties.The plant's hard, durable wood is used to make walking sticks and simple tools. The bark has traditional use in natural dye production. Moreover, due to its strong aroma and the fruit is also used as an insect repellent, particularly effective against houseflies **(Gaur, 1999).**

Conclusion

Zanthoxylum armatum DC. stands as a valuable ethnomedicinal resource, demonstrating a wide spectrum of traditional and pharmacological applications across diverse Indian ecosystems. Its therapeutic versatility—spanning gastrointestinal, respiratory, dermatological, and dental conditions—coupled with antimicrobial, antioxidant, and anti-inflammatory activities, underscores its relevance to both traditional and modern medicine. Additionally, its roles in indigenous diets, oral hygiene, pest management, and spiritual practices highlight its cultural and practical significance. Scientific studies validate many of its traditional uses and reveal promising avenues for future drug discovery, particularly in cancer treatment, liver protection, and vector control. Given its ecological adaptability and diverse utility, there is a compelling need to conserve *Z. armatum* in its native habitats and integrate it more effectively into sustainable healthcare and economic development strategies. Conservation efforts, coupled with focused phytochemical and clinical research, could unlock further therapeutic potentials of this underutilized Himalayan medicinal plant.

References

Annappan, U., Rajkishore, V. B., & Ramalingam, R. (2015). A review on *Zanthoxylum alatum* Roxb. *Research Journal of Pharmacognosy and Phytochemistry*, *7*(4), 223–226.

https://doi.org/10.5958/0975-4385.2015.00034.5

Baquar, S. R. (1989). *Medicinal and poisonous plants of Pakistan*. Printas.

Barkat, U., Muhammad, I., & Muhammad, N. (2011). Evaluation of *Zanthoxylum armatum* DC for in vitro and in vivo pharmacological screening. *African Journal of Pharmacy and Pharmacology, 5*(14), 1718–1723.

Batool, F., Sabir, S. M., Rocha, J. B. T., Shah, A. H., Saify, Z. S., & Ahmed, S. D. (2010). Evaluation of antioxidant and free radical scavenging activities of fruit extract from *Zanthoxylum alatum*: A commonly used spice from Pakistan. *Pakistan Journal of Botany, 42*(6), 4299–4311.

Gaur, R. D. (1999). *Flora of District Garhwal, North Western Himalaya (with ethnobotanical notes)* (p. 811). Srinagar: Transmedia.

Gaur, R. D. (2008). Traditional dye-yielding plants of Uttarakhand, India. *Natural Product Radiance, 7*(2), 154–165.

Gilani, S. N., Khan, A. U., & Gilani, A. H. (2010). Pharmacological basis for the medicinal use of *Zanthoxylum armatum* in gut, airways and cardiovascular disorders. *Phytotherapy Research, 24*, 553–558.

Guo, T., Deng, Y. X., Xie, H., Yao, C. Y., Cai, C. C., Pan, S. L., & Wang, Y. L. (2010). Antinociceptive and anti-inflammatory activities of ethyl acetate fraction from *Zanthoxylum armatum* in mice. *Phytotherapy Research, 82*(3), 347–351.

Joshi, B., Lekhak, S., & Sharma, A. (2009). Antibacterial property of different medicinal plants: *Ocimum sanctum*, *Cinnamomum zeylanicum*, *Xanthoxylum armatum*, and *Origanum majorana*. *Journal of Science, Engineering and Technology, 5*(1), 143–150.

Kala, C. P., Farooquee, N. A., & Dhar, U. (2005). Traditional uses and conservation of Timur (*Zanthoxylum armatum* DC.) through social institution in Uttaranchal Himalaya, India. *Conservation and Society, 3*, 224–230.

Kanwal, R., Arshad, M., Bibi, Y., Asif, S., & Chaudhari, S. K. (2015). Evaluation of ethnopharmacological and antioxidant potential of *Zanthoxylum armatum* DC. *Journal of Chemistry, 2015*, Article ID 608675.

Kaur, V., Kumar, T., & Bora, S. K. (2011). Pharmacological evaluation of *Zanthoxylum armatum* root extract on analgesic and anti-inflammatory activity. *Journal of Pharmacy Research, 4*(8), 2561.

Kumar, A., & Gupta, S. (2020). Traditional uses of Timur (*Zanthoxylum armatum* Roxb.) in Uttarakhand—Past and future prospects. *Journal of Cardiovascular Disease Research, 11*(4), 686–694.

Mehta, D. K., Bhandari, A., Satti, N. K., Singh, S., Das, R., Suri, K. A., & Sharma, S. N. (2011). Anti-inflammatory activity of methanolic extract of fruit of *Zanthoxylum armatum*. *Inventi Impact: Ethnopharmacology, 52*, 11.

Paridhavi, M., & Agrawal, S. S. (2007). Safety evaluation of a polyherbal formulation, Zuroor-e-Qula. *Natural Product Radiance, 6*(4), 286–289.

Paul, A., Kumar, A., Singh, G., & Choudhary, A. (2018). Medicinal, pharmaceutical and pharmacological properties of *Zanthoxylum armatum*: A review. *Journal of Pharmacognosy and Phytochemistry, 7*(4), 892–900.

Ramanujam, S. N., & Ratha, B. K. (2008). Effect of alcohol extract of a natural piscicide—Fruits of *Zanthoxylum armatum* DC on Mg^{2+}- and Na^{+}, K^{+}-ATPase activity in various tissues of a freshwater air-breathing fish, *Heteropneustes fossilis*. *Aquaculture, 283*(1–4), 77–82.

Ranawat, L. S., Bhatt, J., & Patel, J. (2009). Hepatoprotective activity of ethanolic extracts of bark of *Zanthoxylum armatum* DC in CCl_4 induced hepatic damage in rats. *Journal of Ethnopharmacology, 127*(3), 777–780.

Samant, S. S., Dhar, U., & Palni, L. M. S. (1998). Medicinal plants of Himalaya: Diversity, distribution and potential values. *Himavikas, Gyan Prakash, Nainital, 13*, 163–172.

Sati, S. C., Sati, M. D., Raturi, R., Badoni, P. P., & Singh, H. (2011). A new flavonoidal glycoside from stem bark of *Zanthoxylum armatum*. *Journal of Pharmacognosy and Herbal Formulations, 1*(2), 29–32.

Sekar, T., Ayyanar, M., & Gopalakrishnan, M. (2010). Medicinal plants and herbal drugs. *Current Science, 98*(12), 1558–1559

Sharma, S., & Subedi, S. (2022). Medicinal value of *Zanthoxylum armatum* DC (Timur): A review. *Asian Journal of Pharmacognosy, 7*(3), 25–32.

Singh, T. D., Meitei, H. T., Sharma, A. L., Robinson, A., Singh, L. S., & Singh, T. R. (2015). Anticancer properties and enhancement of therapeutic potential of cisplatin by leaf extract of *Zanthoxylum armatum* DC. *Biological Research, 48*(1), 1–9.

Tiwary, M., Naika, S. N., Tewary, D. K., Mittal, P. K., & Yadav, S. (2007). Chemical composition and larvicidal activities of the essential oil of *Zanthoxylum armatum* DC. (Rutaceae) against three mosquito vectors. *Journal of Vector Borne Diseases, 44*, 198–204.

Upadhyaya, K., & Ashok, P. K. (2010). Concentration-dependent antioxidant activity of *Zanthoxylum armatum*. *Journal of Pharmacy Research, 3*(7), 1581–1582.

Verma, K. K., Kumar, B., Raj, H., & Sharma, A. (2021). A review on chemical constituents, traditional

uses, pharmacological studies of *Zanthoxylum armatum* (Rutaceae). *Journal of Drug Delivery and Therapeutics, 11*(2-s), 136–142. https://doi.org/10.22270/jddt.v11i2-s.4736

Verma, N., & Khosa, R. L. (2010). Hepatoprotective activity of leaves of *Zanthoxylum armatum* DC in CCl_4 induced hepatotoxicity in rats. *Indian Journal of Biochemistry & Biophysics, 47*, 124–127.

Yun, Z., Ying-Hui, P., Dong-Qin, Z., Fei-Fei, C., Qio-Hui, Q., & Yi, H. (2010). Insecticidal activity of essential oil from *Zanthoxylum armatum* fructification against two mosquito species. *Guihaia, 30*(2), 274–279.