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Traditional Uses of Timur (*Zanthoxylum Armatum* Roxb.) in Uttarakhand - Past and Future Prospects

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Abstract

Zanthoxylum armatum Roxb. is a vulnerable medicinal plant known for its medicinal activities for long globally. It has been widely described in different traditional systems of world like Ayurveda, Chinese, etc. The plant is edible and has been in use since ancient times in cough, cholera, fever, itching, piles, leucoderma, rheumatism, tonic, indigestion, tooth complaints, etc. Research is going on different medicinal aspects of this plant but only few properties have been scientifically proved as antibacterial effect against *Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Enterobactor aerogenes,* etc., larvicidal, anti-inflammatory, analgesic, antinociceptive, antioxidant, antibiotic, hepatoprotective, antiplasmodial, cytotoxic, antiproliferative, anthelminthic, antiviral,anticonvulsant and antifungal (*Bipolaris sorokiniana).* Not even half of the medicinal properties have been explored. Plant frequency is decreasing drastically due to its slow growth, poor germination of seeds, illegal harvesting and local ignorance. Instant measures should be taken immediately to prevent extinction of this plant.

Keywords: Timur, *Zanthoxylum armatum,* Medicinal plant

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INTRODUCTION:

India has richest plant based medicinal traditional system because of its rich biodiversity. Like India, in other developing countries, herbal plants constitute very important national resources of health sector. These herbal medicines are mainly used for health care due to their cost value, effectiveness and lesser side effects on human body (Sekar et al., 2010). So, the pharmaceutical industries are directly or indirectly dependent upon the plant material. The Indian Himalayan region (IHR) recognized amongst 34 biodiversity, hot spots in the world. It contains about 1,748 different species of medicinal plants (Samant et al., 1998).

Among different medicinal plants of IHR, *Zanthoxylum* (family: Rutaceae) is one of such vulnerable (Kala, 2005) genus which possess high medicinal, economical as well as ecological importance and have about 250 species spreading all over the world. In India, 11 species of this genus is reported. These are; *Z. budrunga, Z. oxyphyllum, Z. ovalifolium, Z. acanthopodium, Z. planispinum, Z. armatum, Z. nitidium, Z. rhesta, Z. simulans, Z. avicennae* and *Z. limonella*. Outof these, 4 species; Z. *armatum* DC.,*Z. acanthopodium* DC., Z. *oxyphyllum* Edgew, and Z. *budrunga* are present in Uttarakhand (Kala *et al*., 2005).

Z. armatum DC is an important medicinal plant which is commonly known as Indian Prickly ash, Nepal pepper or toothache tree. Local name of this plant is tejphal (Hindi), Tejowati (Sanskrit), Mukthrubi (Manipuri) and timur (Nepal).

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The plant finds its position in a number of traditional medicinal systems of world like Ayurveda, Unani, Chinese, etc. where it has been used in curing many diseases. Modern researchers have attempted to prove its medicinal value but they have covered very little portion and a large amount of research is still to be done.

DISTRIBUTION:

Z. armatum is a vulnerable deciduous shrub or small tree which grows in well drained alluvial, black soil. In India, it has been reported from the warmer valleys of the Himalaya from Jammu and Kashmir to Assam and Khasi (1,000 to 2,100m asl), in the Eastern Ghats in Orissa and Andhra Pradesh (1,200 m) and the lesser Himalayan regions in the north-eastern part of India for example, Naga Hills, Meghalaya, Mizoram, and Manipur (Kala *et al*., 2005). *Z. alatum* is synonyms to it (Gupta *et al*., 2011). In previous studies, Z. *alatum* was later named as Z. *armatum* and Z. *planispinum*, but Flora Hupehensisregards both Z. *armatum* and Z. *planispinum* as distinct species (Gardener, 1995).*Zanthoxylum armatum* prefers semi shady or no shade for growth. Valleys and thickets in the mountain wasteland and the under-storey of mixed forests are customary locations of the species.

TRADITIONAL / FOLK USES:

Timur is known as an important magical plant because plant parts like leaves, stem, bark, fruits, seeds and roots possess medicinal properties and are used in indigenous medicine preparation against various diseases. The medicinal properties of plant have been described in different traditional health systems asAyurveda, Unani, etc.In countries like Nepal, China, etc. a number of traditional uses have been mentioned since long and local people especially women are taking using of this plant.

The Uttrakhand Bhotiya tribal community uses *timur* more than any other ethnic group inUttarakhand due to its availability near their winter settlements. They use *timur*fruit in the form of condiments, spices and medicine.During winter, a soup made from the dried fruit (known as *hag*) is consumed by the entire family to keep warm. A chutney (like a sauce), locally known as *dunkcha*, is also a popular food item. The Bhotiya community also brew liquor from *timur*, but the resulting liquor is palatable only to those highly addicted. Most members of the community consider the tree to have religious significance and magical properties.

Nearly all plant parts like root, stem, leaves, flowers, fruits and seeds are used in traditional medicinal system. Following are some of the traditional uses of various parts of plant.

Root:are used for relief in gums pain (hence it is also known as tooth ache tree) and also in snakebite,

Leaf:has antipyretic action. The tender leaves are even used as vegetable (Prajapati *et al*. 2003).

Stem:the young branches are very good source of tooth brushes and curing gum diseases and hard old branches are used as walking sticks[Arshad & Ahmad, 2004; Abbasi *et al*., 2010]. People purchase them local people when they go for pilgrimage. Local people keep the sticks in their vehicles, house main doors to get rid of evil spirits.

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Bark: istraditionally used in dye yield. The natives of North America crush the bark and apply on their gums for relief. It is also used in China and India as snakebite remedy.Not only for human but bark is also used in some diseases of animals like Buffalo, Cow, Oxen, sheep, goat, horse, mule, dog, cat. Whenmilled with pod of *Capsicum annuum* it is used in disease Fascioltasis (Growth of hard knot on the surface of thyroid gland) and bone fracture (Phondani *et al*., 2010).In North America bark is used to prevent infection in stored grains. In China and Bhotiatribe of India, bark is used in stomachache, tooth-ache, coughs, urinary and veneral diseases, leprous ulcerations, rheumatism and lumbago.

Fruits and seeds:the fruits are considered to be most important part of this plant as they yield timur oil.They find large number of medicinal applications as in toothache (Prajapati, 2003), dyspepsia, carminative and stomachache, condiment and flavouring agent, antipyretic action.Seed infusion of *Zanthoxylumarmatum* mixed with the *Allium sativum* bulb and little salt is taken twice a day in stomach bloating, digestive appetizer, to cure asthma, and bronchitis, eliminate pain, use to treat heart diseases, piles, diseases of mouth, teeth and throat disorder (Farooquee, 2004), also prescribed in dyspepsia and diarrhea, cold and cough. Fruits are also used to ward off houseflies, roundworms and lotion for scabies (Gaur, 1999). The plant is used for Pneumonia and tick infestation [Sindhu *et al.* 2010]. As per Unani formulation the fruits are used in preparing Zuroor-e-Qula. The dried fruits are used for pickling (Manadhar and Manadhar, 2002; Giri and Rana, 2008) and powdered fruit is mixed with *Mentha* sp. and table salt, eaten with boiled egg for chest infection and digestive problems [Islam, 2009].Powder of *Zanthoxylum armatum* dried fruit, *Mentha longifolia* dried leaves, *Trachyspermum ammi* seeds and black salt is taken with water thrice a day for 3-4 days during cholera and indigestion. (Abbasi 2010)

MODERN RESEARCH IN *ZANTHOXYLUM ARMATUM*:

Z. *armatum* fruits, seeds and stem bark are used in the treatment of asthma, bronchitis, indigestion, toothaches, varicose veins, diarrhea, rheumatism, dyspepsia, cholera and toothache (Kanjilal, 1997; Kirtikar and Basu, 1993). The different chemical extracts from stem, bark, fruits and roots have different pharmacological activities. The fruits of timur are analgesic and anodyne and are being used by several industries in making dabur red gel tooth paste, dabur lal dantmanjan, dabur toothpaste, dabur meswak toothpaste and MDH danthmanjan etc. Steam distillation of dried fruits yields an essential oil that has deodorant and antiseptic properties; it is used in soaps and dental preparations. Barkatullah *et al.* (2011) tested the leaves and fruits of this plant for various pharmacological activities including antipyretic action.*Z. armatum* has shown significant antioxidant activity and also contain phenolic compounds*(*Vermaand Khosa2010*).* The bark of several Indian species of *Zanthoxylum* is medicinally active and noted forfebrifugal, sudorific and diuretic properties (Wealth of India 2005).Some of modern researches carried out in *Z.armatum* are as:

Mosquito repellent:

Das *et al*. (1999) studied the mosquito repellent property of its oil against mosquitoes in mustard and coconut oil base and compared with synthetic repellent dimethyl phthalate (DMP) as standard.

Cardiovascular disorders:

The crude extract exhibits spasmolytic effects, mediated probably through Ca^{2+} antagonist mechanism, which provides pharmacological base for its medicinal use in the gastrointestinal, respiratory and cardiovascular disorders. The extract exhibited concentration disorders.

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Piscicidal activity:
The piscicidal activity of ethyl alcohol extract of the fluids evaluated Mg^{2+} and Na^{+}, K^{+}-ATPase activity in different tissues of a carnivorous air breathing catfish heteropneustes fossilis on exposure of fish to different concentrations of extract and at LC50 for different time intervals revealed significant inhibition of enzyme activity in brain, liver and muscle tissue. The inhibition was both dose and time dependent and reversible.

Leech repellent:
Essential oil of it possesses leech repellent activity experiments on persistence of repellent properties of N, N-diethyl phenylacetamide (DEPA), N,N-diethyl-m-toluamide (DEET), 3-acetyl 2(2- 6- dimethyl-5-heptenyl) oxazolidine (citronyl, dimethyl phthalate (DMP) and N-benzoyl piperidine (NBP) on cloth were tested on land leeches in evergreen rain and deciduous forests of Assam. Results obtained were compared with volatile oil of it to evaluate its efficacy as leech repellent. *Z. armatum* oil was at par with citronyl and exhibited better results than DMP and NBP.

Inhibits skin sensitivity
A lipophilic extract of the fruits was credited for reducing mouth irritation due to food. Dilution of this extract with oleyl alcohol gives an ingredient of cosmetic which is easy to formulate and is endowed with a remarkable sooting effect based on inhibition of sensory irritation from sun bathing, shaving, depilation, insect bites, chemical treatments and other causes.

Lousicidal
The seeds exhibit lousicidal potential against tropical hen louse, lipeurus lawrensis tropicalis. The seed extracts were diluted to the desired level (1:0, 1:1, 1:5, 1:10 and 1:100) and the lousicidal properties varied in proportion to the dilution and exposure time.

Anti-inflammatory
Bergapten, a coumarin extracted from the plant exhibited significant inhibition of the production of pro-inflammatory cytokines, namely tumour necrotic factor-α (TNF-α) and interleukin-6 (IL-6) by PBMCs stimulated with lipopolysaccharide in a concentration-dependent manner. Also, linalool and linalyl acetate are known to acquire inflammatory activity.

Antibacterial, antifungal and cytotoxic activities
Singh *et al.* (2012) reported a main flavanoid, 3,5-diacetlyambulin from *Z. armatum*which showed significant antibacterial activity against gram positive bacteria (*Bacillussubtilis*, *B. Megaterium*, *Staphylococcusaureus*) and gram negative bacteria (*Escherichiacoli*, *Shigelladysenteriae*, *S. sonnei*, S. *flexneri*, *Pseudomonaaeruginosa*, *Salmonellatyphi*). The MIC values against these bacteria ranged from 8-64µg/ml. However this flavanoid and monoterpenoid (geraniol) shows weak antifungal activity.Essential oil of *Z. armatum* hasshowed strong inhibition of mycelial growth against the test fungus *Bipolarissorokiniana* (Manandhar and Tiwari, 2005).

Anti-oxidative activity
The ethanolic and methanolic extract of *Z. armatum* fruits shows 2,2-diphenyl-1-picrylhydrazyl (DPPH) radial scavenging activity observed by *in vitro* system in albino wistar

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rats; due to presence of free radical activity, the extract are used as a good source of antioxidant (Batool *etal*., 2010; Upadhyaya and Ashok, 2010).

Anti-inflammatory activity
The ethanolic stem bark extract causes significant reduction in paw edema in male wistar rats due to the inhibition of cyclooxygenase (Sati *etal*., 2011) and fruits extract also show inhibition of carrageenan that induced paw edema in wistar rats (Mehta *etal*., 2011). It also has analgesic activity due to the presence of lignans components (Kaur *etal*., 2011; Guo*etal*., 2010).

Anti-microbial activity
It possesses inhibitory activity against microorganism. The largest zone of inhibition was obtained against *Bacillus subtilis* (23 mm) and minimum bactericidal concentration (MBC) value of 2.5 mg/l was obtained (Joshi et al., 2009). Essential oils of it is assessed for their fungitoxicity against *Alternaria brassicicola* (Parajuli *et al*., 2005).

Insecticidal and larvicidal activity
In combination, *Z. armatum* seed oil, vanillin and fruit oil of *Z. piperitum* have been able to enhance repellent activity against female *Aedes aegypti*, the effect was compared with N,N diethyl-3methylbenzamide(DEET) repellent (Kwon, 2011). The essential seed oil singly showed larvicidal activity against the mosquito spp. *Culex quinquefasciatus*, *Aedes aegypti*, *Anopheles stephensi*(Tiwary *et al*., 2007) and also effective against *Aedes albopictus* and *C. pipiens* (Yun*et al*., 2010).

Piscicide activity
Fruits of this plant can be used as an effective piscicide in fish nursery management. The ethyl alcohol extract was evaluated on Mg^{2+}- and Na+, K+-ATPase activity in different tissues of *Heteropneustes fossilis* (air-breathing catfish). Kinetic studies on Mg^{2+}-ATPase activitysuggested that as piscicide, it is a non-competitive inhibitor (Ramanujam and Ratha, 2008).

Hepatoprotective activity
Administration of its ethanolic leaves extract protect mice liver against the CCl4 induced hepatotoxicity and inflammation (Verma and Khosa, 2010). The extract of the bark increased the level of antioxidant enzyme and also regulate the serum enzymatic levels; in this way, it was able to induce protective mechanism against the CCl4 hepatotoxicity in mice liver (Ranawat *et al*., 2009).The stem has exhibited hypoglycaemic activity in the preliminary trials. Zanthobungeanine, found in stems and roots shows inhibitory activity to plateletaggregation, L-plananin is the most active compound.

Anti-inflammatory activity
Guo *et al.* (2011) have reported antinociceptive and anti-inflammatory activities of ethyl acetate fraction from *Zanthoxylum armatum* in mice

Antitumor activity
Z. armatum has potential as anticancer drug because the crude extract of leaves and fruits show cytotoxicity (Barkatullah et al., 2011). It contains a monoterpene, lupeol which act as therapeutic and chemopreventive agent for the treatment of inflammation and cancer.

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Immunomodulation activity

It also shows a stimulating effect upon the lymphatic system, circulation, mucous membranes and also act as stimulation liniment for rheumatism and fibrositis. Its crude extract useful in the treatment of gastrointestinal, respiratory and cardiovascular disorder, resulted concentration effect on the K+ and Ca++ channel (Gilani et al., 2010).

DISCUSSION:

This paper has attempted to provides comprehensive information on diversity, utilization pattern, status and indigenous/folklore and proved modern medicinal and clinical uses of *Zanthoxylum armatum*. This plant is endemic to this region and is highly important in biodiversity conservation but overexploitation of roots, leaves, whole plant, bark, fruits and seedsindicatesgrave threats on this species.Further, mostly it is used inpharmaceutical industries and in Ayurvedic, Unani,Tibetan and American system of medicine. They are also used in folklore/traditionalway. According to the All India Trade Survey of prioritizedmedicinal plants, demand of some high-value medicinal plantshas increased 50%, whereas availability has declined. The ever-increasing demand of this species in the bothpharmaceutical industries and in traditional system hasresulted in habitat degradation and overexploitation. Ifoverexploitation of this plant continues, it may ultimately disappear from its naturalhabitats. This is a economically importantplants with multiple uses which have been not explored to their maximum yet. It thus faces very high degree of pressures, callsan urgent need for adequate conservation and management.To achieve the goals, a collaborative work plan has tobe prepared involving various stakeholders i.e., local people, vaidhya, scientists,technocrats, government organizations, NGOs and farmers. The plant has got lot of potential but is poorly scientifically explored for this reason also it requires instant attention of scientists.

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