

**Quality Standard,**  
**Good Agricultural and Collection Practice**  
**Zanthoxylum armatum DC.**



Government of Nepal  
Ministry of Forests and Soil Conservation  
Department of Plant Resources  
Thapathali, Kathmandu, Nepal  
2011

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2011

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**Published by:**

Government of Nepal

Ministry of Forests and Soil Conservation

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Cover Photo by Rose Shrestha

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## **Acknowledgement**

Mr Pushpa Raj Shrestha, former Acting Director General of this department is greatly acknowledged for initiating this work. Sincere thanks also go to Mrs Sushma Upadhaya, Officiating Director General for her advice. Dr Sushim Ranjan Baral, former Acting Director General, and Dr Nirmal Kumar Bhattarai, former Scientific Officer of this department and now working at International Centre for Integrated Mountain Development (ICIMOD) as a MAP Expert deserve special appreciation for their technical inputs and editing this publication. Thanks are also due to Mr Dil Bahadur Chhetri, Chief of District Plant Resource Office at Salyan, and Mr Pankaj Kumar Das, Programme Officer of Herbs and NTFP National Coordination Committee (HNCC) for providing various information needed for this booklet.

## **Introduction**

*Zanthoxylum armatum* DC. (Eng. Winged prickly ash; Nep. Timur) is a popular Nepalese spice plant. Its fruits used in pickle and vegetable especially mushroom preparation. Due to its fruit and bark with appealing aroma and multipurpose medical properties, Timur is used in the manufacture of several health-care, cosmetic as well as toiletry products. India is Nepal's major commercial outlet for dried Timur fruits (Edwards 1996; Hertog 1997). Its domestic market is also remarkable with 4000 Kg/year in Kathmandu valley alone (Tiwari *et al.* 2004).

It is one of the top five NTFP species in trade in terms of royalty collection (Das 2006). During the last two decades, the market price of Timur has been increasing considerably. This has attracted more people towards its cultivation. Salyan district of mid western region of the country is one of the main Timur production areas with 400–600 kg of collection annually (Hertog 2000). Approximately 70% of the total value of the NTFPs collected in the district is attributed to the fruits of this species. Based on its varied industrial uses, the demand of Timur is constantly increasing, both in domestic and international markets. Majority of the productions are collected from the wild while the interest of farmers has increased in recent days towards its cultivation in farms and marginal land.

Many community forests in the hills have been conserving and managing the species in the wild, including enrichment plantations in its natural habitats. Due to its increasing commercial demand and price in the international markets, over-harvesting and unscientific collection of Timur has been taking place in Nepal, contributing to rapid depletion of the species in its natural habitats. However, as a result of demonstrations, training and capacity building efforts, etc., done by various governmental, non governmental and international organizations involving local collectors and producers throughout the country, the scenario has improved and cultivation practices have evolved to supplement wild collections at many places. As the result, many farmers have started its cultivation on their private land as well.

Recently, the community forest user groups and local farmers in far west Nepal including districts like Doti, Dadeldhura, Baitadi and Darchula have considered Timur as one of the viable medicinal plants in terms of local livelihood enhancement. Seedling production in community-managed nurseries, cultivation and enrichment plantation in community forests and cultivation on private land has been the established trend in far west Nepal. Timur, thus produced, is being traded through community-owned and community-managed non-timber forest product-based cooperatives, benefiting the community forest user group members and local farmers alike (Personal communication: CFC/ICIMOD/HNCC project on Medicinal Plant in Far-west Nepal).

The safety and quality of raw medicinal plant materials and consumer products depend on the genetic and environmental factors in addition to cultivation methods, collection periods, harvesting techniques, post-harvest processing, transport and storage practices etc. Inadvertent contamination from microbial or chemical agents during any of the production stages can also lead to deterioration in safety and quality. Therefore, it has been felt necessary that detail information on the species, especially its good agricultural and collection practices, post-harvest procedures and quality standards be documented for wider dissemination to facilitate all stakeholders for the identification, conservation, cultivation, and trade of this highly valuable Nepalese medicinal plant species.

## 1. Plant Identity

Scientific name	<i>Zanthoxylum armatum</i> DC.
Synonym	<i>Zanthoxylum violaceum</i> Wall.; <i>Zanthoxylum alatum</i> Roxb., <i>Z. hostile</i> Wall.
Family	Rutaceae
English name	Nepali Pepper, Toothache Tree, and Prickly Ash
Vernacular name	Timur, Tumburu (Sanskrit), Prumo (Gurung & Tamangs), Tejbal (Hindi). Umpur (Chepang), Tirkene (Danuwar), Sungrekun (Lepcha), Midimba, Warekpa (Limbu), Tebu, Timoo (Newari), Aayekya, Khachkan, Khokchippa,

	Terkane (Rai), Yerma, Yermang (Sherpa), Serkren (Sunuwar).
Other name	Nepali dhaniya, Tejwal, Tumru (Hindi), Fagis-akababa-khanda (Arabian), Gyer-ma (Tibetan)
Trade name	Timur

**2. Parts used**                      Fruits, seeds, barks and leaves

### **3. Uses**

Timur seeds and fruits are extensively used in indigenous Ayurved and Yunani systems of traditional medicine. Seed and fruits are used as carminative, stomachic, analgesic, expectorant, diuretic insect/repellent and also used for dental problems and scabies (Kapoor 2001, CSIR 1985, Kirtikar and Basu 1980). Fruit as well as the branches are used as a remedy for toothache; also stomachic and carminative (Chopra *et al.* 1958, Nadkarni 1954).

Mature fruits and bark are used in fever, cough, dyspepsia, cholera, constipation, anthelmintic while immature fruit paste is used in cuts and wounds, as anti-leech and to relieve dental pain. Pounded bark, fruits and leaves are used in stomach pain. Fruits and bark are also used in stunning fish, controlling pests on stored grains and woollen clothes. Its wood is strong and used for walking- sticks and clubs (ESON 2009). Leaves are used for feeding Muga silk worms; leaves yields an essential oil with an aroma reminiscent of rue oil (*Ruta graveolens* L (Ambasta *et al.* 1992). The essential oil from dried



fruit has deodorant, antiseptic and anthelmintic properties, finding its uses in soap materials and dental preparation also. Oil from fresh plants has antifungal activities (ANSAB 2003).

### **Pharmacological Properties**

Timur seeds and fruits are high in linalool content which is effective healing wounds and injuries, pain, swelling, spasm and allergies. Methanolic extract of bark insignificantly inhibits leukotriene, which causes pain, inflammation and broncho-muscular constriction (Kumar *et al.* 2000). Ethanol extract of fruit was found responsive against gram positive bacteria (*Bacillus subtilis*, *Staphylococcus aureus*, *Mycobacterium phlei*) whereas it was neutral to gram negative ones (Taylor *et al.* 2002).

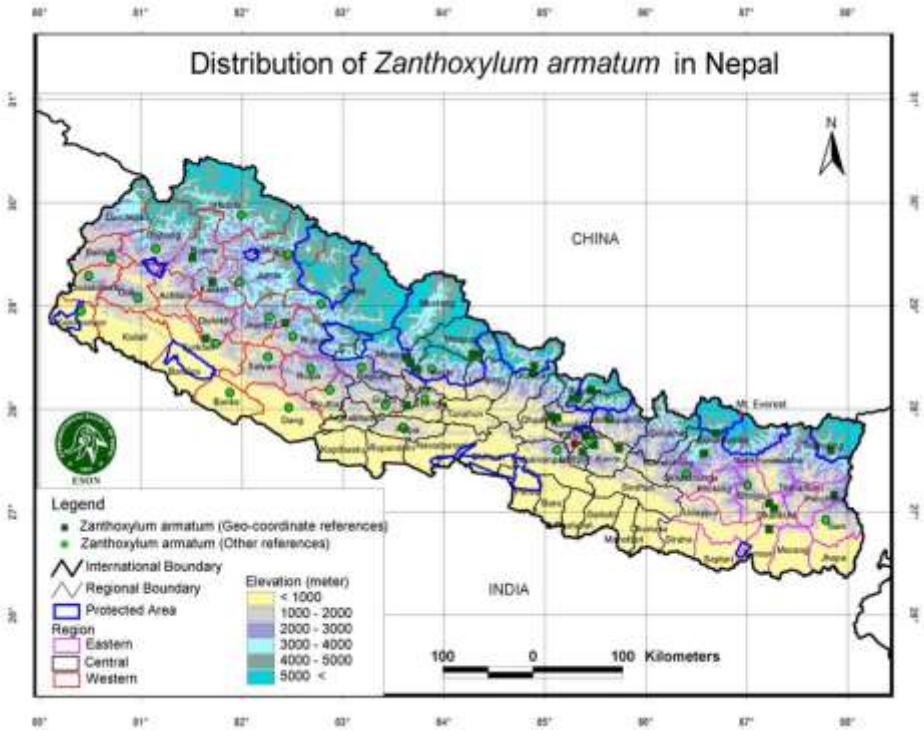
### **Ayurvedic drugs and preparations**

The common Ayurvedic drugs containing Timur are Tejovatyadya Ghrita, Tumarvadi Churna, etc.

## **4. Distribution**

The species is found in hot valleys of subtropical to temperate Himalayas (Kashmir to Bhutan), NE. India, China, Taiwan and Philippines .

In Nepal, it is distributed from west to east at an elevation of 1000-2500m. (Bhattarai and Ghimire 2006, DPR 2007; Baral and Kurmi 2006)



**Map 1. Distribution of *Zanthoxylum armatum* in Nepal ( ESON 2009)**

#### 4.1 Ecological characteristics

Usually this species dominates the north-east facing slopes with *Quercus*, *Berberis*, *Rubus*, *Rhododendron*, *Cotoneaster* and *Myrica* dominated forests in subtropical to temperate climatic zones of Nepal. Moist areas with deep soil and sites exposed to sun in degraded slopes, shrub lands, natural forests and wastelands are found suitable habitats for this plant. However, vigorous growth of

plants can be seen in sunny habitats with good humus enriched sandy loam soil (Kunwar 2006).

#### **4.2 Major production areas**

Very recently, commercial cultivation of this species has been popular in some areas of western and central Nepal. The Rapti Valley including Rolpa, Salyan, Pyuthan, Rukum districts of mid-west Nepal, is renowned for high quality Timur production.

Thirty-eight districts viz. Baglung, Baitadi, Bajhang, Bajura, Banke, Bhaktapur, Bhojpur, Dadeldhura, Dailekh, Dang, Dhankuta, Dolpa, Doti, Gorkha, Humla, Kalikot, Kaski, Kathmandu, Kavrepalanchok, Lalitpur, Makawanpur, Manang, Mugu, Mustang, Myagdi, Nuwakot, Okhaldhunga, Palpa, Panchthar, Parvat, Rasuwa, Rolpa, Salyan, Sindhupalchok, Solukhumbu, Surkhet, Syanja and Taplejung have been reported to produce the species in considerable quantities.

### **5. Morphological Characteristics of the Plant**

A shrub or sometimes a small tree about 6m tall, with corky bark and with numerous long straight spines on branchlets and leaf stalks, with pinnate leaves. Leaves are 10-23cm long, alternate, trifoliate or imparipinnate, pungent and aromatic, with glabrous, narrowly winged petiole having two stipular straight pink prickles. Leaflets 3-11, elliptic or lanceolate slightly serrate with transparent gland, apex acute, dark glossy green above & pale beneath, terminal leaflet

larger than the laterals. Flowers small, green or light yellow in short branched lateral or axillary clusters. Flowers about 1 mm, one-sexed; calyx with 6-8 acute lobes; petals absent; stamens 6-8, much longer than calyx in male flowers. Leaf-stalk narrowly winged; leaflets 2-6 pairs, lanceolate, about 8 cm, toothed, sparsely gland-dotted. Ripe capsules 3-4 mm, globular, red, wrinkled, aromatic; seed shining black (Bhattarai and Ghimire 2006, DPR 2007, Polunin and Stainton 1984).

**Flowering season:** March- May

**Fruiting season:** July-October

## **6. Characteristics of the Drug Material**

### **6.1 Diagnostic Features of Crude Drug**

#### **Macroscopic**

Fruits are globose; reddish black to black in colour with rough texture; split into two halves with yellowish inner surface bearing single shining black hard seed. Bark is blazed, 7.5-10mm pale yellowish brown with or without pale streaks, darkening on exposure. In the market it comes in dark brown or black pieces in packet. Oil extract from seed (yellow in colour) tastes pungent and has slight burning sensation on tongue for some time. It has spicy odour resembling cubebis (*Piper cubeba*) and wild rose (*Rosa canea*).

## **Microscopic**

Fruit powder consists of abundant dark clusters of fragments of fruit coat along with few parenchymatous cells, fragments of reticulate vessels.

## **Powder drug**

Powdered drug is dark brown free flowing with yellowish fragments of inner testa & black particles and with strong characteristic odour, aromatic taste that remains for few minutes with tingling effect (Rajbhandary and Ranjitkar 2006).

## **7. Preferred growing conditions**

### **Soil/Climatic conditions**

It doesn't require much fertile land for cultivation. It generally prefers loamy or clayey soil with medium moisture content and fertility with pH 6.5-7. It can also be grown on red laterite soil. The marginal land that is not useful for other crops may be used for this plant. The subtropical-temperate climatic zones (1000-2500m) with loose sandy soil and rich organic matter are preferred for cultivation. The farmers usually cultivate it at the margins of their farmland and also in barren spaces not suitable for the cultivation of other crops.

## **8. Method of Cultivation**

### **8.1 Selection of plant**

Good strains of plants are selected after observing its quality and yield as the mother plant for collection of planting materials, and tagged. Healthy and best yield quality plants (i.e. having high yield and high fruit oil content) from sunny places should be selected for propagation.

### **8.2 Vegetative propagation**

Timur can be propagated from stem cuttings of 1 year old branches. Stem pieces with 1-2cm diameter having 2-3 nodes should be taken for cutting. These cuttings are dipped in 2-3% of Rootex no. 3, a root initiator, and planted in poly bags or nursery bed on sunny places during January-February. This method is labor intensive and expensive also, hence usually not preferred for mass propagation.

### **8.3 Propagation from seeds**

Fruits are collected in September- October when fully mature and appear red in colour. They are dried in shade for 4-5 days. The shining black and glazed seeds are collected and further dried under sun for 4-5 days and immediately sown in nursery beds. Freshly harvested seeds are found best for the large scale cultivation showing high percentage of germination. Seeds should be soaked in running water for 24-48 hours or washed repeatedly in lukewarm water before sowing in order to wash out the essential oil present on the seed surface.

For nursery bed, one meter wide and raised bed preferably running east-west are prepared by mixing fine soil, sand and compost in equal proportions. The seeds are sown 3-5 cm deep in line with 7-10cm spacing. Dome shaped plastic house should cover the nursery beds to maintain the temperature and humidity and also to protect from rain. Beds are irrigated frequently to keep them evenly moist. Germination time may vary from 1 to 6 months. The germination of the treated seeds has been found to vary between 60-80% depending upon the maturity of the seeds and other physical conditions. About 500 gm seeds are required for producing seedlings to cover one hectare of land.

To get the stable/strong seedling, pricking should be done. Four-leaved seedlings should be transplanted in nursery bed or in poly bags (13cm x 5cm, punched with 2-4 holes) filled with mixture of forest soil, sand and manure (1:1:1 ratio) without disturbing the root. Seedlings of 20-25cm height or 1 year old with prickles developed are ready for plantation in the field (Chhetri 2004).

#### **8.4 Land preparation**

For plantation, land or soil for cultivation area should not be in environmentally hazardous condition i.e. not at a risk of contamination of hazardous substances including heavy metals, pesticides or other industrial wastes. Pits of 30-45cm deep and 30-45cm diameter should be prepared with 3x3 m spacing three months before planting preferably before monsoon in March -April. Each pit

should be filled with soil mixture prepared by mixing equal proportions of local soil, forest soil and compost. About 5kg of well rotten compost or farm yard manure for each pit is recommended as a basal dose.

### **8.5 Plantation**

Plantation should be done in May-June (after pre-monsoon rain but before monsoon). Healthy seedlings of 30 cm height are planted in the prepared pits in the field. Seedlings with well-developed pricks show less mortality rate. About 1100 seedlings are needed for 1 hectare of land. Organic cultivation using 5-6 tonnes/h farm yard manure has been recommended (Chhetri, 2004).

## **9. Management**

### **9.1 Irrigation**

Irrigation is needed regularly in the establishment phase. Mulching with dry leaves should be done after transplanting the seedlings to retain moisture in the pit. Once established, the plants are able to survive in rain-fed condition. Water logging should be avoided. Irrigating water should not be contaminated by domestic animal and human wastes.

### **9.2 Thinning and weeding**

Weeding should be carried out once in a month for some months after plantation. Later weeding may be done as and when needed. After 4-5 years of planting, the dried and unwanted branches of the



plants are pruned. Light pruning triggers vigorous growth of the plant.

### **9.3 Manuring**

About 5kg of cow dung or organic compost per pit should be applied as a basal dose before planting. Later manuring is not needed. Compost used should be well decomposed.

### **9.4 Disease and pest control**

Crinkling of the leaves and black ant infestation is common in Timur. Parasites and epiphytes like lichens are also problematic for this tree. For this, organic pest management measure should be used.

### **9.5 Soil fertility increment**

Intercropping with leguminous plants e.g. Mucuna, Soyabean and other pulses are found to be beneficial from the field experiences.

## **10 Harvesting and Post Harvest Procedures**

The crop starts yielding fruit from third year of plantation. The plants developed from cuttings start fruiting earlier than those from seeds. The ripe fruits (dark red coloured) from healthy and disease free plant should be collected manually or using secateurs/sticks with plastic sheets or cloth spread on the ground beneath the branches. Harvesting by branch cutting should not be practiced as the cut branches need nearly 2 years to mature enough to bear fruit. Harvesting equipment should be clean and hygienic. An individual

can collect 4-5 kg seeds in a day (Kunwar 2006). In nature, regeneration takes place from seeds. Therefore, only 90% of the mature fruits should be collected to assure natural regeneration from seeds.

After harvest, the fruits are dried in shade and unwanted materials such as broken pieces of leaves; small twigs of the same or other plant are removed. Fruits, after complete drying, are stored in moisture free container or jute bags and kept in well ventilated rooms. Mechanical damage, high compaction and storage which promote composting should be avoided. Time between harvest and transport to drying site should be kept as short as possible to avoid contamination and loss of essential oil.

### **11. Expected yield**

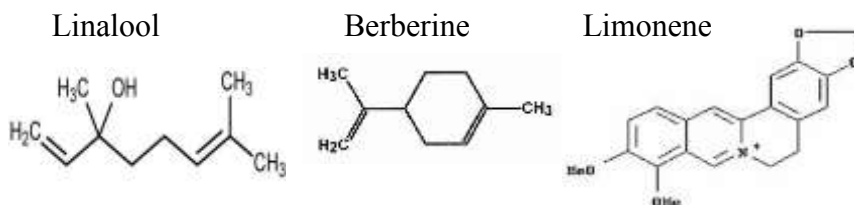
Five year old plants yield on average about 3 kg of fruits per year. (i.e. 3000-3500 kg /yr./ha.). The fresh to dry weight ratio is 1:0.25. Timur flowers usually around April to May and produces constant fruit yields over the years. More mature trees produce considerably high yield of fruits. Fully mature trees have been seen to produce up to 15kg of fruits per tree per season. However, hailstorms in spring can destroy the flowers, thus reducing the yield.

### **12 Quality Standards**

#### **Chemical constituents of the Plant material**

Bark contains a bitter crystalline principle identical with berberine, a volatile oil, and some resin (Kapoor 2001). The fruit contains an essential oil consisting chiefly of 1-L-phellandrene with small amount of linalool and limonene together with methyl cinnamate,  $\beta$ -phellendrene, zeraniol, sabinene, citrol, etc.. Leaves yield an essential oil which has carbonyl compound identified as methyl-nonyl ketone. The ketone-free fraction contained linalyl acetate, sesquiterpene, hydrocarbon, and tricosane (Kapoor 2001). From the stem bark, dictamine has been isolated (Chopra et al. 1969). Dried bark also contains lignans-sesamin, fagesin and epieudesmin, a neutrallactone-pulvialid, dictamins including 8-hydroxy dictamine and 8-fragmine (Acharya *et al.* 1979). The roots yielded the alkaloids dictamine,  $\gamma$ -fagarine, magnoflorine, skimmianine, xanthoplanine. The stem bark and wood also yield the alkaloid magnoflorine (Willaman and Li 1970; Qadri and Hamid 1962).

### Chemical structure of major constituents



### Quality evaluation of Bark (ICMR 2006)

Foreign matter	Not more than 2.0%.
Ash	Not more than 10.0%

Acid insoluble ash	Not more than 3.0%
Ethanol soluble extractive	Not less than 4.0%.
Water soluble extractive	Not less than 6.0%.

### 13 Adulterants/substitutes

There are altogether 7 species of *Zanthoxylum* found in Nepal viz. *Z. armatum* DC., *Z. acanthopodium* DC, *Z. nepalense* Babu, *Z. nitidum* (Roxb.) DC., *Z. ovalifolium* Wight., *Z. oxyphyllum* Edgew. and *Z. tomentellum* Hook. f. Among them *Z. nepalense* Babu and *Z. Oxyphyllum* Edgew. are used as substitutes for *Z. armatum* DC. Adulteration at the farmers' level has not been observed but it is said that traders use 'Tigedi', 'Pithechor' seed as adulterant. 'Tigedi', 'Pithechor' are the dye yielding plants and have lower prices in comparison to Timur. Fruit weight increment is also done by treating with saline water (Kunwar 2006).

### 14 Cultivation calendar

Seed collection	September – October
Seed sowing	October – November/ March-April
Nursery/Poly bags preparation	October – November/ March- April
Stem cutting	January – February
Planting	April -May
Flowering	March – June
Fruiting	May – July/
Harvesting	October – November (Local myth: Bhadra 12 <sup>th</sup> is the best time for collection in Salyan)

**16. Economics of Cultivation per hectare (modified from Basnet 2007)**

S.N.	Description	Quantity	Labour	Rate	Amount
1.	Seedling cost	1100		10/-	11000/-
		seedlings			
2.	Pit Preparation	1100	75MD	300	22500/-
3.	Compost Manure	5 tonnes		3000	15000/-
4.	Manure + Soil		50 MD	300/-	15000/-
	Mixing and Sowing				
5.	Irrigation and Weeding		30 MD	300/-	9000/-
6.	Miscellaneous				8000/-
7.	Plant Care and Management (4 yrs)				10000/-
8.	Harvest and Storage		50 MD	300/-	15000/-
			Total Cost		105500/-
9.	Production (Dried fruit 3000 kg)				
10.	Total Income		3000 Kg	100	300000/-
11.	Net Income every year after 3 yrs of plantation				194500/-

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Timur Seeds



Timur seedling in nursery bed



Timur seedling ready for plantation



Timur Plant 3 years' old



Timur plants at road sides



Timur plants in wild haitat

