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Medicinal Value of *Zanthoxylum armatum* DC (Timur)*:* A Review

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Abstract: The use of plants for medicinal purposes has been a popular tradition since ancient times. Parts of plant such as leaves, roots, rhizomes, stems, etc serve as valuable source of medicine, also for different hazardous and fatal diseases. *Zanthoxylum armatum* DC is a plant with high medicinal as well as commercial value. It is locally known as "Timur" in Nepal and is effective in curing stomachache, gastritis, coughs, toothaches, etc. It is also a popular flavoring agent in traditional dishes. The goal of this analysis is to assemble all the information regarding the plant profile, traditional use, medicinal value, and commercial value of this species. The findings of this paper are fully based on secondary data sources. Information was collected from about 32 published articles from various online platforms, and the collected information was analyzed and presented here in this paper. Timur is a medium sized odoriferous tree which is widely distributed throughout the Indian subcontinent specifically from Kashmir to Bhutan, up to the altitude of 2500 m from the sea level. This plant serves as a rich source of phytochemical constituents like fatty acids, glycosides, flavonol, flavonoids, lignins, phenolics, sterols, terpenoids, alkaloids, alkenoids, amino acids, and various aromatic and volatile compounds. Thus, more emphasis must be given to the production of this plant.

Keywords: Medicinal plants; Rutaceae; Timur seeds; Traditional uses

INTRODUCTION

Medicinal plants have been serving as a valuable asset for treatment of various diseases locally for millions of years (Fitzgerald et al., 2020; Poudel et al., 2021). According to a report prepared by WHO, globally about 70% of people are dependent on medicinal plants for curing diseases through traditional healing methods. In the context of Nepal, 75% of people, especially from remote areas are getting treatment by traditional healers (Hasan et al., 2013). Traditional herbal medicines are popular among local and indigenous people from highlands to terai regions (Miya et al., 2020; Pariyar et al., 2021). Medicinal plants have fewer side effect than allopathic medicine (Gahatraj et al., 2020).

The central Himalaya is considered to be the storehouse of several species of medicinal plants. Nepal which is located in this Himalayan region has always been a place of great interest to researchers. Out of 7000 species of flowering plants found in Nepal, 10% are found to have medicinal value (Watanabe et al., 2005). 2300 meditional plants are traditionally used by different ethnic groups (Kadel et al., 2020). Numerous medicinal plants in the wild are being extracted unconsciously, without replacement (Sharma et al., 2004). Out of 1950 species of medicinal plants, 143 species are considered as commercially valuable species (Bhattarai et al., 2006). Among them, *Zanthoxylum armatum* (syn. *Z. alatum*) is one of the vital medicinal plants. *Zanthoxylum armatum* (syn. *Z. alatum*) is familiar as "Timur" "Nepal pepper" or "Indian prickly ash" (Singh and Singh, 2011). Timur is a branched, medium sized climber which can reach up to 6 m in height and have dense foliage. Branches of *Z.armatum* are equipped with thorns about 2cm long. It develops as an understory species in many of the forests as well as on open areas between 1000 to 2100m altitude (Hertog and Wiersum, 2000). It is often believed that Timur collected on 12th of Bhadra have effective medicinal properties. Since ancient times, it is used for the treatment of gastritis, pain in stomach, cough used as an antidote, and in delivery (Magar et al., 2020). Therefore, the knowledge of medicinal plants should be transferred from one generation to another (Poudel et al., 2021). Therefore, the main notive of this study is to assemble all the information regarding the plant profile, traditional use, medicinal value, and commercial value of *Zanthoxylum armatum*.

METHODS

Secondary data sources were used to extract the required information. The entire details of this paper were withdrawn from about 32 published articles. Various online platforms such as Research gate, Google scholar, etc. were used to search and download published articles. Timur, *Zanthoxylum armatum*, medicinal plants, Timur seeds, traditional usage, and other keywords were utilized to obtain information for this systematic review. This paper describes the species' taxonomy, structure, distribution, medicinal and commercial value.

RESULTS AND DISCUSSION

Table 1: The taxonomic classification of *Zanthoxulum armatum* (Bhattacharjee et al., 2019)

Kingdom	Plantae
Class	Angiosperms
Order	Sapindales
Family	Rutaceae
Genus	*Zanthoxylum*
Species	*armatum*
Binomial name	*Zanthoxylum armatum*

Distribution: This species is widespread throughout the Indian subcontinent from Kashmir to Bhutan up to 2500m altitude. It also occurs in most of China, Japan, Nepal, Pakistan, Malaysia, Taiwan, and Philippines at the altitudinal range of 1300-1500m (Kayat et al., 2016) with the China having largest distribution range (Xu et al., 2019). In the context of Nepal, this species grows from west to east at an altitude of 1000 to 2500m in open areas as well as in dense forests (Phuyal et al., 2019) and its massive cultivation occurs in the mid-western region of Nepal (Bhatt et al., 2018). Till now 250 species of this genus have been discovered around the world (Brijwal et al.,2013). Nepal alone harbors eight species of genus *Zanthoxylum* which are *Z. armatunm, Z. oxyphyllum, Z.avalifolium, Z. nepalenses, Z. nitidum, Z bungeanum., Z. simulans*, and *Z. accanthopdium* (Kayat et al., 2016). From the viewpoint of farmers, Timur favors deep, moist soils that are exposed to sunlight (Hertog and Wiersum., 2000). The plant grows well in places that receive sufficient rainfall (Bhattacharjee et al., 2019).

Plant profile: Timur is a small aromatic tree or a large spiny shrub. Leaves of this plant are winged, spiked, stalked, and are imparipinnate compound (Barkatullah et al.,2014). Flowers are minute, yellow- colored, and develop in leaf axils. Flowers consist of 6-8 sepals with petals absent. The flowers are often seen flowering from March to April. Seeds are usually rounded and shiny black, measuring 3mm diameter (Singh and Singh, 2011). The ripe fruit appears red and diameter of them ranges from 4mm to 5mm (Figure1). Dry fruit of Timur also has an aroma which can develop an anesthetic feeling on the tongue (Prajapati et al., 2015). Fruiting begins from October to November. TThe tree consist of thorns with are vertically flattened on the trunk and branches. Leaflets are stalk-less (Baruwa and Elancheran, 2018). Timur has a corky bark (Kayat et al., 2019).

Figure 2: Ripen fruit and seed of Timur

Phytochemical analysis: Several phytochemical constituents such as amino acids, flavonoids, flavonol glycosides, lignins, terpenoids, fatty acids, alkaloids, phenolics, sterols are contained in ethereal oil of Timur. Various aromatic and volatile as well as other numerous compounds have been extracted from the essential oil of Timur in decent amount (Brijwal et al., 2013). Kalia et al. (1999) isolated armamide, asarin, and fargesin from the bark of this plant. Similarly, Ramidi et al. (1998) extracted tambulin (flavonoid) from the seed. Seeds of Timur are composed of hydroxylic (4z) enolic acid and several volatile compounds (Ahmed et al., 1993). Essential oil of seeds is enriched with 22 different components which was proved by Gas chromatograohy- Mass spectrometry(Gc-Ms) analysis (Waheed et al., 2011) with linalool (53.05%), bergamot mint oil (12.73%), β-myrcene (3.69%), β-limonene (3.10%), α-pinene (4.08%), and limonene diepoxide (11.39%), as major constituents. From the bark extract a new amide "armatamide" and two lignans; "asarinin" and "fargesin" have been isolated. A new flavonoid glycoside is yielded from the alcoholic extract of stem bark (Bhattacharjee et al., 2019).

Propagation: Fruit-loving birds disperse the seeds of *Zanthoxylum armatum*. During digestion, the seeds are excreted outside thus stimulating germination. Vegetative propagation can also be carried out in Timur by branch cutting (Hertog and Wiersum,2000). Matured seed collection can be carried out from June to July. If the seeds are insufficient, then air layering can be a better option for propagation (Paul et al., 2018).

Artificial regeneration: The propagules are raised either in a nursery or in the field. Seeds are planted in the nursery in August and September. Seed germinates within 20 to 30 days of sowing. When the seedlings reach 20 to 30 cm in height they are transplanted into the field. Stored seeds require three months of cold stratification which germinate in February and March.The soil should be mixed with ten to twelve tones of manure per hectare before transplanting to provide enough nutrients for the transplants. Using a cultivator the land should be plowed two to three times. The plant can be raised as a single crop or can be planted with other herbaceous species as well. During the establishment stage, the plant must be supplied with a regular irrigation facility. The resulting plant is normally a healthy plant without any physiological disorders (Barua and Elancheran, 2018).

Commercial value: NTFPs have been the important source of income since ancient times in Nepal. Annually, large amount of NTFPs including Timur are collected from the mid-hills of Nepal and they are traded with India (Malla et al., 1993; Sinha et al., 1993; Edwards, 1996; Den Hertog, 1997; Olsen, 1997), together with the fruits of Timur. Most pharmaceutical companies use the fruits of Timur to manufacture different types of toothpaste (Kala et al., 2011). Owing to their disinfectant, antiseptic, and deodorant properties, the fruits of Timur are also used for the treatment of dental problems and the lotion is applied against scabies. Timur is enriched with aroma and valuable fragrance and thus is used in making several health care products (Hertog and Wiersum, 2000). India manufactures most of the products and hence has a well-established market for dried Timur fruits (Edwards 1996; Den Hertog 1997). Studies suggest that the market price of Timur has been increasing considerably within the last two decades (Hertog and Wiersum, 2000). A study by

Lamichhane et al. (2021) showed Timur as the most traded NTFP in the Jajarkot district of Nepal. Fruits of this plant is used to flavor traditional cuisines and the younger twigs can be used as a toothbrush (Brijwal et al., 2013). Bark is the source of traditional dye (Gaur, 2008).

Traditional medicinal value: Timur is regarded as an important magical plant since all of its parts, including the leaves, stem, bark, fruits, seeds, and roots, have therapeutic characteristics, making it valuable in traditional medicine (Table 2). It possesses stomachic, carminative, and anthelminthic properties and due to this reason, it is valuable in the traditional health system (Brijwal et al., 2013). The preparation of Zuroor-e-Qula (Powdered polyherbal Unani formation) with antimicrobial and anti-inflammatory activity requires the seeds of Timur as an important ingredient (Paridhavi and Agrawal, 2007). Similarly, the Bhotiya tribal community of India uses Timur in many ways; in the form of condiments, spices, medicines, as a spice in traditional dishes. Soup prepared from dry timur seeds is known as hag. It is consumed to keep body warm during winter (Kala et al., 2021).

Table 2: Traditional use of Timur in different countries (Singh and Singh, 2011)

Country	Traditional uses
India	Seeds and bark are utilized to treat fever, dyspepsia, and cholera. Leaves, bark, and roots are used in traditional fishing as a fish poison. (Piscicidal) used as a snake-bite remedy.
Nepal	Fruit decoction is used to treat abdominal pain. Berries possess carminative and antispasmodic properties thus, are used for rheumatism and skin diseases. The bark is used to treat cholera, diabetes, and asthma. Diarrhea, dysentery, and stomachache can be cured by taking powdered dried fruits with hot water.
Japan	Seeds are used to treat indigestion, flatulence, and depression.
Pakistan	Dried fruits are used as a spice To treat gum problems and toothache, younger twigs are used as a toothbrush.
China	An infusion in vinegar serves as bugs repellent or is used to expel worms infecting the ear. Lotion made from Timur plant is used to treat scabies. Used as a snake-bite remedy.

Ayurvedic properties: Timur mainly focuses on the excretory, circulatory, digestive, and respiratory systems of the body. Seeds are used to cure krimi (a parasitic infection), low appetite, and durgandhya (Foul smell coming out of the body). Seeds of Timur are bitter and pungent in taste and aggravate pitta. Seeds are used to treat, piles, heart diseases, cough, digestive problems, throat disorders, asthma, hiccups and dental problems (Paul et al., 2018).

Medicinal properties: Studies revealed that the fruits of Timur are most frequently used which is followed by young branches (twigs) and seeds. Leaves possess carminative property and are used for treating dyspepsia and stomachache whereas branches are used as a toothbrush to cure toothache. Similarly, seeds of Timur are used for the treatment of fever and cholera and help to increase saliva secretion (Kanwal et al., 2015). According to a report, it is found that the leaf extracts of Timur bring out

apoptosis and also sensitize the cancer cells to chemotherapeutic drugs (Singh et al., 2015). Plant extract is effective for curing pneumonia and tick infestation. The powdered fruit mixed with table salt and Mentha species is capable of curing chest infection and digestive problems. Dried fruits possess antiseptic, antifungal, and antibacterial properties. Other medicinal uses of Timur (Paul et al., 2018) are: (i) Asthma, difficult breathing: Chewing a few seeds proves beneficial. (ii) Arthritis, joint swelling, pain in joints, skin diseases, eczema, vitiation of blood: 5 grams or 10 grams of fresh leaves are boiled in one glass of water until the volume is reduced to one-fourth of its original size. Drinking this decoction once-twice a day may be useful. (iii) Boils: External application of a fine paste made from roots is effective. (iv) Cough: Drinking decoction prepared from seeds once-twice a day is effective. (v) Cholera: Decoction prepared from the bark is effective to treat cholera. (vi) Earache: A medicated oil prepared by cooking Timur + Sonth + Hing is used as an ear drop. (vii) Gum bleeding: Mixing bark powder with honey and massaging on gums provides relief. (viii) Mouth freshener: Chewing fruits of Timur freshens the mouth. (xi) Swelling: Topical application of a poultice of warm leaves is effective. (xii) Stomatitis: Decoction is used as a gargle. (xiii) Roundworms: Intake of seeds in any form helps to remove roundworms

CONCLUSION

Timur is an important aromatic plant with high medicinal and commercial value. The use of Timur as a flavoring agent or spice has been popular since ancient times, and it is also used in folk medicine, essential oil production, and as an ornamental garden plant. The entire plant has medicinal properties and is effective in treating stomachaches, toothaches, gastritis, coughs, fevers, and other ailments. Also, the bark is used as an insect repellent. Various studies have been conducted to date to learn more about this plant's indigenous use, medicinal value, commercial importance, and phytochemical constituents. However, further investigation is needed to explore more about the phytochemical constituents, new derivatives that can be isolated, propagation techniques, and so on. Also, there seems an urgent need to develop a reproductive propagation technique for the conservation and expansion of this plant.

DECLARATION OF CONFLICT OF INTEREST

No conflict of interest to declare.

REFERENCES

Acharya K. P, Chaudhary R. P, Vetaas O. R. 2009. Medicinal plants of Nepal: Distribution pattern along an elevational gradient and effectiveness of existing protected areas for their conservation. Banko Janakari.19(1): 16-22.

Ahmad A, Misra LN, Gupta MM. 1993. Hydroxyalk-(4Z)-enoic acids and volatile components from the seeds of *Zanthoxylum armatum* . J. Nat Products.56(4): 456-460.

Barua C. C, Yasmin N, Elancheran R. 2018. A review on effective utilization, phytochemical compounds, pharmacological intervention of a popularly used plant for developing a new drug: *Zanthoxylum armatum* with reference to its anticancer activity. MOJ Bioequiv Availab.5(3): 156-167.

Bhatt T. D, Dhungana A, Joshi J, Yadav P, Basyal C. 2018. Variation in Chemical Composition of Essential Oil Extracted from the Fruits of *Zanthoxylum armatum* DC.(Timur) of Nepal. J. Plant Resource.6(1): 100-105.

Bhattacharjee A, Biplab Kumar D, Das B, Dkhar D Kachari D.2019. "*Zanthoxylum armatum* : A Systematic Review of its Ethnomedicinal Properties, Phyto chemistry,Pharmacology and Toxicology". Advances in Pharmacology and Clinical Trends .4(3): 1-11.

Bhattarai K. R, Ghimire M. 2006. Commercially important medicinal and aromatic plants of Nepal and their distribution pattern and conservation measure along the elevation gradient of the Himalayas. Banko Janakari.16(1): 3-13.

Brijwal L, Aseesh P, Tamta S. 2013. An overview on phytomedicinal approaches of *Zanthoxylum armatum* DC.: An important magical medicinal plant. J. Med. Plants Res.7(8): 366-370.

Budha-Magar S, Bhandari P, Ghimire S. K. 2020. Ethno-medicinal survey of plants used by Magar (Kham) community, Rolpa district, Western Nepal. Ethnobotany Research and Applications.19: 1-29.

Edwards D. M. 1996. The trade in non-timber forest products from Nepal. Mountain Research and Development.383-394.

Fitzgerald M, Heinrich M, Booker A. 2020. Medicinal plant analysis: A historical and regional discussion of emergent complex techniques. Frontiers in pharmacology.10: 1480.

Gaur R. D. 2008. Traditional dye yielding plants of Uttarakhand, India.4

Gahatraj S, Bhusal B, Sapkota K, Dhami B, Gautam D. 2020. Common medicinal plants of Nepal: A review of Triphala: Harro (*Terminalia chebula*), Barro (*Terminalia bellirica*), and Amala (*Emblica officinalis*). Asian J. Pharmacogn. *4*(3): 5-13.

Hasan M, Gatto P, Jha P. K. 2013. Traditional uses of wild medicinal plants and their management practices in Nepal-A study in Makawanpur district. Int J Med Aromat Plants. 3(1): 102-112.

Hertog W. 1997. Access makes the difference? Harvest and trade of non-timber forest products on communal and private land. Unpublished MSc thesis, Department of Forestry, Wageningen Agricultural University, Wageningen.

Hertog W. H, Wiersum K. F. 2000. Timur (*Zanthoxylum armatum*) Production in Nepal. Mountain Research and Development. 20(2): 136-145.

Ibrar M, Muhammad N. 2011. Evaluation of *Zanthoxylum armatum* DC for in-vitro and in-vivo pharmacological screening. African J. Pharmacy and Pharmacology. 5(14): 1718-1723.

Kandel B, Thakuri B. S, Paudel S, Sigdel S, Khanal P, Sapkota K, Chandra P. 2020. Ethnobotanical uses of locally available plants for respiratory diseases by fifteen ethnic groups of Nepal: A. *Asian J. Pharmacogn*. *4*(4): 11-21.

Kala C. P, Farooquee N. A, Dhar U. 2005. Traditional uses and conservation of timur (*Zanthoxylum armatum* DC.) through social institutions in Uttaranchal Himalaya, India. Conservation and Society. 3(1): 224-230.

Kalia N. K, Singh B, Sood R. P. 1999. A new amide from *Zanthoxylum armatum*. Journal of Natural Products. 62(2): 311-312.

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.

Kayat H. P, Gautam S. D, Jha R. N. 2016. GC-MS analysis of hexane extract of *Zanthoxylum armatum* DC. Fruits. J. Pharmacognosy and Phytochemistry. 5(2): 58.

Lamichhane R, Gautam D, Miya M. S, Chhetri H. B, Timilsina S.2021. Role of Non-Timber Forest Products in National Economy: A Case of Jajarkot District, Nepal. Grassroots Journal of Natural Resources. 4(1): 94-105.

Malla S. B, Shakya P. R, Rajbhandarai K. R, Bhattarai N. K, Subedi M. N. 1993. Minor Forest Products of Nepal: General Status and Trade, Forestry Sector Institutional Strengthening Program, Component NR 2. Kathmandu: His Majesty's Government, Nepal and Finnish International Development Agency.

Miya M. S, Timilsina S, Chhetri A. 2020. Ethnomedicinal uses of plants by major ethnic groups of Hilly Districts in Nepal: A review. Journal of Medicinal Botany. *4*: 24-37.

Olsen C. S. 1997. Commercial non-timber forestry in central Nepal: emerging themes and priorities [6 publications included, 9 papers listed].

Paridhavi M, Agrawal S. S. 2007. Safety evaluation of a polyherbal formulation, Zuroor-E–Qula.

Pariyar D, Miya M. S, Adhikari A. 2021. Traditional uses of locally available medicinal plants in Bardiya district, Nepal. Journal of Medicinal Herbs. 12(2): 85-92.

Paul A, Kumar A, Singh G, Choudhary A. 2018. Medicinal, pharmaceutical and pharmacological properties of *Zanthoxylum armatum*: A Review. J. Pharmacognosy and Phytochemistry, 7(4), 892-900.

Phuyal N, Jha P. K, Raturi P. P, Gurung S, Rajbhandary S. 2019. Essential oil composition of *Zanthoxylum armatum* leaves as a function of growing conditions. International Journal of Food Properties. 22(1): 1873-1885.

Poudel B, Bhandari J, Poudel A, Gautam D. 2021. Ethnomedicinal use of Common Garden Species in Arghakhanchi district, Western Nepal. Asian J. Pharmacogn. *4*(1): 31-65.

Prajapati N, Ojha P, Karki T. B. 2015. Antifungal property of essential oil extracted from *Zanthoxylum armatum*(Timur). Journal of Nutritional Health & Food Engineering. 3(1): 1-5.

Ramidi R, Ali M, Velasco-Negueruela A, Pérez-Alonso M. J. 1998. Chemical Composition of the Seed Oil of *Zanthoxylum alatum* Roxb. J. Essential Oil Res. 10(2): 127-130.

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.

Singh T. P, Singh O. M. 2011. Phytochemical and pharmacological profile *of Zanthoxylum armatum* DC.-an overview.

Sinha S, Achet S. K, Amatya K. R, Bajracharya P, Sheak A. 1993. Non-timber Forest Products in Nepal: The Scope for Sustainable Commercialization. Washington, DC: Appropriate Technology International.

Waheed A, Mahmud S, Akhtar M, Nazir T. 2011. Studies on the components of essential oil of *Zanthoxylum armatum* by GC-MS. American Journal of Analytical Chemistry. 2(2): 258.

Watanabe T, Rajbhandari K. K, Malla K. J, Yahara S. 2005. A hand book of medicinal plants of Nepal.

Xu D, Zhuo Z, Wang R, Ye M, Pu B. 2019. Modeling the distribution of *Zanthoxylum armatum* in China with MaxEnt modeling. Global Ecology and Conservation. 19: e00691.