The Pharma Innovation Journal 2022; SP-11(1): 200-203

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(1): 200-203

www.thepharmajournal.com
Received: 01-11-2021
Accepted: 03-12-2021

Keyur Rathod
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Ram Mayur L
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Rakesh Jaliya
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Ravindra Dhaka
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Sumankumar Jha
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Bimal S Desai
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author
Sumankumar Jha
College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

Oroxylum indicum: Ethnobotany, phytochemistry and therapeutic uses

Keyur Rathod, Ram Mayur L, Rakesh Jaliya, Ravindra Dhaka, Sumankumar Jha and Bimal S Desai

Abstract
Oroxylum indicum, commonl known as Tetu and belong to Bignoniaceae family. Itis used to treat several human ailments since ancienttimes. It is use to treat the various diseases such as; urticaria, jaundice, asthma, sore throat, laryngitis, hoarseness, gastralgia, diarrhea, dysentery, infantile, erythema measle, etc. It is also having potential to treat against SARS-CoV-2 (COVID-19) infection in humans. Studies also report that species having the various functional properties like; antioxidant, anti-inflammatory, anticancer, antimicrobial, anti-arthritic etc. In this review, it has been an attempt to explore the ethnobotany, phytochemistry and therapeutical potential of this medicinally important tree.

Keywords: *Oroxylum indicum*, ethnobotany, phytochemistry, therapeutical, medicinal plant

Introduction
Oroxylum indicum is also Synonmsly called as *Bignonia indica* L. and *Calosanthes indica*blume. Commonly known as the tree of Damocles (English); Sonapatha or Shyonak (Hindi); Tentu (Gujarati); Aralu (Sanskrit); Davamadak (Konkani) and belonging to Bignoniaceae family (Jagetia, 2021) [13]. It is important medicinal tree species which used by humans from ancient times for treat various diseases. *Oroxylum indicum* is a small to medium-sized, lanky, soft- wooded and fast growing deciduous tree that can grow up to 8–15 m tall and its trunk is about 40 cm in diameter in general.

Morphology
Bark of the plant is light greyish brown in color and soft, spongy in texture with corky lenticels. The flowers are abundant in numbers, reddish purple outside and pale, pinkish-yellow within which release a strong, fetid odour to attract pollinators and they form massive seed pods (fruits) that fall down from bare branches (Barchung *et al.*, 2018) [2]. Fruits are woody, winged, large, flat and sword shaped. The seeds present within fruit are round, flat and thin with broad silvery papery wings except at the base. The leaves are pinnately compound which generally grows up to 3–10 cm long with 2–4 leaflet pairs and they are evergreen (Nik Salleh *et al.*, 2020) [25].

Taxonomical Classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Division	Lamiales
Family	Bignoniaceae
Genus	Oroxylum
Species	indicum

Distribution
Oroxylum indicum is widely distributed throughout Asian regions, including India, Thailand, Vietnam, Malaysia, Indonesia, Philippines, China, Bhutan, Taiwan, and Japan. Itis native to the Indian sub-continent in the Himalayan foothills up to a height of 1000–1200 m. It is visible in the forest biome of Manasa National Park in Assam, India (Sowjanya *et al.*, 2019) [35].

Medicinal uses

Natural products have played an essential role in the healthcare of humans since their evolution and keep on to play an important role even in the most modern state-of-the-art therapeutic era. *Oroxylum indicum* has been used to treat several human ailments since earliest period. Different parts of Tetu are used for human healthcare traditionally and in Ayurveda, where it is one of the most essential ingredients of Brahma Rasayana, Dashmularishta, DhanawantaraGhrita, Amritarishta, Narayana Taila, Dantyadyarista, and Chyavanprasha (Balkrishna *et al.*, 2005; Warrier *et al.*, 1995; Dinda *et al.*, 2015; Jagetia, 2021) [1, 38, 10, 13]. Ever part of *Oroxylum indicum*, bark, leaves, fruit, root, stem, flower and seeds are reported for wide biological activities and has already been useful in corresponding medicine to treat human diseases (Dev *et al.*, 2010; Deka *et al.*, 2013) [9, 8]. The experimental studies have revealed that active constituents of *Oroxylum indicum* including oroxylin A, baicalein, and chrysin have the potential to act against the COVID-19 infection of SARS-CoV-2 in humans (Jagetia, 2021) [13].

Pattern of use by tribes

Oroxylum indicum are used for the treatment of various ailments is one of the parts of the local tribal communities' such as Rabha, Garo, Khasi, and Jaintia in Meghalaya (India); Kuki, Mao, Maram in Manipur (India) (Barchung *et al.*, 2018) [2]. *Oroxylum indicum* root bark paste is orally administered to treat dysentery, diarrhea jaundice, and rheumatism by the Naga tribe in India (Jamir *et al.*, 2010) [14]. A glass of bark decoction with two spoons of sugar is often given to cure jaundice by the halam tribe of northeast India (Das *et al.*, 2012) [6]. Seeds and bark of *Oroxylum indicum* are given in conditions of pneumonia, respiratory troubles, and fever by different tribes in India (Patil *et al.*, 2008; Panghal *et al.*, 2010) [28, 26]. Different ethnomedicinal used by different tribes communities are described in Table 1.

Table 1: Ethnomedicinal uses of *Oxoxylum indicum*

Plant Part	Ethnomedicinal Uses	Reference
Fruits	Kill crabs in the paddy fields, served as a vegetable, most important ingredients of Brahma Rasayana, Dashmularishta, Dhanawantara Ghrita, Amritarishta, Narayana Taila, Dantyadyarista, and Chyavanprasha, to improve appetite, treat throat infection, bronchitis, heart disorders, leukoderma and piles	Jagetia, 2021 [13]; Dinda *et al.*, 2015 [10]; Khare *et al.*, 2004 [16]; Nadkarni, 1992 [23]; Chopra *et al.*, 2002 [5]; Drury *et al.*, 2010 [11]
Seeds	Treat throat complications and hypertension, digestive and purgative, treat boils and wounds, powdered seeds are given to induce conception in women, paste made from grounded seeds with fire soot is applied to the neck to treat tonsillitis, inflammations, skin diseases, sprains, and rheumatism	Singh *et al.*, 2002; Jagetia, 2021 [13]
Twigs	Kill crabs in the paddy fields	Jagetia, 2021 [13]
Leaves	Snakebite and to treat ulcers, headache, and enlarged spleen	Lalrinzuali *et al.*, 2018 [20]; Khare, *et al.*, 2004 [16]; Nadkarni, *et al.*, 1982 [23]
Flowers	Served as a vegetable, grown as an ornamental plant	Warrier *et al.*, 1995 [38]
Roots	Aphrodisiac, antidiabetic, astringent, antiarthritic, carminative, diaphoretic, constipating, anthelmintic, febrifuges, diuretic, digestive, and expectorant	Kirtikar *et al.*, 2001 [17], Paranjpe *et al.*, 2005 [27], Dinda *et al.*, 2015, [10] Warrier *et al.*, 1995 [38]
Root bark	Digestive tonic, treat nasopharyngeal cancer, stomatitis, and tuberculosis, treat dysentery, diarrhea jaundice, and rheumatism	Jamir *et al.*, 2010 [14]; Bhattacharje *et al.*, 2005 [3]; Khare *et al.*, 2004 [16]
Stem bark	Kill maggots on cattle wounds, stomach disorders	Lalrinzuali *et al.*, 2015 [19]; Warrier *et al.*, 1995 [38]; Nakahara *et al.*, 2002 [24]; Lalrinzuali *et al.*, 2018 [20]; Rout *et al.*, 2009 [30]

Pharmacological Activities

Oroxylum indicum has shown various pharmacological activities in various study systems of vitro and in vivo under the different extracts. Antioxidant: Antioxidant property found in various plant parts such as; Fruits (ethanol and water extract), Stem bark (50% aqueous ethanol), leaves; seed; root (Methanol). Antimicrobial: Root Bark (Ethyl acetate and Methanol), Stem bark (Ethyl Acetate), Anti-inflammatory: Leaves (Aqueous), Stem bark (Aqueous and alcoholic extracts). Anticancer: Fruit, Stem bark (Ethanol, Aqueous, Methanol). Anti-mutagenicity: Fruit (Methanol). Immunomodulatory: Root Bark (*n*-Butanol). Gastroprotective: Root bark (Alcoholic and n- Butanol), Anti-hepatotoxic: Leaves (Ethanol) (Table 2) (Barchung *et al.*, 2018) [2].

Table 2: Pharmacological properties of *Oroxylum indicum*

Plant parts	Functional properties	Reference
Fruit	Antioxidant	Yan *et al.*, 2011 [39]
	Anticancer	Roy *et al.*, 2007 [31]
	Antimutagenicity	Nakahara K, *et al.*, 2002 [24]
Seed	Antioxidant	Yan *et al.*, 2011 [39]
Leaves	Antioxidant	Mishra *et al.*, 2010 [22]
	Anti-inflammatory	Laupattarakasem *et al.*, 2003 [21]
	Anti-hepato-toxic	Tenpe *et al.*, 2009 [36]
Stem	Antioxidant	Mishra *et al.*, 2010 [22]
	Antimicrobial	Kumar *et al.*, 2011 [18]
	Anti-inflammatory	Tenpe *et al.*, 2009 [36]
Stem Bark	Antioxidant	Gupta *et al.*, 2008 [12]

	Antimicrobial	Kumar *et al.*, 2011 [18]
	Anti-inflammatory	Tenpe *et al.*, 2009 [36]
	Anticancer	Brahma *et al.*, 2011 [4]
Root bark	Immunomodulatory	Zaveri M, *et al.*, 2006 [40]
	Antimicrobial	Uddin *et al.*, 2003 [37]
	Gastroprotective	Zaveri M, *et al.*, 2007 [41]

Phytocompounds

Oroxylum indicum is usually known to present its diverse bioactive compounds. Various biological activities reported in different parts of the *O. indicum* plant are mediated by a broad range of secondary metabolites, such as flavonoids, glycosides, alkaloids, tannins, terpenoids, saponin, phenols, quinines, etc. are found from the extraction of different parts of the plant (Table 3). Among them, flavonoids are the major storage components of *O. indicum* which could be found in almost all parts of the plant. Among all of these flavonoids, baicalein is the most abundantly found and dominant active compound of the *O. indicum*. Numerous researches conducted on phytochemical investigations clearly demonstrated the abundance of baicalein isolated from various parts of this plant including the stem barks, root barks, leaves, fruits and also seeds. The secondary metabolites are not associated with the growth and development of the species (Barchung *et al.*, 2018) [2].

Table 3: Different phytoconstituents detected in the *Oroxylum indicum*

Plant Part	Phytoconstituents	Reference
Stem bark	Phenolics, flavonoids, saponins Alkaloids, Tannins, saponins, sterols, phenols, fats, oils, glycosides,	Kalaivani *et al.*, 2009 [15]; Samatha *et al.*, 2012 [32]; Das *et al.*, 2014 [6]; Lalrinzuali *et al.*, 2015 [19]
Stem and root bark	Glycosides, terpenoids phenols, alkaloids,	Radhika *et al.*, 2011 [29]
Root bark	Flavonoids, alkaloids, glycosides, tannins, sterols, phenols, lignins, saponins, fats, oils	Samatha *et al.*, 2012 [32]
Seeds	Alkaloids, flavonoids, tannins, glycosides,sterols, phenols, saponins, fats, oils	Samatha *et al.*, 2012 [32]
Tender leaves	Phlobatannins, flavonoids, phenols andtannins, glycosides	Satya Eswari *et al.*, 2018 [33]

Conclusions

Oroxylum indicum is used in traditional and Ayurvedic systems of medicine to treat numerous human diseases from ancient times to still current pandemic satiation of COVID-19. In ancient times is use as various traditional methods by different tribes communities. It is useful in various Ayurvedic products as one of the important ingredient. The scientific studies of *Oroxylum indicum* has well-known for its analgesic, anti-inflammatory, anthelmintic, antimicrobial, antidiabetic, anti-obesity, hepatoprotective, cardioprotective, gastroprotective, anticancer, and wound healing activities. *Oroxylum indicum* is also known for the presence of various phytoconstituents i.e. flavonoids, glycosides, alkaloids, tannins, terpenoids, saponin, phenols, quinines, etc.

Acknowledgments

All the authors acknowledge the project “Establishment of Forest Biodiversity Conservation Center” funded by Government of Gujarat, India.

References

1. Balkrishna A. Ayurved Jadi-Booti Rahasya; Divyaprakasan, Divya Yog Mandir Trust: Haridwar, India, 2005, ISBN 81-89235-44-8
2. Barchung J, CS K. Phytocompounds and its Therapeutic Properties of *Oroxylum Indicum*- A Review. Int. J Res. Pharm. Sci. 2018;9(3):971-979.
3. Bhattacharje S. Use of flavours and fragrances. In Handbook of Aromatic Plants, 2nd ed.; Bhattacharje, S.K., Ed.; Pointer Publishers: Jaipur, India, 2005, ISBN 8171324071.
4. Brahma B, Prasad SB, Verma AK, Rosangkima G. Study of the antitumor efficacy of some select medicinal plants of Assam against murineascites dalton’s lymphoma. Pharmacology online. 2011;3:155-168.
5. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants; National Institute of Science Communication and Information Resources: New Delhi, India, 2002.
6. Das BK, Al-Amin MM, Russel SM, Kabir S, Bhattacherjee R, Hannan JMA. Phytochemical screening and evaluation of analgesic activity of *Oroxylum indicum*. Indian J Pharm. Sci. 2014;76:571-575.
7. Das S, Duttachoudhury M, Mandal SC, Talukdar A. Traditional knowledge of ethnomedicinal hepatoprotective plants used by certain ethnic communities of Tripura state. Indian J Fundam. Appl. Life Sci. 2012;2:84-97.
8. Deka DC, Kumar V, Prasad C, Kumar K, Gogoi BJ, Singh L *et al*. *Oroxylum indicum*—A medicinal plant of North East India: An overview of its nutritional, remedial, and prophylactic properties. J Appl. Pharm. Sci. 2013;3:S104-S112.
9. Dev LR, Anurag M, Rajiv G. *Oroxylum indicum*: A review. Pharmacogn. J. 2010;2:304-310.
10. Dinda B, Silsarma I, Dinda M, Rudrapaul P. *Oroxylum indicum* (L.) Kurz, an important Asian traditional medicine: From traditional uses to scientific data for its commercial exploitation. J Ethnopharmacol. 2015;161:255-278.
11. Drury CH. Ayurvedic Useful Plants of India; Asiatic Publishing House: Delhi, India, 2010, ISBN 819080913X.
12. Gupta RC, Sharma V, Sharma N, Kumar N, Singh B. In vitro antioxidant activity from leaves of *Oroxylum indicum* (L.) (Vent.)-A North Indian highly threatened and vulnerable medicinal plant. J Pharm Res. 2008;1(1):65-72.
13. Jagetia GC. A Review on the Medicinal and Pharmacological Properties of Traditional

Ethnomedicinal Plant Sonapatha, *Oroxylum indicum*. Sinusitis. 2021;5(1):71-89.
14. Jamir NS. Takatemjen and Limasemba. Traditional knowledge of Lotha-Naga tribes inWokha district, Nagaland. Indian J Tradit. Knowl. 2010;9:45-48.
15. Kalaivani T, Mathew L. Phytochemistry and free radical scavenging activities of *Oroxylum indicum*. Environ. We Int. J Sci. Technol. 2009;4:45-52.
16. Khare C. Indian Herbal Remedies: Rational Western Therapy, Ayurvedic, and Other Traditional Usage, Botany, 4th ed.; Springer: Berlin/Heidelberg, Germany; New York, NY, USA, 2004, ISBN 3-540-01026-2.
17. Kirtikar K, Basu B. Indian Medicinal Plants; Oriental Enterprises: Deharadun, India, 2001, 4.
18. Kumar V, Chaurasia AK, Naglot A, Gopalakrishnan R, Gogoi BJ, Singh L *et al*. Antioxidant and antimicrobial activities of stem bark extracts of *Oroxylum indicum* Vent. (Bignoniaceae)– A medicinal plant of northeast-ern India. South Asian J Exper Biol. 2011;1(3):152-157.
19. Lalrinzuali K, Vabeiryureilai M, Jagetia GC. Phytochemical and TLC profiling of *Oroxylum indicum* and milletiapachycarpa. J Plant Biochem Physiol. 2015;3(152):2.
20. Lalrinzuali K, Vabeiryureilai M, Jagetia GC. Topical application of stem bark ethanol extract of Sonapatha, *Oroxylum indicum* (L.) Kurz accelerates healing of deep dermal excision wound in Swiss albino mice. J. Ethnopharmacol. 2018;227:290-299.
21. Laupattarakasem P, Houghton PJ, Hoult JR, Itharat A. An evaluation of the activity related to inflammation of four plants used in Thailand to treat arthritis. J Ethnopharmacol. 2003;85:207-15.
22. Mishra SL, Sinhamahapatra PK, Nayak A, Das R, Sannigrahi S. In vitro Antioxidant Potential of Different Parts of *Oroxylum indicum*: A Comparative Study. Indian J Pharm Sci. 2010;72(2):267-269.
23. Nadkarni K. Indian Materia Medica, 3rd ed.; Popular Prakashan: Bombay, India, 1982.
24. Nakahara K, Trakoontivakorn G, Alzoreky NS, Ono H, Onishi-Kameyama M, Yoshida M. Antimutagenicity of some edible Thai plants, and a bioactive carbazole alkaloid, mahanine, isolated from Micromelumminutum. J Agric. Food Chem. 2002;50:4796-4802.
25. Nik Salleh NNH, Othman FA, Kamarudin NA, Tan SC. The Biological Activities and Therapeutic Potentials of Baicalein Extracted from *Oroxylum indicum*: A Systematic Review. Molecules. 2020;25(23):5677.
26. Panghal M, Arya V, Yadav S, Kumar S, Yadav JP. Indigenous knowledge of medicinal plants used by Saperas community of Khetawas, Jhajjar District, Haryana, India. Journal of Ethnobiology and Ethnomedicine. 2010;6(1):1-11.
27. Paranjpe P. Indian Medicinal Plants; Chaukhamba Sanskrit Pratishthan: Delhi, India, 2005.
28. Patil G, Mali P, Bhadane V. Folk remedies used against respiratory disorders in Jalgaon district, Maharashtra. Nat. Prod. Radiance. 2008;7:354-358.
29. Radhika LG, Meena CV, Peter S, Rajesh KS, Rosamma MP. Phytochemical and antimicrobial study of *Oroxylum indicum*. Anc. Sci. Life. 2011;30:114-120.
30. Rout SD, Panda T, Mishra N. Ethno-medicinal plants used to cure different diseases by tribals of Mayurbhanj district of north Orissa. Stud. Ethno-Med. 2009;3:27-32.
31. Roy MK, Nakahara K, Thalang VN, Trakoontivakorn G, Takenaka M, Isobe S *et al*. Baicalein, a flavonoid extracted from a methanolic extract of *Oroxylum indicum* inhibits proliferation of a cancer cell line in vitro via induction of apoptosis. Pharmazie. 2007;62(2):149-153.
32. Samatha TALARI, Srinivas P, Shyamsundarachary RUDROJU, Rajinikanth M, Rama Swamy N. Phytochemical analysis of seeds, stem bark and root of an endangered medicinal forest tree *Oroxylum indicum* (L) Kurz. International Journal of Pharma and Bio Sciences. 2012;3(3):1063-1075.
33. Satya Eswari J, Dhagat S, Naik S, Dibya S. Phytochemical and antimicrobial studies of *Oroxylum indicum* extracts. Pharmaceutical Processing. 2018;6(1):007-014.
34. Singh HB, Prasad P, Rai LK. Folk medicinal plants in the Sikkim Himalayas of India. Asian Folklore Studies, 2002, 295-310.
35. Sowjanya K, Swati S, Manasa M, Srilakshmi S, Mahima K. Review on *Oroxylum indicum*. Journal of Pharmaceutical Sciences and Research. 2019;11(8):2905-2019.
36. Tenpe CR, Upaganlawar A, Burle S, Yeole YG. In vitro antioxidant and preliminary hepatoprotective activity of *Oroxylum indicum* Vent leaf extracts. Pharmacology online. 2009;1:35-43.
37. Uddin K, Sayeed A, Islam A, Rahman AA, Khatun S, Khan GRMAM *et al*. Biological activities of extracts and two flavonoids from *Oroxylum indicum* Vent. (Bignoniaceae). Online J Biol Sci. 2003;3(3):371-375.
38. Warrier P, Nambiar V, Ramankutty C. Indian Medicinal Plants- A Compendium of 500 Species; Orient Longman Ltd.: Chennai, India, 1995.
39. Yan RY, Cao YY, Chen CY, Dai HQ, Yu SX, Wei JL *et al*. Antioxidant flavonoids from the seed of *Oroxylum indicum*. Fitoterapia. 2011;82(6):841-848.
40. Zaveri M, Gohil P, Jain S. Immunostimulant activity of n-butanol fraction of root bark of *Oroxylum indicum*, vent. Journal of Immunotoxicology. 2006;3(2):83-99.
41. Zaveri M, Jain S. Gastroprotective effects of root bark of *Oroxylum indicum*, vent. Journal of Natural Remedies. 2007;7(2):269-277.