REVIEW ARTICLE

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Phytocompounds and its Therapeutic Properties of *Oroxylum Indicum* - A Review

Jyotish Barchung, Vanitha V*, Jayalakshmi M, Pushpabharathi N, Kalpana C.S

Department of Biochemistry, School of Life Sciences, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Pallavaram, Chennai – 600 117 Tamil Nadu, India

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ABSTRACT

Plant-based drugs have been used for centuries as an essential source of precursors in a variety of industries, including foods and pharmaceuticals. *Oroxylum indicum* is a plant that grows in India and South East Asia. Pharmacological studies report that the extraction of this species shows the various functional properties of antioxidant, anti-inflammatory, anticancer, antimicrobial, anti-arthritic etc. In this review, it has been an attempt to explore the ethnopharmacological value of this plant.

* Corresponding Author

Name: Dr. V. Vanitha
Phone: +91-994170966
Email: vanitha.sls@velsuniv.ac.in

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INTRODUCTION

Plants provide active bio-compounds and the novel structures for the development of therapeutic drugs. Medicinal plants continue to have a significant impact on the medical and drug development industry. Many researchers report that the phyto-compounds can stimulate the immune system to remove the toxic substances in the diet, which may become malignant (Vanitha and Jayalakshmi 2017).

Over thousands of years, the plant *Oroxylum indicum* is used as a traditional system of medicine for treatment of various diseases. It is the member of 'Bignoniaceae'family commonly called 'Sonapatha" or "Indian trumpet tree" (Joshi KC *et al.,* 1997). Due to its strange appearance, the tree is often grown as an adorning tree. Most of the farmers have used this sword-like fruit to kill crabs in wet paddy fields and also a paste made of the bark is applied to wounds of animals to kill maggots (Warrier PK *et al.,* 1995). The taste of *Oroxylum indicum* fruits is sweet, acrid, stomachic, anthelmintic. The fruits are also good in treating of the heart diseases and the throat, piles, bronchitis and also used as an expectorant (Kirtikar KR, Basu BD., 2001). The different parts of this plant have various properties which can be used in treating allergic disease, urticaria, jaundice, asthma, sore throat, laryngitis, hoarseness, gastralgia, diarrhea, dysentery, infantile, erythema, and measles.

Oroxylum indicum is a semi-deciduous tree. However, the tree is broadly dispersed in tropical and subtropical regions and thus it can be found all over India and South East Asia (Jayaram K, Prasad MN., 2008). In India, the people from the North-Eastern region comprising Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Sikkim and Tripura, the flowers and fruits of *Oroxylum indicum* are used as a vegetable. Indeed, the plants are used for the treatment of various ailments is one of the parts of the local tribal communities' in Meghalaya (India) such as Rabha, Garo, Khasi, and Jaintia and Manipur (India) such as Kuki, Mao, Maram.

Tangkhul etc. However, it is safe for human consumption when taken in normal doses (http://nif.org.in).

Taxonomical Classification

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

Habitat

Oroxylum indicum is a deciduous tree widely distributed in tropical and subtropical regions. This plant grows throughout India and South East Asia, Sri Lanka, Philippines, Indonesia, China, Bhutan, Malaysia, and Mallaca. In India, it is highly found in Himalayan foothills, Eastern and the Western Ghats and North East India that comprises of Arunachal Pradesh, Assam, Meghalaya, Manipur Mizoram, Sikkim, and Tripura (Jayaram K, Prasad., 2008). This species is mostly found up to an altitude of 1200 m mainly in ravines, in the damp region and moist places in the forests (Chauhan NS *et al.,* 1999).

Morphology

The *Oroxylum indicum* is a medium-sized, soft-wooded tree which can grow to a height of 10-16 m. The bark of the tree is light brown colour and its trunk is about 40 cm in diameter. The flowers are open for the night time it has a malodorous smell mostly attractive to bats. (http://tropical.theferns.info). The flowers are wide, fleshy and the colour is a lurid purple outside, inward dull or pale pinkish yellow. Calyx and corolla are about the size of 2.5 cm and 6.5cm respectively. However, the stamens are slightly exerted and base of the filament is woolly. The fruits of *Oroxylum indicum* is follicle which can attain 30-40cm long and 5-10 cm broad. The flowers are violet in colour and have a foul smelling. Flowering occurs during July to August, while the fruits appear from December to March. The size of the fruits are compressed, strap/ sword shaped and two valved. The seeds are flattened, winged and size is about 3-inch board. The leaves can reach 3-8 cm long, 2-3 pinates. The leaflets are prolate and curved. During January, leaf fall occurs each year (http://www.planetayurveda.com).

Common Names

There are many common names of *Oroxylum indicum* in different languages all over the worlds. (http://en.wikipedia.org/wiki/Bignoniaceae).
Some of the names are followed in Table 1:

Assamese: Bhatghila
Rabha: Panjikong
English: Broken Bones Tree, Indian trumpet flower, Midnight horror, Oroxylum,
Chinese: Hanyu pinyin: mù húdié, butterfly tree
Nepalese: Tatelo
Bengali: Tona
Sanskrit: Bhut-vriksha, Dirghavrinta, Kutannat, Manduk (the flower) patrorna, Putivriksha, Shallaka, Shuran or Son, Vatuk
Kannada: Tattuna, Konkani: Davamadak
Malayalam: Palaqapayyani, ashrppathiri, Vellappathir
Hindi: Sonapatha – Sona means gold
Tamil: Cori-konnai, Palai-y-utaicci, Puta-puspam (the flower),
Telugu: Manduka-parnamu, Pampena, Sukanasamu

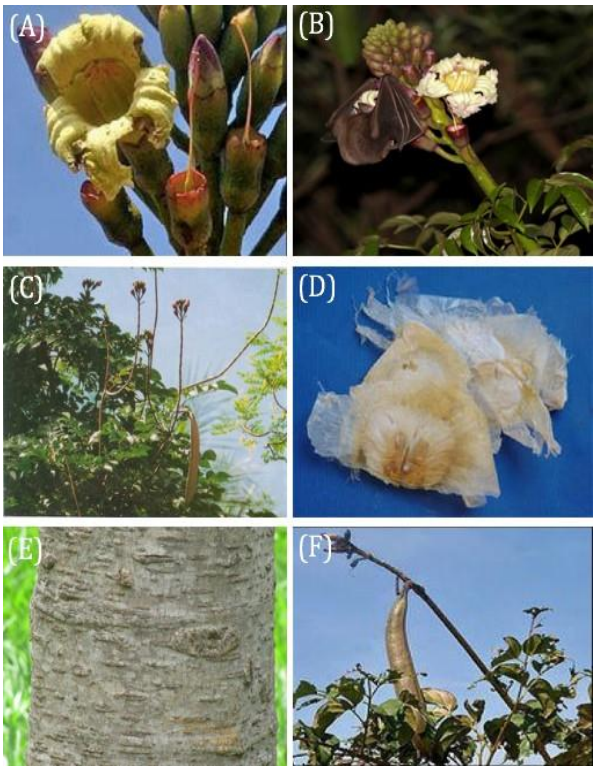


Figure 1: Different parts of *Oroxylum indicum*: (A) Flower (B) Pollination by a bat (C). Inflorescence (D) Seed (E) Stem (F) Fruit with Leaves

Phytocompounds

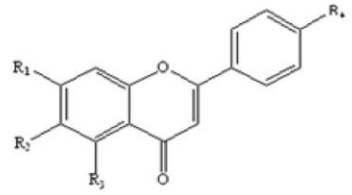
The plant *Oroxylum indicum* is popularly known to present its various bioactive compounds. From the previously isolated phytocompounds, some secondary metabolites like flavonoids, glycosides, alkaloids, tannins, terpenoids etc. are found from the extraction of different parts of the plant. The secondary metabolites are not associated with the growth and development of the species (Vanitha V *et al.,* 2017).

Table 1: Recently isolated compounds from different parts of *Oroxylum indicum*

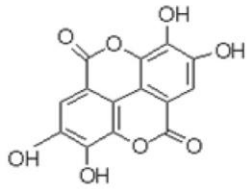
S.No.	Compound Name	IUPAC Names	Fig No.	References
1.	Baicalein	5,6,7-Trihydroxy-2-phenyl-4H-1-benzopyran-4-one	I	Sankara et al., 1972
2.	Chrysin	5,7-Dihydroxy-2-phenyl-4H-1 benzopyran-4-one	II	Dinda et al., 2007, Sankara et al., 1972
3.	Ellagic acid	2,3,7,8-Tetrahydroxy [1]-benzopyrano [5,4,3-cde] [1] benzopyran-5,10 dione	III	Dinda et al., 2007.
4.	Biochanin A	5, 7-Dihydroxy-4'-methoxyisoflavone	IV	Sankara et al., 1972
5	Ursolic acid	[(3β)-3-Hydroxyurs-12-en-28-oic acid]	V	Suratwadee et al., 2002.
6	Oroxylin A	5, 7-dihydroxy-6-methoxy flavone	VI	Vasanth et al., 1991.
7	8, 8' Bis-baicalein	-	VII	Vasanth et al., 1991.
8	β-Sitosterol	17-(5-Ethyl-6-methylheptan-2-yl)-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthren-3-ol	VIII	Dinda et al., 2007.
9	Scuttellarien	5,6,7,4'-Tetrahydroxy-2-phenyl-4H-1-benzopyran-4-one	IX	Dinda et al., 2007.
10	6–Hydroxyluteolin	2-(3,4-dihydroxyphenyl)-5,6,7-trihydroxy-4H-1-benzopyran-4-one 3,4,5–	X	Dinda et al., 2007.
11	Oroxoloside methyl ester	trihydroxy–6-(6-methoxy-4-oxo-2-phenyl-4-H-chromen-7-yloxy) tetrahydropyran-2-carboxylic acid methyl ester	XI	Vasanth et al.,1991
12		Chrysin 6-C-β-D-glucopyranosyl-8-O-β-D-glucuronopyranoside	XII	Yan R et al., 2011
13		Baicalein 7-O-β-D-glucuronopyranosyl-(1→3)[β-Dglucopyranosyl-(1→6)]-β-Dglucopyranoside	XIII	Yan R et al., 2011
14		Scutellarein 7-O-β-D-glucopyranosyl-(1→6)-β-D-glucopyranoside	XIV	Yan R et al., 2011
15	Chrysin-7-Ogentiobioside	5-hydroxy-2-phenyl-7-((3S,4S,5S)-3,4,5-trihydroxy-6-(((3S,5S)-3,4,5,6-tetrahydroxytetrahydro-2H-pyran-2-yloxy)methyl)-tetrahydro-2H-pyran-2-yloxy)-4H-chromen-4-one	XV	Yan R et al., 2011
16	Baicalein-7-Odiglucoside	5,6-dihydroxy-2-phenyl-7-((3S,4S,5S)-3,4,5-trihydroxy-6-(((3S,5S)-3,4,5,6-tetrahydroxytetrahydro-2H-pyran-2-yloxy)methyl)-tetrahydro-2H-pyran-2-yloxy)-4H-chromen-4-one	XVI	Yan R et al., 2011
17	Baicalein-7-Oglucoside	5-hydroxy-2-phenyl-7-((3S,4S,5S)-3,4,5-trihydroxy-6-(hydroxymethyl)-tetrahydro-2Hpyran- 2-yloxy)-4H-chromen-4-one	XVII	Yan R et al., 2011
18	Scutellarein-7-Oglucopyranoside	--	XVIII	Yan R et al.,2011
19	Aequinetin	Chrysin-7-O-glucuronide	XIX	Yan R et al.,2011
20	Chrysin 6-C-β-D-glucopyranosyl-8-O-β-D-glucuronopyranoside	5,7-dihydroxy-2-phenyl-6-((2S,3S,4R,5S)-3,4,5-trihydroxy-6-(hydroxymethyl)-tetrahydro-2Hpyran-2-yl)-8-((2R,5S)-3,4,5-trihydroxytetrahydro-2H-pyran-2-yl)-4H-chromen-4-one	XX	Yan R et al.,2011

Table 1: Continued

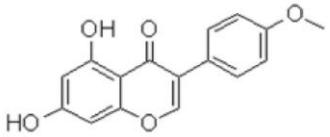
S.No.	Compound Name	IUPAC Names	Fig No.	References
21	Pinocembrin	5,7-dihydroxy-2-phenyl-2	XXI	Yan R et al.,2011
22	Pinobanksin	3,5,7-trihydroxyflavanone,	XXII	Yan R et al.,2011
23	Lupeol	(1R,3aR,5aR,5bR,9S,10R,11aS)-3a,5a,5b,8,8,9,10,11a-octamethyl-1-(prop-1-en-2-yl)-icosahydro-1H-cyclo-penta[a]chrysene	XXIII	Yan R et al.,2011
24	2α-Hydroxyl lupeol	2-Methyl-6-phenyl-4H-pyran-4-one	XXIV	Yan R et al.,2011
25	Dimethyl Sulfone	Methylsulfonylmethane	XXVI	Yan R et al.,2011
26	Echinulin	(3S,6S)-3-[[2-(1,1-Dimethyl-2-propenyl)-5,7-bis (3-methyl-2-butenyl)-1H-indol-3-yl]methyl]- 6-methyl-2,5-piperazinedione	XXVII	Yan R et al.,2011
27	Adenosine	2-(6-amino-9H-purin-9-yl)-5-(hydroxymethyl)furan-3,4-diol	XXVIII	Yan R et al.,2011



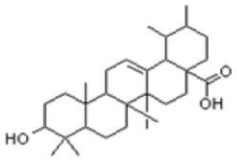
(I) R_1 = OH, R_2 = OH, R_3 = OH, Baicalein
(II) R_1 = OH, R_2 = H, R_3 = OH, Chrysin
(IX) R_1 = OH, R_2 = OH, R_3 = OH, R_4 = OH, Scutellarein



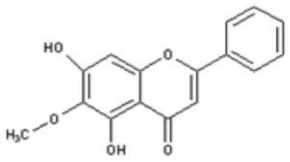
(III) Ellagic acid



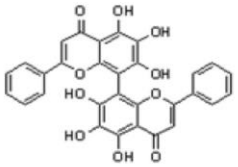
(IV) Biochanin A



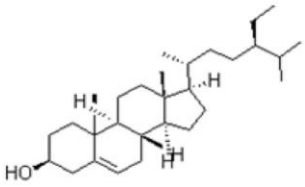
(V) Ursolic acid



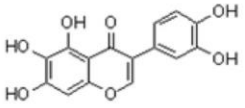
(VI) Oroxylin A



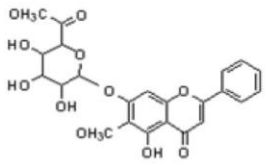
(VII) 8, 8'-Bisbaicalein



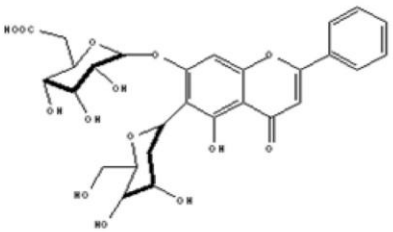
(VIII) β-Sitosterol



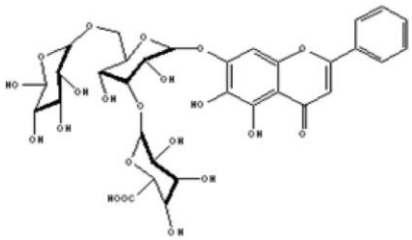
(X) 6 – Hydroxyluteolin



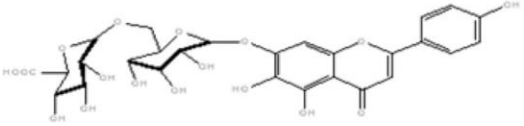
(XI) Oroxoloside methyl ester



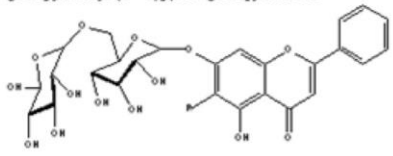
(XII) Chrysin 6-C-β-D-glucopyranosyl-8-O-β-D-glucuronopyranoside



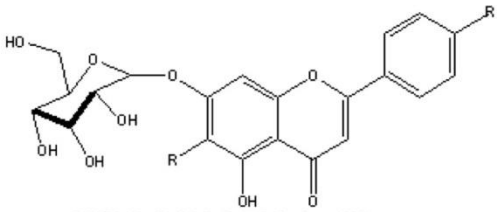
(XIII) Baicalein-7-O-β-Dglucuronopyranosyl-(1→3)[β-D-glucopyranosyl-(1→6)]-β-D- glucopyranoside



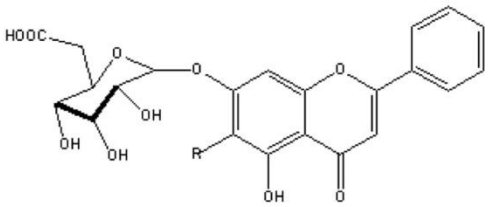
(XIV) Scutellarein 7-O-β-D-glucopyranosyl-(1→6)-β-D-glucopyranoside



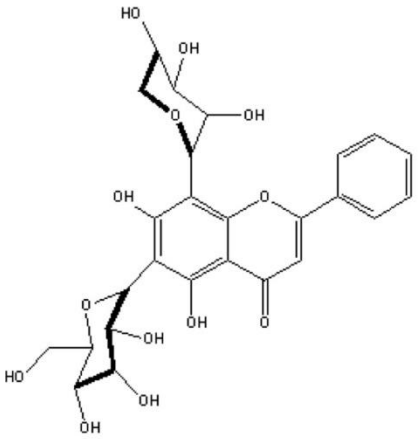
(XV) R= H, Chrysin-7-Ogentiobioside,
(XVI) R= OH = Baicalein-7-O-diglucoside,



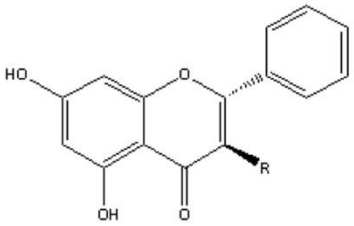
(XVII) R= H (Baicalein-7-O-glucoside)
(XVIII) R= OH (Scutellarein-7-O-glucopyranoside)



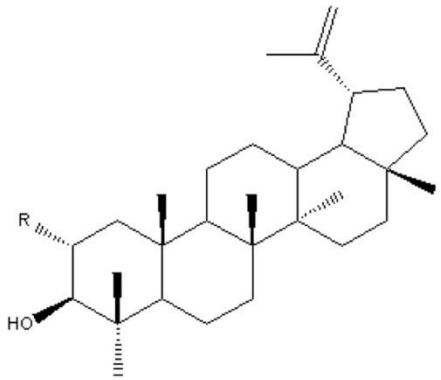
(XIX) R= H (Chrysin-7-O-glucuronide)



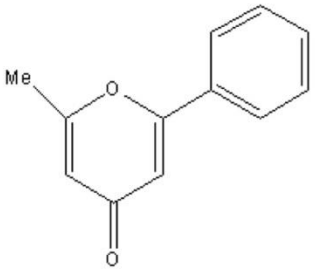
(XX) Chrysin-6-C-β-D-glucopyranosyl-8-C-α-L-arabinopyranoside



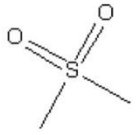
(XXI) R=H (Pinocembrin), (XXII) R=OH(Pinobanksin)



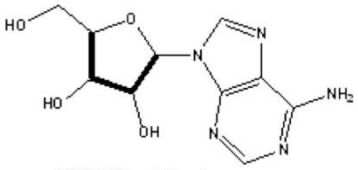
(XXIII) R= H (Lupeol), (XXIV) R= OH (2α-Hydroxyl lupeol)



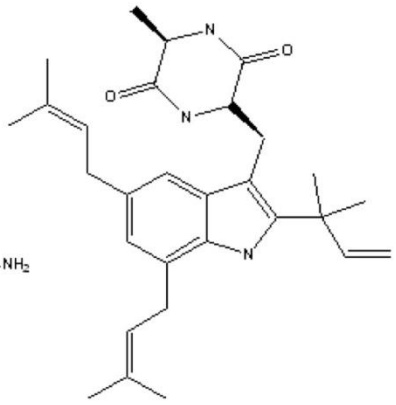
(XXV) 2-Methyl-6-phenyl-4H-pyran-4-one



(XXVI) Methylsulfonylmethane



(XXVIII) Adinosine



(XXVII) Echinulin

The leaves of *Oroxylum indicum* contain a flavanoid like chrysin (5, 7-Dihydroxy-2-phenyl-4H-1-benzopyran-4-one), oroxylin-A (5, 7-dihydroxy-6-methoxy flavone) and baicalein (Chen LJ *et al.,* 2003 and Chen LJ *et al.,* 2005) oroxyloside methyl ester and chrysin-7-O- methyl glucoside, anthraquinone and aloe-emodin (Jayaram K *et al.,* 2008 , Dalal NV *et al.,* 2004 and Dey AK *et al.,* 1978). The fruit pod contains Oroxylin A (5, 7-dihydroxy-6-methoxy flavone), chrysin (5, 7-Dihydroxy-2-phenyl-4H-1-benzopyran-4-one), triterpene carboxylic acid and ursolic acid.

The root and stem of *Oroxylum indicum* contain three flavones named oroxylin A (5, 7-dihydroxy-6-methoxyflavone), baicalein (5, 6, 7-Trihydroxy-2-phenyl-4H-1-benzopyran-4-one) and chrysin (5, 7- dihydroxyflavone) (Sankara S *et al.,* 1972).

Table 2: Different pharmacological properties of *Oroxylum indicum*

Entry	Functional Properties	Plant Parts	Solvent Extract	Reference
1	Antioxidant	Stem Bark	Ethyl acetate, Methanol, Ethanol,	Gupta *et al.,* 2008; Upaganlawar *et al.,* 2007; Kumar et al. 2011; Mishra *et al.,* 2010; Kalaivani *et al.,* 2009 Mishra *et al.,* 2010.
		Stem	Chloroform	Mishra *et al.,* 2010.
		Leaves	Methanol	Mishra *et al.,* 2010.
		Root	Methanol	Mishra *et al.,* 2010.
		Fruit	Methanol	Yan R *et al.,* 2011.
		Seed	Methanol Aqueous Ethanolic	
2	Antimicrobial	Root Bark	Ethyl acetate & Methanol	Uddin *et al.,* 2003; Thatoi *et al.,* 2008; Islam *et al.,* 2010;
			Methanol,	Kumar *et al.,* 2011.
		Stem bark	Ethyl Acetate	
3	Anti-inflammatory	Leaves	Aqueous	Laupattarakasem *et al.,* 2003;
		Stem bark	Aqueous & alcoholic extracts	Tenpe *et al.,* 2009;
4	Anticancer	Fruit, Stem bark	Ethanol, Aqueous, Methanol	Roy *et al.,* 2007; Tepsuwan *et al.,* 1992; Narisa *et al.,* 2006; Brahma *et al.,* 2011.
5	Antimutagenicity	Fruit	Methanol	Nakahara K, *et al.,* 2002
6	Immunomodulatory	Root Bark	*n*-Butanol	Zaveri M, *et al.,* 2006
7	Gastroprotective	Root bark	Alcoholic & *n*-Butanol	Zaveri M, *et al.,* 2007
8	Anti-hepatotoxic	Leaves	Ethanol	Tenpe *et al.,* 2009;

From the extraction of seed, it has been reported that four flavonoids, chrysin (, 7-Dihydroxy-2-phenyl-4H-1-benzopyran-4-one), baicalein (5, 6, 7-Trihydroxy-2-phenyl-4H-1-benzopyran-4-one), baicalein-7-O-glucoside, baicalein-7-O-glucoside (Chen LJ *et al.,* 2003). Recent studies reported found to be total twenty-seven compounds, but there are no details in which parts of plant present The numerous chemical constituents (Sankara S *et al.,* 1972 and Yan R *et al.,* 2011). Some of the previously isolated compounds from different parts of *Oroxylum indicum* are mentioned in Table 2 which shows the general name, IUPAC name and Fig of the compound.

ETHNOPHARMACOLOGY

This species has been used for centuries as a traditional folk medicine for prevention and treatment of several various diseases like jaundice, inflammation, cancer, diarrhea, fever, ulcer, oxidative stress arthritis and microbial infection. *Oroxylum indicum* is an incredible plant because every part of this plant like stem, root, leaf, and seed possess medicinal properties. It has been used in Ayurvedic medicine as the root of this plant has an active ingredient for the well known of Ayurvedic formulation such as Chyavanprash, Dashmularistha, Narayan Taila, Brahma Rasayana, Dhanwatara, etc. (Jabbar S *et al.,* 2004 and Kirtikar KR *et al.,* 2001)

Due to its hot potency, it helps in reducing pain and inflammation. It can promote healing of the wound and helps in improving skin texture. Beside it regularize the digestion and prevents diarrhea also it has a very effective in worms and infection. The paste made of bark powder can be used for a disease like mouth cancer, scabies, and other skin diseases.

The fruits are beneficial in gynecological disorder and even in case of childhood disorder. In most case dried seed powder is used by women to in-

duce conception (http://www.planetayurveda.com). In the perfume industry, the seed is also used which yield a nondrying oil. Various medicinal and chemical extract of different parts of the plants shows different pharmacological activities. In Table 3, it includes the functional properties and solvent extract of different parts of *Oroxylum indicum*.

BIOLOGICAL SIGNIFICANCE

Anti-inflammatory Activity

The leaves of *Oroxylum indicum* is found to possess significant anti-inflammatory activity. Dichloromethane extract of stem bark and root were found to have anti-inflammatory properties. The anti-inflammatory activity was carried out by the carrageenan-induced rat paw edema model in rats using diclofenac sodium as a standard drug. Two doses 150 mg/kg and 300 mg/kg of aqueous extract of *Oroxylum indicum* were used. After the experiment both the dose produced less effective than the standard diclofenac sodium and hence it showed significant ($P<0.05$) anti-inflammatory activity at 5h which can inhibit the release of prostaglandin-like substances (Upaganlawar AB *et al.,* 2009).

Antimicrobial Activity

The various extracts of *Oroxylum indicum* for antimicrobial activity have been covered against pathogenic bacteria hence this extract reveals the uses for various treatment. The antimicrobial activity of crude extract of *Oroxylum indicum* was tested against fourteen pathogenic bacteria (five gram-positive and nine gram-negative) and seven pathogenic fungi. In antibacterial screening, each sample was determined by dissolving in methanol with the concentration of 200µg / 10µg. After the experiment, it was evident that the crude ethyl acetate extract showed mild to moderate activity against all bacteria and fungi whereas the methanolic extract showed less activity against bacteria but it showed moderate activity against fungi (Kawsar U *et al.,* 2003 and Chopade VV *et al.,* 2008).

Anticancer Activity

The methanol extract of *Oroxylum indicum* shows the antiproliferative activity on HL-60 cell line and anticancerous on CEM, B-16, and HCT-8 cell lines. The extract of this plant contains the flavonoid baicalein. In in-vitro, the effects of baicalein was further investigated on the viability and induction of apoptosis in the HL-60 cell line. By using trypan blue staining, the cell viability was evaluated for 24h treating with baicalein. Hence the results revealed 50% inhibition of HL-60 cells line was induced by baicalein with the concentration of 25-30 µM. Due to the exposure with 10 or 20 µM baicalein, at S or G2M phases, the cell accumulation was associated with the inhibition of proliferation of HL-60 cells. Therefore, it concludes that the baicalein has the antitumors effects on human cancer cells (Roy MK *et al.,* 2007).

Anti-proliferative Activity

To investigate the antiproliferative activity of *Oroxylum indicum* was studied on human breast tumour cell lines. *Oroxylum indicum* has an antiproliferative activity which results in MCF7 and MDA-MB-231 breast cancer cell lines (Lambertini E *et al.,* 2004).

Anti-arthritic Activity

For in vitro release of myeloperoxidase (MPO) from rat peritoneal leukocytes an aqueous and ethanol extract of *Oroxylum indicum* were tested. Hence the results show the significant effect of aqueous extract had, i.e. 64% inhibition of release of MPO (Laupattarakasem P *et al.,* 2003).

Antioxidant activity

For the production of different oxidative species and free radical which lead to adverse effects on various tissues and vital organ. For the determination of in-vitro antioxidant activity, the aqueous and ethanol extract of *Oroxylum indicum* leaves were done by two methods, i.e., DPPH (1, 1-Diphenyl-2picrylhydrazyl) free radical scavenging activity and Nitric oxide radical scavenging activity in Griess reagent (1% sulphanilamide, 2% phosphoric acid and 0.1% N-1-naphthyl ethylenediamine dihydrochloride).

From the above experiment, ethanol extracts exhibit the maximum antioxidant activity in both the methods which shows the activity of IC50=18.8 µg/ml in scavenging DPPH radicals and IC50=18.38 µg/ml in Nitric Oxide radical. Hence the results indicate that the ethanol extract of *Oroxylum Indicum* has more potent on free radical scavenging activity (Upaganlawar AB *et al.,* 2007).

CONCLUSION

Oroxylum indicum is a well-known plant used in the Indian system of medicine as well as traditional folk medicine. Moreover, the different part of this plants can be used for treating diseases. Besides, this plant has a unique source of various types of compounds having diverse chemical structure and nature. Recent studies reported found to be total twenty-seven compounds, but there are no details in which parts of plant present the numerous chemical constituents. In this review, the effort has been put to accumulate the numerous sources from the earlier scientific reports on this medicinal plants which contain morphology, phytocompounds, ethnopharmacology and it is biological significance.

REFERENCES

Chauhan NS. Medicinal and Aromatic plants of Himachal Pradesh. 1st ed. New Delhi: Indus Publishing. Oroxylum indicum; 1999; pp. 96–298.

Chen LJ, Games DE, Jones J. Isolation and identification of four flavonoids constituents from the seeds of Oroxylum indicum by high-speed counter-current chromatography. J Chromatogr A. 2003; 988:95–105.

Chen LJ, Song H, Lan XQ, Games DE, Sutherland IA. Comparisons of high-speed counter-current chromatography instruments for the separation of the extracts of the seeds of Oroxylum indicum. J Chromatogr A. 2005; 1063:241–5.

Chopade VV, Upaganlawar AB, Yeole PG. Antimicrobial activity of Oroxylum indicum. Antiseptic. 2008; 105:146–7.

Dalal NV, Rai VR. In vitro propagation of Oroxylum indicum Vent. A medicinally important forest tree. J For Res. 2004; 9:61–5.

Dey AK, Mukherjee A, Das PC, Chatterjee A. Occurrence of aloe-emodin in the leaves of Oroxylum indicum Vent. Indian J Chem. 1978; 16B:1042.

Dinda B., Mohanta B.C., Arima S., Sato N., Harigaya Y.Flavonoids from the stem-bark of Oroxylum indicum. Nat Prod Sci. 2007; 13 (3):190-194.

Gupta R.C., 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

Islam M.K., Eti Z.I., Chowdhury J.A. Phytochemical and Antimicrobial analysis on the extract of Oroxylum indicum (Linn.) stem bark.Iranian J Pharm & Therapy. 2010; 9 (1): 25-28.

Jabbar S, Khan MT, Choudhury MS, Sil BK. Bioactivity studies of the individual ingredients of the Dashamularishta. Pak J Pharm Sci. 2004; 17:9–17.

Jayaram K, Prasad MN. Genetic diversity in Oroxylum indicum (L.) Vent. (Bignoniaceae), a vulnerable medicinal plant by random amplified polymorphic DNA marker. Afr J Biotech. 2008; 7:254–62.

Joshi KC, Prakash L, Shah RK. Chemical examination of the roots of Tabebuia rosea and heartwood of Oroxylum indicum. Planta Med. 1977; 31: 257–8.

Kalaivani T., Mathew L. Phytochemistry and Free radical scavenging activities of Oroxylum indicum. Environ We Int J Sci Tech.2009; 4: 45-52.

Kawsar U, Sayeed A, Islam A, Rahman AA, Ali A, Khan AM, et al. Biological activities of extracts and two flavonoids from Oroxylum indicum Vent. J Biol Sci. 2003; 3:371–5.

Kirtikar KR, Basu BD. Indian Medicinal Plants. Oriental Enterprises, Dehradun, Vol. 4 2001; 1105–1107.

Kumar V., Chaurasia A.K., Naglot A., Gopalakrishnan R., Gogoi B. J., Singh L., Srivastava R. B., Deka D.C. Antioxidant and antimicrobial activities of stem bark extracts of Oroxylum indicum Vent. (Bignoniaceae)– A medicinal plant of northeastern India. South Asian J Exper Biol. 2011;1 (3):152-157.

Lambertini E, Piva R, Khan MT, Lampronti I, Bianchi N, Borgatti M, et al. Effects of extracts from Bangladeshi medicinal plants on in vitro proliferation of human breast cancer cell lines and expression of the estrogen receptor alpha gene. Int J Oncol. 2004; 24:419–23.

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.

Mishra S.L., Sinhamahapatra P.K., 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

Nakahara K., Trakoontivakorn G., Alzoreky N.S., Ono H., Onishi- Kameyama M., Yoshida M. Antimutagenicity of some edible Thai plants and a bioactive carbazole alkaloid, mahanine, isolated from Micromelum minutum. J Agri & Food Chem. 2002; 50: 4796-4802.

Roy MK, Nakahara K, Trakoontivakorn G, Takenaka M, Isobe S, Tsushida T. Baicalein, a flavonoid extracts from a methanolic extract of Oroxylum indicum inhibits proliferation of a cancer cell line in Vitro via induction of apoptosis. Pharmazie. 2007; 62:149–53.

Sankara S., Nair A.G.R. Flavonoids from the leaves of Oroxylum indicum and Pajanelia longifolia. Phytochem. 1972 B; 11: 439-440.

Sankara S., Nair A.G.R. Flavonoids of stem bark of Oroxylum indicum. Curr Sci. 1972 A; 41: 62-63.

Suratwadee J., Valai S., Murakami A., Oe-Kyung K., Won H.K., Hajime O. Suppressive effects of edible Thai plants on superoxide and nitric oxide generation. Asian Paci J Canc Preven. 2002; 3: 215-223.

Tenpe C.R., Upaganlawar A., Burle S., Yeole Y.G. In vitro antioxidant and preliminary hepatoprotective activity of Oroxylum indicum (Vent.) leaf extracts. Pharma online. 2009; 1: 35-43

Thatoi H.N., Panda S.K., Rath S.K., Dutta S.K. Antimicrobial activity and ethnomedicinal uses of some medicinal plants from similipal biosphere reserve Orissa. Asian J Plant Sci. 2008; 7 (3): 260–267.

Uddin K.A., Sayeed A., Rahman I.A.A., Khatun S., Khan G.R.M.A.M., Sadik M.G. Biological activities of extracts and two flavonoids from Oroxylum indicum Vent. (Bignoniaceae). J Biol Sci.2003; 3 (3): 371-375.

Upaganlawar AB, Tende CR, Yeole PG. Antiinflammatory activity of aqueous extract of Oroxylum indicum Vent.leaves extract-preliminary study. Pharmacology online. 2009;1:22–6.

Upaganlawar AB, Tende CR. In vitro antioxidant activity of leaves of Oroxylum indicum Vent. Biomed. 2007;2:300.

Vanitha V *et al.,* Assesment of Minerals from Shell Waste of Penaeus indicus Int.J.Res.Pharm.Sci., 8 (2), 194-197.

Vanitha Varadharaj, Jayalakshmi Muniyappan. Phytochemical and Phytotherapeutic properties of Celosia species-A Review. IJPPR.2017;9 (6)820-825

Vasanth S., Natarajan M., Sundaresan R., Rao B.R., Kundu A.B. Ellagic acid from the root bark of Oroxylum indicum. Indian Drugs. 1991;28: 507-509.

Warrier PK, Nambiar VP, Ramankutty C, Vasudevan R, editors. Indian Medicinal Plants: A compendium of 500 species. 1st ed. Chennai: Orient Longman Private Ltd; 1995. Oroxylum indicum; pp. 186–90.

Yan R., Cao Y., Chen C., Dai H., Yu S., Wei J., Li H., Yang B. Antioxidant flavonoids from the seed of Oroxylum indicum. Fitoterapia.2011; 82: 841–884

Zaveri M., Gohil P., Jain S. Immunostimulant activity of the n-butanol fraction of root bark of Oroxylum indicum (Vent.). J Immunotoxicol.2006; 3 (2): 83-99.

Zaveri M., Jain S. Gastroprotective effects of root bark of Oroxylum indicum (Vent.). J Natural Rem. 2007; 7 (2): 269-277.