

BIOGRAPHY OF INDIAN KINO TREE (*PTEROCARPUS MARSUPIUM*) AND ITS ETHNOBOTANICAL USES: A REVIEW

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ABSTRACT

Pterocarpus marsupium (Fabaceae) is popularly known as Indian Kino Tree and ranks next to teak and rose wood in peninsular India. Kino is a moderate to large sized deciduous tree found at elevations from 200 to 500 m. This wood is often compared with teak and has been paid less attention for extensive cultivation and the native stands are fast disappearing, though little known to the world's foresters and virtually untried in plantations. Parts of the plant (heart wood, leaves, bark and flowers) have long been used for their medicinal properties in Ayurveda. The flowers are bitter, improve the appetite and cause flatulence. *Pterocarpus marsupium* has a long history of use in India as

a treatment for diabetes. The bark is used for the treatment of stomach-ache, cholera, dysentery, urinary complaints, tongue diseases and toothache. This review explains Biography of Indian Kino tree and its ethnobotanical uses.

KEYWORD: Herbal drugs, astringent, pharmacological, phytochemical.

INTRODUCTION

Pterocarpus Marsupium Roxb. (Fabaceae) is one of the herbal drugs which finds in Ayurveda, Unani and homeopathic system in the medicine. *Pterocarpus marsupium* commonly known as Indian Kino tree or asana or vijayasar is a large deciduous tree found in the subtropical region in the world.^[1] It is a decent source of tannins and flavonoids hence used for the treatment of influential astringent, leprosy, leukoderma, toothache, fractures, diarrhoea, passive haemorrhage and dysentery etc. marsupium which helps in the researchers for the for the various pharmacological and phytochemical uses and also in qualitative research.^[2] The history of the herbal medicine is as old as human civilization and also in the current cases. It is found specifically in the area of Kerala-Karnataka, Western Ghats, Madhya Pradesh, Bihar

and Orissa.^[3,4] The major phytoconstituents of *P. Marsupium* are pterostilbene and marsupin, liquiritigenin.^[5] iso liquiritigenin, pterosupin, p-hydroxybenzaldehyde, 7, 4,-dihydroxyflavone, propterol, marsupol, carsupin.^[6,7,8] Different plant parts of *Pterocarpus Marsupium* have been used for various diseases like leaves for skin diseases, flower for fever, gum-Kino for diarrhoea, dysentery and bark as astringent and for toothache.^[9,10] The heart wood possesses astringent, anti-inflammatory, anti-diabetic and anodyne properties.^[11] *P. Marsupium* is well known for its excellent timber that ranks next to teak and rose wood in peninsular India.^[12] The wood and bark of *Marsupium* are known for their medicinal properties in Ayurveda and also used as anti-diabetic activity.^[13,14] Phytochemical studies on *Marsupium* have shown that the plant contains iso-flavonoids, terpenoids and related phenolic compounds, lophenol, epicatechin and aurone glycosides.^[15,16]

SCIENTIFIC CLASSIFICATION^[17]

Table 1: Scientific classification.

Synonym:	Indian Kino, Bijasal, Vijayasagar, Bibla, Malbarkino.
Family:	Fabaceae
Domain:	Eukaryota
Kingdom:	Plantae
Subkingdom:	Viridaplantea
Phylum:	Magnoliophyta
Subphylum:	Euphyllophytina
Class:	Magnoliopsida
Subclass:	Rosidae
Super order:	Fabanae
Order:	Fabales
Genus:	<i>Pterocarpus</i>
Species:	<i>Marsupium</i>

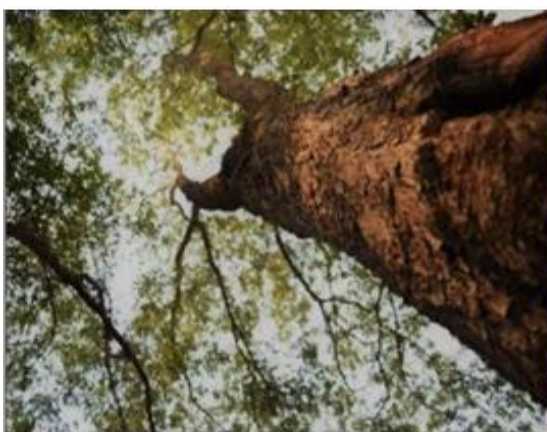
VERNACULAR NAMES^[17,18,19]

Table 2: Vernacular names.

Sr.no	Language	Vernacular names
1	English:	Indian Kino
2	Hindi:	Vijayasagar, Bija
3	Gujrati:	Biyo
4	Bengali:	Piyasala, Pitasala
5	Kannada:	Bijasara, Asana
6	Sanskrit:	Bijaka, Pitasara, Asana
7	Urdu:	Bijasar
8	Telugu:	Yegi, Vegisa
9	Punjabi:	Lal Chandan, Channanlal

Plant Description^[12]

Plant morphology and Phenology *P. marsupium* is a moderate deciduous tree with spreading branches, producing a straight bole. Bark is about 1.25 cm thick, grey, rough, longitudinally fissured in small irregular scales, blaze pink with whitish markings and older trees exuding a b astringent gum resin which is in blood red colour. Leaves are impar pinnate, 17.5-22.5 cm long, usually leaflets 5-7, oblong and coriaceous. The tree is nearly evergreen or leafless for a short time in the hot season in April-May the new leaves appear in May-June. The panicles of fragrant yellow flowers appear from June to September. The pods are light yellowish brown, nearly orbicular, 2.5-5 cm diameter, flat, winged containing 1-2 seeds, convex and bony, seeds are dolabriform, 1-1.25 cm long, reddish brown, fairly hard, with a smooth leathery testa. Under favourable conditions the tree attains a height of 33 m and a girth of 2.6 m or more. Wood is hard and durable.

Plant Profile**Fig.1: P. marsupium tree****Fig.2: P. Marsupium flower.****Fig.3: P. marsupium seeds.****Fig. 4: P. marsupium bark.**

Origin, Habbitat and Distribution

P. marsupium is growing in defoliate and evergreen jungles of Southern, Western and Central regions of India. It is present generally in Gujarat, Bihar, West Bengal, Orissa, Uttar Pradesh, Western Ghats, Kerala, Karnataka, and Madhya Pradesh, of prominent India, Srilanka and Nepal. It develops generally on hills or undulating lands or rocky grounds up to a height of 150 to 1100 meter. The usual rainfall of its habitat ranges starting from 750 to 2000 mm and even more in Southern India. The maximum temperature was ranged from 35°C to 48°C and minimum temperature was ranged from 0°C to 18°C. It can increase in huge variety of soils and geographical situations like quartzite, shale, conglomerates, lateritic, gneiss and sandstone. It favours well-drained sandy and sedimentary soil to loamy soil. The species is adequate light loving and the young seedlings are frost-tender.^[20,21]

Identity, Purity and Strength

Table no.3: Identity test and result.^[22]

Identity test	Result
Foreign matter	Not more than 2 percent
Total ash	Not more than 2 percent
Acid insoluble ash	Not more than 0.5 percent
Alcohol soluble extractive	Not more than 7 percent
Water soluble extractive	Not more than 5 percent

Marketed Product^[23,24]

Marketed products are composed of *P. marsupium*, Terminalia chebula, Emblica officinalis and Momordica charantia extracts; Diabecon composed of *Pterocarpus marsupium*, Glycyrrhiza glabra, Asparagus and Gymnemasylvestre extracts; Diabeta composed of Pterocarpus marsupium, Zingiber officinale, Acacia Arabica, Tinosporacordifolia, Curcuma langa, Gymnemasylvestre and Azadiracthaindica extracts; and Silbinol containing *P. marsupium* bark and heartwood extracts are the different marketed formulation.



Fig.5. Skin Pharmaceuticals.



Fig.6. Energy products.

Ethanobotnical Uses and Phytoconstituent^[25,26,27,28]

Table 4: Ethnobotanical uses and phytoconstituents.

Sr.no	PHYTOCONSTITUENT	USES
1.	4-hydroxy -4-methyl-2-pentanone	Antimicrobial
2.	Furan-2-one-,3,4,-dihydroxy-5[1-hydroxy-2-fluoroethyl]	Antiviral
3.	Benzoic acid, 2,6-bis[(trimethylsilyl)oxy]-trimethylsilyl ester	Antifungal, antibacterial
4.	1-monolinoleoylglyceroltrimethylsilyl ether	Anti-inflammatory, antimicrobial, antia arthritic, antioxidant, antiasthma
5.	Ethyl iso-alcoholate	Anticancer, diuretic, antimicrobial, antiashthma
6.	Milbemycin b,13-chloro-5-demethoxy-28-deoxy-6,28-epoxy-5-(hydroxyamino)-25-(1-methylethyl)	Antiparasitic
7.	3-O-methyl-D-glucose	Preservative
8.	Tetra decanoic acid	Nematicide, lubricant anti-oxidant, cancer preventive
9.	Dibutyl phthalate	Antimicrobial, antifouling
10.	9,12-octadecanoic acid	Anti-inflammatory, insectifuge, hepatoprotective, cancer preventive
11.	1,2-benzenedicarboxylic acid and di-isooctyl ester	Antimicrobial
12.	Hexadecenoic acid, ethyl ester	Antioxidant, pesticide, nematicide, cancer preservative, anti acne
13.	epicatechin	Antidiabetic, antihyperlipidemic
14.	pterostilbene	Blood glucose level, antitumor effects

MEDICINAL USE OF VARIOUS PARTS OF *P. MARSUPIUM*

Various parts of the *P. marsupium* tree have been used as traditional ayurvedic medicine in India from time immemorial. The medicinal utilities have been described, especially for leaf, fruit and bark. The bark is used for the treatment of stomach-ache, cholera, dysentery, urinary

complaints, tongue diseases and toothache. The gum exudes 'Kino', derived from this tree, is used as an astringent.^[29] The gum is bitter with a bad taste. However, it is antipyretic, anthelmintic and tonic to liver, useful in all diseases of body and styptic vulnerate and good for griping and biliousness, ophthalmia, boils and urinary discharges. The flowers are bitter, improve the appetite and cause flatulence.^[30] *P. marsupium* has a long history of use in India as a treatment for diabetes. It is a drug that is believed to have some unique features such as beta cell protective and regenerative properties apart from blood glucose reduction.^[31,32] Some of the medicinal attributes of various parts of *P. marsupium* have been summarized in Table.

Table 5: Some Medicinal Uses of *P. MARSUPIUM* in Ayurveda.

Sr.No	Part	Medicinal uses
1)	Leaf	External application for boils, sores and skin diseases, stomach pain
2)	Flower	Astringent, toothache
3)	Bark	Fever
4)	Gum Kino	Diarrhea, dysentery, leucorrhoea, passive haemorrhages

BIOLOGICAL USES OF *P. MASRUPIUM*

Although a large number of compounds have been isolated from various parts of *P. marsupium*, few of them have been studied for biological activity as shown in Table 5.

Table 6: Biological Uses of *P. Masrupium*.^[27,28]

Sr.No.	Neem compound	Source	Biological source
1.	liquiritigenin	bark	Antidiabetic, Antihyperlipidemic effect
2.	Isoliquiritigenin	bark	Antidiabetic
3.	Pterosupin	bark	Antihyperlipidemic effect
4.	Epicatechin	bark	Antidiabetic, Anthelmintic properties
5.	Pterostilbene	bark	blood glucose levels, Anti-oxidant and anti tumour effects
6.	Marsupinol	bark	Antihyperlipidemic effect

REPORTED PHARMACOLOGICAL ACTIVITY

1. Antidiabetic activity

The ethanolic extract of *P. marsupium* stem wood has antidiabetic activity. The highest blood glucose lowering effect (57.56%) was found in 180 min for standard drug glimepiride along with for ethanolic extract at a dose of 200 mg/kg b. wt. (51.30%) and at 400 mg/kg b. wt. (55.13%). The extract showed antidiabetic activity which is dose and time dependent. The ethanolic extract of heartwood (1gm/kg per oral and 2 gm/kg per oral) significantly. Bioassay

showed fractionation of extract had potent antidiabetic properties in vitro and in vivo.^[33]

2. CNS activity

(-)-Epicatechin was separated from the bark and it was established for its action on CNS of rats, mice and frog. It was examined that (-)-epicatechin don't have any effect on CNS of rats, mice and frog. (-)-Epicatechin had been showing positive chronotropic and inotropic effects on the heart of frog and propranolol use to block this effect. Hyperglycaemia is produced in rats at higher doses (200 and 500 mg/kg b. wt.) of this compound and this effect is also prevented by propranolol indicating adrenergic activity.^[34]

3. Antioxidant activity

Ethanol, isopropyl alcohol (IPA) and acetone stem wood extracts of *P. marsupium* showed antioxidant activity in 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method.^[33] Methanolic extract (100 µg/ml) is achieved to have maximum 2,2-diphenyl-1-picrylhydrazyl free radical scavenging effect followed by ethyl acetate and aqueous extracts. The scavenging effect achieved saturation with further increase in concentration of extracts. This study had showed significant antioxidant activity of *P. marsupium* bark extract in DPPH, superoxide, ABTS, hydroxyl radical, nitric oxide scavenging and suppression of in vitro lipid peroxidation.^[35]

4. Antimicrobial activity

Antimicrobial activity of aqueous and methanolic bark extracts of *P. marsupium* was evaluated by using disc diffusion method. It showed the zone of inhibition ranges from 11-22 mm for different extracts. Methanol extract showed significant effect by preventing *A. Niger* at 25 µg/ml and *E. faecalis*, *S. typhi* at 12.5 µg/ml. It was found that *P. marsupium* showed significant antimicrobial action against microbes.^[36]

5. Antibacterial activity

Methanolic extract of *P. marsupium* stem was tested by using paper disc diffusion method against gram +ve bacteria *Bacillus coagulans* and gram +ve bacteria *Escherichia coli*. 100 mg/ml concentration significantly inhibited growth of both the bacteria.^[37] The acetone and isopropyl alcohol extract of *P. marsupium* (50 mg/ml) showed the antibacterial activity against the Gram +ve bacteria (*Staphylococcus aureus* and *Bacillus cereus*) but did not show antibacterial activity against Gram +ve bacteria (*Escherichia coli* and *Salmonella Typhi*). Ethanol extract of *P. marsupium* (50 mg/ml) did not show any antibacterial activity.^[38]

6. Anti-inflammatory activity

Methanolic and aqueous extract evaluated anti-inflammatory effect by acute inflammation model using carrageenan induced rat paw edema method. Methanol extract at dose 50 mg/kg b. wt. and aqueous extract at dose 100 mg/kg b.wt. indicated significant decrease in paw edema. It was found that both extracts had significant anti-inflammatory activity.^[39,40] *P. marsupium* aqueous extract at doses of 100 mg/kg and 200 mg/kg b.wt was found to decrease the elevated inflammatory cytokine, TNF- α level in NIDDM diabetic rats.^[41]

7. Antiulcer activity

Methanolic heartwood extract of *P. marsupium* (750 mg/kg b.wt) lowers the blood glucose level in both normal rats and NIDDM rats. It saved the mucosa by influencing the increase in mucosal offensive (LPO and NO) factors and decrease in defensive factors (superoxide dismutase and catalase). It did not indicate any safety against ulceration caused by aspirin, pylorus ligation, cold restraint stress, and ethanol in normal rats.^[42,43]

8. Analgesic activity

The ethyl acetate, petroleum ether and methanol leaf extracts of *P. marsupium* were evaluated for analgesic activity in Swiss albino mice. Improvement in writhing response of different extract was compared. The methanolic extract at the doses of 120 mg/kg b.wt was more effective than ethyl acetate and petroleum ether extracts.^[44] Central analgesic effects of *P. marsupium* bark extract was evaluated in mice by using hot plate method. *P. marsupium* bark extract at dose of 500 mg/ml significantly improved reaction time as compared to standard.^[45]

9. Antifungal activity

A study was carried for 10 days in which after 7 and 10 days of therapy 78% and 93% excellent to good response was found from the alcoholic extract compared to 73% from the aqueous extract. Thus, it shows that the ointment prepared from alcoholic extract is more effective than aqueous extract. There was no side effect after continuous uses of drug for 10 days.^[46]

CONCLUSION

Through various phytochemicals were isolated, it helps to achieve its therapeutic value and plays a significant role in modern system of remedy and it requires supplementary exploitation. It is vital to recognize the active components and their molecular interaction, which will help to examine therapeutic value of the product and also homogenize the product. The Literature review survey revealed that *P. marsupium* is a versatile medicinal plant and also is a the unique

source of various types of compounds having diverse chemical structure. *Pterocarpus marsupium* a tree having excellent timber yielding as well as medicinal properties which also further needs to be investigated.

FUTURE PROSPECTIVE

The Sami -Sabinsa group has committed to fund a 10 yrs. reforestation project that will oversee the planting of more than 166,600 Indian Kino (*Pterocarpus Marsupium*, Fabaceae) trees on 250 acres in the large central Indian state of Madhya Pradesh. “While there have been some initiatives by Indian forest departments for propagating teak and other timber trees, an initiative for the cultivation of the Indian Kino tree has hardly been done by the government agencies or private enterprise” wrote Shaheen Majeed, president of Sabinsa Worldwide.

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