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Review Article

A Pharmacognostic, phytochemical and pharmacological review of *Pterocarpus marsupium*: Comprehensive Review

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Abstract

Research in herbal drug is need of the hour to find definite lead for discovery of medicine from plant source. Many traditional medicinal plants are under screening to scientifically reinforce their traditional claims. *Pterocarpus marsupium* is time tested important source of herbal medicine which has been used extensively for treatment of diabetes mellitus. It has also exhibited antimicrobial activity, analgesic activity, anticataract activity. Acute toxicity test determines safe dose of the *Pterocarpus marsupium*. Various extraction methods such as Infusion, Decoction, Maceration, Percolation and Hot Water Extraction s employed for efficient extraction of phytoconstituents. Primary phytoconstituents present in the bark comprises of liquiritigenin, isoliquiritigenin, pterosupin, epicatechin, and pterostilbene. Current review is carried out to study pharmacognstic, phytochemical and pharmacological activity of the drug, which can be useful for researcher to provide synoptic overview about *Pterocarpus marsupium*

Keywords: *Pterocarpus marsupium*, Review, Fabaceae, Indian kino, Asan

Introduction

Phytoconstituents from plants are boon to mankind as they are rich source of medicines since ages. Allopathic system comprises mainly of medicine derived from chemical source which has mild to life threatening side effects¹. Modern world is shifting towards finding definitive leads from herbs as they are found to be safe and equally effective². Drugs from herbal origin and natural sources have been described in Ayurvedic text and literature have potential to provide definitive lead for the development of new drug, which can be economical and affordable.³

In view of various research carried out to reinforce traditional claims of the plants for treatment of disease and management of disorders, this review is carried out to find out the scientific information about *Pterocarpus marsupium* Roxb. which has been used since ancient times for home remedies. It has been used extensively in alternative system of medicine.

Pterocarpus marsupium Roxb. is a herb pertaining to family Fabaceae indigenous to India, commonly found in western ghats in Sahyadri, Karnataka, Maharashtra and Gujrat.⁴ It comprises of a large deciduous tree which can grow till 30m in height having stout crooked stem and widely spreading branches; bark is thick with yellowish grey having outer layer

corky. Leaves compound imparipinnate, leaflets 5-7, coriaceous, oblong, obtuse, emarginated, or even bilobed at the apex, glabrous on both surfaces, main nerve numerous prominent⁵.

Flowers yellow in terminal panicles, short lateral and terminal fusco-pubescent paniculate racemes, usually shorter than the leaves, pedicel shorter, articulated beneath the flower; bracts and bracteoles minute. Calyx 6mm long, veined brown-pubescent; teeth very short, broadly triangular the upper the largest. corolla with crisped margins; 1.3 cm long, pale yellow with crisp margins; standard 11mm, broad with a long claw. Stamens monadelphous or the staminal tube often finally slit on both the sides making them isadelphous.⁶ Ovary shortly stalked; stipitate; style incurved, glabrous, stigma terminal. Pods 2.5-5 cm diameter, nearly circular, glabrous or nearly so, the wings veined, Seed small 1-2, convex and Bony (brown book). Pods indehiscent, turgid with circular wing, ovate to orbicular.⁷

Parts Used: Leaves, heartwood, bark, flower, gum.

Traditional Uses

The heartwood is astringent, bitter, acrid, cooling, anti-inflammatory, union promoter, depurative, urinary astringent,

haemostatic, anthelmintic, constipating, anodyne, alterant and rejuvenating. It is useful in elephantiasis, inflammations, fractures, bruises, leprosy, skin diseases, leucoderma, erysipelas, urethrorrhoea, diabetes, rectalgia, rectitis, ophthalmopathy, haemorrhages, vermiosis, diarrhea, dysentery, odontalgia, gout, rheumatoid arthritis, cough, asthma, bronchitis, and greyness of hair. Leaves are useful in boils, sores and skin diseases. The flowers are bitter, sweet, cooling, appetizing and febrifuge and are useful in anorexia and fever. The gum is bitter, styptic, vulnerary, boils, gleet, urethrorrhoea, odontalgia, diarrhea, psoriasis, wounds and ulcers, helminthiasis, fevers, hepato pathy and ophthalmia.⁸

Taxonomy⁹

Kingdom: Plantae

Clade: Tracheophytes

Order: Fabales

Family: Fabaceae

Subfamily: Faboideae

Genus: *Pterocarpus*

Ayurvedic Properties¹⁰

Rasa- kashaya, tikta

Guna - laghu, Ruksha

Veerya - Ushna

Vipaka - Katu

Doshaghnata - Kaphapittashamaka

Rogaghanta - Madhumeta, prameha, sthaulya, Kustha, Udarda, Visarpa,

Shwitra, Shotha, Palitya, Abhighataja, Bhagna, Atisara,

Pravahika, Krimi, dantashoola, Raktapitta, Raktavikara.

Karma- Kushthaghna, Keshya, Shothahara, Stambhana, Krimighna,

Raktashodhaka, Raktapittashamaka, Mootrasangrahanaya,

Madhumehahara, Yonidoshahara, Sandhaniya, Rasayana.

Pharmacognosy¹¹

Heartwood is golden yellowish brown with dark streaks, straining yellow when damp and turning darker on exposure, strong and tough, difficult to break but brittle, odourless and astringent in taste. The wood consists of vessels, tracheids, fibre tracheids and wood parenchyma, all the elements being lignified and filled with tannins. The vessels are medium sized, elongated at one or both the ends with well-marked perforations at either end and possess simple pits, on their side walls. These appear solitary occasionally multiples of 2 or 3 in scattered manner, leading to a semi ring porous condition and are characterized by presence of tyloses. The tracheids are long, abundant, thick, walled with tapering ends and having simple pits on side walls. The xylem parenchyma is small, thick walled with blunt ends, rectangular, mostly simple pitted and paratracheal in nature, surrounding the vessels. Medullary rays are uni-to biseriate with ray cells, 6-13 cells high, and 1-2 cells wide. Tree bark yields a reddish gum referred to as Kino gum which becomes brittle on hardening and is very astringent.

Physical constants⁸

Foreign matter- not more than 2%, total ash -Not more than 2%. Acid insoluble ash - not more than 0.5%. Alcohol soluble extractive- not less than 7%. Water soluble extractive- not less than 5%.

Chemical constituents¹²

Plant yields Gum Kino which contains kinotannic acid, beudesmol, marsupol, carpusin, propterol, marsupinol, propterol - B, a flavone, a new sesquiterpene alcohol - selin - 4915)-en-1B, 11- Diols, pteristillbene, a new compound marsupin, a new chalcone derivative, pseudobaptigenin. Liquiritigenin and its iso derivative and other related derivatives, a non glucosated tannin, kinoin and kino - red and procatechuic acid.

Propagation and cultivation¹¹

It prefers a soil with fair proportion of sand, though it is often found on red loam with certain amount of clay. The normal rainfall in its natural habitat ranges from 75-200 cm. It is planted as a shade tree in coffee estates in South India. Natural reproduction is through seeds, the early development of seedlings is favoured by shelter from the sun and loose soil clear of weeds. Artificial reproduction is through seeds. Whole pods are sown and germination can be hastened by cutting across their ends and then soaking them in water for a few days prior to sowing. Stump planting of one year old plants raised in nursery is said to give good results. Seedlings may also be raised in baskets for planting out. Direct sowing is also successful.

Common names.¹³

Bengal -Pitsal, Pitshul, Piyashal

Gujarati- Bia, Bibla, Bio, Hiradakhana

Hindi - Banda, Bija, Bijasal, Bijasar, Biya, Hira dokhi, Peisar Piasal, Pitshola

Konkani -Assan Asson

Malayalam- Karintakara, Malantakar, Venna

Marathi -Asan, Asana, Bibla, dhorbenla, Honi, Huni

Sanskrit -Asana, Bandhukapushpa, Bijaka, Bijavriksha, Mahakutaja,

Mahasarja, Nilaka, Sauri

Tamil - Asanam, Kani, Kurinji, Pidasaram, pirasaram,

Sarvasadagam, Sarudagam, Tamisu Tannini, Timisam, Timil,

Timisu, Udiravengai, Vandunarmalar, Vengai, Visaga

Telgu- Peddagi, Peddavegisa, peddgi, peddegu, Vegisa, Vengisa, Yegi

Urdu -Damulakhvain

Uriya -Piyasalo

Extraction of active constituent

Different extraction methods such as Infusion, Decoction, Maceration, Percolation Hot Water extraction have been employed for efficient extraction of active constituents from *Pterocarpus marsupium*.

- Infusion : Dried heartwood of the plant was soaked in 100 ml water overnight in a beaker. Brown coloured aqueous extract was collected next morning which was further processed using rotary evaporator and was shade dried and powdered.¹⁴
- Decoction : Jahromi and Ray processed dried heartwood of *Pterocarpus marsupium* by pulverizing and further boiling with distilled water till volume was reduced to less than 100ml.¹⁵
- Maceration : In different studies carried out by Joshi *et al*, Ahmed *et al* dried pieces of the *Pterocarpus marsupium*

were soaked in alcohol (absolute ethanol) for a week, further it was vacuum dried and stored at 4°C for further use.^{16,17}

- d. Percolation : Bark of *Pterocarpus marsupium* was powdered and was extracted using Soxhlet apparatus with 95% alcohol after defatting with petroleum ether.^{18, 19}

Pharmacological Activities

Acute toxicity studies

Aqueous extract of *Pterocarpus marsupium* was found safe till dose of 5g/kg, when studied till 12.5g/kg. Adverse effects were visible above dose of 7.5g/kg and mortality at dose of 10.75g/kg.²⁰

Antidiabetic activity

An active constituent of *Pterocarpus marsupium*, (-)-epicatechin (1), has been reported to reverse hyperglycemia in alloxan diabetic rats when given before or within 24 hr after the dose of alloxan.

Marsupsin and pterostilbene the phenolic compounds of *Pterocarpus marsupium* significantly lowered the blood glucose level of hyperglycemic rats. (-) Epicatechin, a benzopyran extracted from the bark of *Pterocarpus marsupium*, is reported to have insulin mimetic activity²¹

Anti-cataract activity

An aqueous extract of *Pterocarpus marsupium* Linn bark (PM) 1 g / kg/day, Ocimum sanctum Linn leaves (OS) 200 mg/ kg and alcoholic extract of Trigonella foenum-graecum Linn seeds (FG) 2 g/kg were given to alloxanised rats until the development of cataract. PM followed by FG exerted anti-cataract effect evident from decreased opacity index.²²

Antioxidant Activity

Hyponid is a herbomineral formulation composed of the extracts of ten medicinal plants (*Momordica charantia*, *Melia azadirachta*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Gymnema sylvestris*, *Enicostemma littorale*, *Emblica officinalis*, *Eugenia jambolana*, *Cassia auriculata* and *Curcuma longa*). Hyponid administration decreased levels of glycosylated haemoglobin, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin and alpha-tocopherol in diabetic rats. Plasma reduced glutathione and vitamin C were significantly elevated by oral administration of hyponid.²³

COX-2 inhibition Activity

An extract of *Pterocarpus marsupium* Roxb. containing pterostilbene has been evaluated for its PGE2-inhibitory activity.²⁴

Cardiotonic activity

The heartwood of *Pterocarpus marsupium* contains 5, 7, 2-4 tetrahydroxy isoflavone 6-6 glucoside which are potent antioxidant and are believed to prevent cardiovascular diseases. Cardiotonic effect of aqueous extract of heartwood of *Pterocarpus marsupium* was studied by using isolated frog heart perfusion technique (IFHP).²⁵

Antihyperlipidemic activity

Methanolic extract of *Pterocarpus marsupium* at the dose of 500mg/kg p.o. significantly exhibited antihyperlipidemic activity by decreasing the lipid level as well as blood glucose level in alloxan induced diabetic wistar rats.^{26, 27}

Hepatoprotective activity

Aqueous and methanolic extract of stem of *Pterocarpus marsupium* when tested at dose of 25mg/kg p.o. for 14 days

shown promising hepatoprotective activity in carbon tetrachloride (CCl₄) induced hepatotoxicity model. Levels of enzymes such as alkaline phosphatase, alanine transaminase, lactate dehydrogenase were significantly reduced and hepatoprotective activity was prominent from histology slides.²⁸

Antidiarrheal activity

Alcoholic extract of *Pterocarpus marsupium* revealed antidiarrheal activity by reducing the gastric motility at oral dose of 500mg/kg of body weight.²⁹

Antimicrobial activity

Aqueous and alcoholic extract of stem bark of *Pterocarpus marsupium* exhibited significant antimicrobial potential inhibiting the growth of *S. typhi*, *A. Niger*, *E. Faecalis* by disc diffusion method as dose range of 12.5-25µg/ml(30)³¹

Anti-inflammatory activity

Alcoholic and aqueous extract reduced the inflammation exhibiting anti-inflammatory effect in carrageenan induced rat paw edema method at the dose level of 50-100mg/kg of body weight.^{32, 33}

Analgesic activity

Research studies has found that extract of *Pterocarpus marsupium* shows improvement in pain threshold in hot plate method at dose level of 500mg/kg.³⁴

Conclusion

Pterocarpus marsupium has exhibited immense potential as herbal drug having pharmacological activities such as antidiabetic, hepatoprotective, antimicrobial activity and analgesic activity. World is shifting from synthetic drug to herbal drug. In this context plant such as *Pterocarpus marsupium* can provide potential lead for development of herbal medicine with minimal to nil adverse effects. Current study emphasizes the research work carried out on this plant and there is further need to isolate the active phytoconstituents which can pave way for the new and safe herbal drug.

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