Psoralea corylifolia Linn.—“Kushtanashini”

Khushboo P. S., Jadhav V. M., Kadam V. J., Sathe N. S.1

Department of Quality Assurance, Bharati Vidyapeeth’s College of Pharmacy, Sector 8, CBD Belapur, ‘Department of Rasa- Bhaishajyakalpana, Y. M. T. Ayurvedic Medical College, Kharghar, Navi-Mumbai – 400 614, India

Submitted: 04-03-10 Revised: 01-04-10 Published: 10-07-10

ABSTRACT

Plants have been the basis of many traditional medicines throughout the world for thousands of years and continue to provide new remedies to mankind. Plants have been one of the important sources of medicines since the beginning of human civilization. The recent resurgence of plant remedies resulted from several factors, such as effectiveness of plant medicines and lesser side effects compared with modern medicines. Psoralea corylifolia, commonly known as babchi, is a popular herb, which has since long been used in traditional Ayurvedic and Chinese medicine for its magical effects to cure various skin diseases. This plant is also pharmacologically studied for its chemoprotective, antioxidant, antimicrobial, and antiinflammatory properties. This review attempts to highlight the available literature on P. corylifolia with respect to its ethnobotany, pharmacognostic characteristics, traditional uses, chemical constituents, and summary of its various pharmacologic activities and clinical effects. Other aspects, such as toxicology and precautions are also discussed. This will be helpful to create interest toward babchi and may be useful in developing new formulations with more therapeutic and economical value.

Key words: Babchi, leukoderma, Psoralea corylifolia, psoriasis, psoralen

INTRODUCTION

Indigenous herbs are used as remedies against various diseases in the traditional system of medicine or in ethnomedical practices. For the past few decades, compounds from natural sources have been gaining importance because of the vast chemical diversity they offer. This has led to a phenomenal increase in the demand for herbal medicine in the last 2 decades. They are relatively safe, easily available, and affordable to the masses. These drugs have given important lead in drug research, resulting in the discovery of novel molecules.

Dry fruit of leguminous plant Psoralea corylifolia Linn. (syn: Callicarpa corylifolia Linn.) is one of the most popular Traditional Chinese Medicine and officially listed in Chinese Pharmacopoeia.[1] P. corylifolia is an annual herb growing throughout the plains of India. The plant is of immense biological importance, and it has been widely exploited since ages for its magical effect against several skin diseases, such as psoriasis, leukoderma, and leprosy.[2]

CLASSIFICATION

The plant classification details are[3]

- Kingdom: Plantae
- Division: Angiospermae
- Class: Dicotyledoneae
- Order: Rosales
- Family: Leguminosae
- Subfamily: Papilionaceae
- Genus: Psoralea
- Species: corylifolia Linn.

REGIONAL NAMES

Regional name of the plants based on[4-23]

- Beng: Bavachi, Hakuch, Latakasturi, Kakuch, Barachi, Bakuchi
- Bomb: Bawachi, Bobawachi
- Hindi: Babachi, Babchi, Bavanchiyan, Bhavaj, Bakucii, Bemchi
- Guj: Babchi, Bavacha, Babichi, Bawchi
- Mar: Babachi, Bavachya, Bavachi, Bavanchi
- Pers: Wagchi, Vakuchi, Ba bakhi
- Punj: Babchi
- Sans: Aindavi, Avalguja, Bakuchi, Chanderlekha, Chanderprabha, Kushthahantri, Sitavari, Somaraji, Vejani, Vakuchi, Sugandha kantak, Krishnaphala, Chandraraji, Asitavachha, Kalameshi, Somavalli, Bakuci, Sasankarekha

Address for correspondence:
Dr. Khushboo P. Salaskar,
E-mail: khushi_s28@yahoo.com

DOI: 10.4103/0973-7847.65331
DISTRIBUTION/HABITAT

It grows throughout the plains of India, especially in the semi-arid regions of Rajasthan and Eastern districts of Punjab, adjoining Uttar Pradesh. It is also found throughout India in Himalayas, Dehra Dun, Oudh, Bundelkhand, Bengal, Bombay, some valley in Bihar, Deccan, and Karnataka. This plant is also widely distributed in the tropical and subtropical regions of the world, especially China and Southern Africa.

PROPAGATION AND CULTIVATION

The plant thrives well in areas with low to medium rainfall during the summer months and on a variety of soils ranging from sandy, medium loam to black cotton in dry tropical regions of India. The germination percentage can be considerably increased by sowing the seeds during summer, that is, March–April and leaving them in the heat of the soil. Mechanical puncturing of the seed coverings or presowing treatment with concentrated sulfuric acid for 60 min has also been found effective in breaking the dormancy of the seeds and increasing the germination percentage considerably. The crop takes 7–8 months to reach maturity. As seeds continue to mature continuously, 4–5 pickings are usually taken between December and March. Clonal propagation of *P. corylifolia* through shoot tip and axillary bud culture is done. Survival rate on transfer to field was 95%. 

PARTS USED

Seeds, seed oil, roots, and leaves.

DESCRIPTION OF THE PLANT

It is a small, erect, annual herb growing up to 60–120 cm in height throughout sandy, loamy plains of Central and East India [Figures 1 and 2].

Seeds are brownish black in color, oblong, and flattened. Das, described the seeds as kidney shaped, 2–4 mm long, 2–3 mm broad, and 1–1.5 mm thick, hard, smooth, exalbuminous with straw-colored testa, with an agreeable aromatic odor and a pungent-bitter taste. They have grooved and gland-dotted stems. Leaves are simple, broadly elliptic, rounded, and mucronate at apex, clothed with white hairs on both surfaces, covered with numerous black dots, 5 main nerves springing from the base. Flowers are dense, corolla yellow or bluish purple, axillary, 10–30 flowered racemes. Flowering time is from August to December. Fruit is small, 5 mm long, subglobose, slightly compressed, pitted black, beaked without hairs, indehiscent, one-seeded pod, which is adhering to the pericarp.

MICROSCOPY

Transverse section of the fruit shows pericarp with prominent...
ridges and depressions, consisting of collapsed parenchyma and large secretory glands containing oleo-resinous matter; testa, an outer layer of palisade epidermis, layer of bearer cells, and 2–3 layers of parenchyma; cotyledons of polyhedral parenchyma and 3 layers of palisade cells on the adaxial side.[29]

**PROPERTIES**

The ayurvedic properties of plants based on[6,7,24]

**PHYTOCHEMISTRY**

The fruits of *P. corylifolia* consist of a sticky oily pericarp (12% of the seed), a hard seed coat and kernel.[10] Chopra *et al* found that the seeds contain an essential oil (0.05%), a nonvolatile terpenoid oil, a dark brown resin (8.6%), and traces of alkaloidal substance.[32-34] Dymock stated that the seeds contain 13.2% of extractive matter, albumin, sugar, ash 7.4%, and traces of manganese.[34] Sen *et al* found that the seeds contained an unsaponifiable oil having the formula C₁₇H₂₄O, boiling between 180 and 190°C, a yellow acid substance C₄₀H₄₅O₁₀ with a m.p. 105–107°C, containing 4 (OH) groups.[4-5] A pigment from the alcoholic extract and a methyl glycoside having a m.p. 161–162°C, containing 4 (OH) groups.[4-5]

**USES**

The most amazing aspect of this plant is that every part of it is useful. Roots, stems, leaves, seeds, and whatever blooms it has, all are used to treat a variety of skin problems, such as leukoderma, skin rashes, infections, and others.[42] It is given the name “Kushtanashini” (leprosy destroyer).[21]

![Figure 3: Structure of major constituents in Psoralea corylifolia](image-url)
very ancient remedy for leukoderma; it has been tried extensively not only by the practitioners of the Indian medicine but also by the followers of the Western system. The furanocoumarins, which contain psoralens, promote pigmentation. The powder is used by Vaidyas internally for leprosy and leukoderma and externally in the form of paste and ointment. Oil has a powerful effect on the skin. It helps fight vitiligo, a disorder in which patches of skin lose their pigmentation. It is used in the inflammatory diseases, mucocutaneous disorders, dermatitis, and edematous conditions of the skin. It also alleviates boils and skin eruptions. The plant has blood purifying properties. It is used to treat itching red papules, itching eruptions, extensive eczema with thickened dermis, ringworm, rough and discolored dermatosis, dermatosis with fissures, and scabies. It has shown to improve the color of skin, hair, and nails. Seeds are given in scorpion-sting and snake bite. Seeds are useful in bilious disorders. P. corylifolia extracts have found to possess antitumor, antihyperglycemic, antidepressant, and antioxidant activities. Its water extract possesses antibacterial property. Seed and extract powder are used as diuretic, antihistaminic, laxative, and for healing wounds. Seeds are used as stomachic, stimulant, aphrodisiac, and diaphoretic. It is used in the treatment of various kinds of disorders, such as asthma, cough, nephritis, and others. The major components psoralen and isopsoralen have antitumor, antibacterial, and antiviral properties. It is a good hair tonic and hence used in alopecia areata and hair loss.

It is an effective invigorant against impotence, menstrual disorder, and uterine hemorrhage. It is a cure for gynecologic bleeding. It is also useful to treat spermatorrhea and premature ejaculation. It shows coronary vasodilatory activity. The seeds act as deobstructive and heal ulcer, heart troubles, and cure blood disorders and leprosy.

The crude drug has been used for the treatment of enuresis, pollakiuria, painful feeling of cold in the waist and knees, and weak kidney. It is used in the treatment of debility and other problems related to kidney inefficiency, such as febrile disorders, low back pains, frequent urination, incontinence, and bed wetting.

The root is useful in treating the caries of the teeth. P. corylifolia is used to promote bone calcification, making it useful for treating osteoporosis and bone fractures. Leaves are used to alleviate diarrhea. Fruit is bitter, helps to prevent vomiting, cures difficulty in micturition, used in treating piles, bronchitis, and anemias and improves complexion. P. corylifolia contains bakuchinin, corylifolinin, and psoralen all of which inhibit the multiplication of osteosarcoma and lung cancer cells. They are also useful in fibrosarcoma, malignant ascites, and leukemia. It has hepatoprotective properties.

P. corylifolia is used in lumbago and tuberculosis. Essential oil is used as tonic and aphrodisiac. Seeds are sweet, bitter, acrid, and astringent. They impart vigor and vitality; improve digestive power and receptive power of mind. Seeds are antipyretic and aleuetic. P. corylifolia is a well-known nerve tonic in vata diseases. It is used in the treatment of intestinal amoebiasis. The herb is cytotoxic, antimutagenic, and antirepellant.

Other uses: Seeds are used to make perfumed oil. The ethanolic extract has been used as a food additive for the preservation of some processed foods or pickles in Japan. The seed cake rich in nitrogen and minerals is used as feed or manure.

PHARMACOLOGIC/BIOLOGICAL ACTIVITIES

Essential oil has a distinct stimulatory action on voluntary muscles in high dilutions (1 in 100,000). It produced contraction of isolated rectus abdominis muscle of frog. Also, the isolated uterus of guinea pig showed tonic contractions. Well-marked contraction of the arterioles of the frog was seen on perfusion of oil. Petroleum ether extract of seeds produced a rise in the blood pressure on anesthetized dogs and caused stimulation of the intestinal smooth muscle. Corylifolinin isolated from the benzene extract produced coronary vasodilation and inhibitory action on HeLa cells and an estrogenic effect.

The essential oil in dilution of 1 in 50,000 and 1 in 10,000 has been found to kill paramaecia and streptococci within 15 and 10 min, respectively. The oil also showed selective antifungal activity. The fruit extract inhibits the growth of Staphylococcus citrates, Staphylococcus aureus, Staphylococcus albus, including strains resistant to penicillin and other antibiotics. Psoralen shows strong inhibition of bacteria, such as Microsporum canis, Microsporum gypseum, Trichophyton rubrum, Trichophyton mentagrophytes, S. aureus, Candida albicans, Escherichia coli, P. aeruginosa, and others. Katsura et al proved that bakuchiol is a useful compound against oral pathogens and has a great potential for use in food additives and mouthwashes for preventing and treating dental caries. The cell growth of S. mutans was inhibited in a bakuchiol concentration-dependent manner and the growth of S. mutans was completely prevented with 20 µg of bakuchiol/mL. Psoraladin showed stronger antibacterial activity against Gram-negative bacteria Shigena sonnei and Shigena flexneri.

Bavachinin A isolated from fruits revealed a marked anti-inflammatory, antipyretic, and mild analgesic properties at a dose of 25–100 mg/kg. It has demonstrated better antipyretic activity than paracetamol and showed no effect on the central nervous system, and the maximum lethal dose was greater than 1000 mg/kg in mice. It also showed anti-inflammatory activity against carrageenan-induced edema in rats.

Bakuchiol, one of the major constituent of P. corylifolia, has been
shown to possess a prominent cytotoxic effect on L929 cells in all cultures. It also showed cytotoxicity against cultured human cell lines, namely, A549, SK-OV-3, SK-MEL-2, XF-498, and HCT-15. Psoralidin, a coumestan derivative isolated from the seeds, showed a cytotoxic effect on stomach cancer cell line with IC50 values of 53 µg/mL in SNU-1 and 203 µg/mL in SNU-16. Byung et al. showed antimutant and cytotoxic activity of the drug. Guo and co-workers proved that psoralen and isopsoralen had antitumor activity against BGC-823 cancer cells.

The water-soluble extract containing bakuchiol has been found to possess hepatoprotective activity in tacrine-induced cytotoxicity in human liver-derived HepG2 cells. The EC50 value of bakuchiol was 1 µg/mL and of silymarin was 5 µg/mL.

Bakuchiol and 2 of the flavonoids, isobavachin and isobavachalcone, showed broad antioxidant activities in rat liver microsomes and mitochondria.

P. corylifolia seed extract has been reported to stimulate the immune system in mice. Administration of the seed extract was also found to inhibit EAC ascitic tumor growth and stimulate natural killer cell activity, antibody-dependent cellular cytotoxicity, antibody forming cells, and the antibody complement-mediated cytotoxicity during tumor development.

A potential antifilarial activity of P. corylifolia leaves and seeds on cattle filarial parasite Setaria cervi was observed. The alcoholic extract produced death of microfilariae and showed antimycobacterial activity. Khatune et al proved pesticidal activity of 6-[(3-methylbut-2-enyl)-6',7-dihydroxycoumestan.

It was observed that flavonoids, mainly corilin and bavachin, have osteoblastic proliferation-stimulating activity and thus might stimulate bone formation and act against osteoporosis. Rashid Ali and Agarwal showed that psoralen accelerates the photooxidation of DOPA under sunlight as well as photo flood lamplight. The oleoresinous extract of seeds given to nonsyphilitic leucokera patients has been found to be effective. Topical application prepared from P. corylifolia gave positive result in epilating folliculitis. The coumarinic extracts from seeds showed photosensitizing activity in guinea pigs. Topical application of active fraction from seeds inhibited the growth and delayed the onset of papilloma formation. Psoralen, when orally taken by rabbit at a dose of 4 mg/g and exposed in sun, there was pigment deposition. Petroleum ether extract of the seeds showed anthelmintic activity against earthworms. Chandhoke and Ray reported that isopsoralen showed tranquilloidsative, anticonvulsant, and central muscle-relaxant properties in rats, mice, and rabbits.

Methanolic extract of seeds containing isobavachalcone and neobavaisoflavone inhibited the aggregation of platelets. Bakuchiol prevented mitochondrial lipid peroxidation. Psoralen extended sleeping time in mice induced by phenobarbital sodium. Psoralen has an effect on medicine metabolism. It increases liver microsome protein concentration thus increasing the concentration of P-250 and NADPH–cytochrome C.

Anti-early pregnancy experiment showed that 10 mg injection of isopsoralen to mice uterus released strong anti-early pregnancy effects. Anti-skin transplantation rejection effects of isopsoralen was proved by 2 mg/cap isopsoralen dose to rabbit, one capsule daily for 20–30 days. Psoralen, only in large doses, induces embryo deformity in guinea pigs. Bakuchiol possesses DNA polymerase inhibitory activity.

The glucoside of the isoavonoids, diazidein, called diazidin, inhibits the enzymes alcohol dehydrogenase and NAD-dependent alcohol aldehyde dehydrogenase. These enzymes catalyse the oxidation of acetaldehyde, the primary product of alcohol metabolism. So, when diazidin is present, alcohol levels in the bloodstream increase and cannot be metabolized by the enzymes. An important consequence of this is that alcoholics soon lose their appetite for alcohol.

Chen et al. studied the antidepressant activity of total furanocoumarins present in P. corylifolia (TFPC) in the chronic mild stress model of depression in mice. The results revealed that TFPC possess potent and rapid antidepressant properties that are mediated via MAO, the hypothalamic–pituitary–adrenal axis, and oxidative symptoms. Thus, it makes P. corylifolia, a potentially valuable drug for the treatment of depression in the elderly. Xu and co-workers also proved psoralen’s antidepressant effects, using forced swimming test model of depression in male mice.

Guo and co-workers proved that the powder and extracts of P. corylifolia possessed strong antioxidant properties when tested in lard at 100°C by using oxidative stability instrument. Antioxidant activity of compounds decrease in the following order: Psoralidin > BHT > α-tocopherol > bakuchiol > corilofolin > corilin > isopsoralen > psoralen.

Matsuda et al. stated that from the ethanol soluble fraction of P. corylifolia, Δ3,3-hydroxybakuchiol; Δ3,2-hydroxybakuchiol, bavachin, and psoralidin showed inhibitory activities against antigen-induced granulation in RBL-2H3 cells.

CLINICAL STUDIES

A clinical trial was carried out on 30 patients having vitiligo by the local application of an Ayurvedic preparation containing P. corylifolia as the main ingredient, along with oral administration of Gandhaka rasayana. Early cases of vitiligo showed maximum improvement within 1–10 months, whereas chronic cases having vitiligo of lip showed a poor response.
Oral administration of 8-methoxypsoralen along with exposure of the patient to sunlight for 5–30 min daily for 1–7 weeks gave very encouraging results. Results of another trial showed that the use of psoralen along with its chemical derivatives, namely, trioxalen, supplemented with exposure to sunlight is a more effective treatment for psoriasis. In one study, 49 patients underwent 6 months of Psoralea corylifolia treatment. Of these patients, 14% were cured and another 19% regained pigmentation on at least two-thirds of the affected skin.\(^{31}\) A clinical trial was conducted in 76 patients in the age group 16–24 years with grade II and III acne vulgaris. They were advised to apply a topical preparation, Clarina cream, along with herbal Purim tablets containing P. corylifolia as one of the ingredients. Results revealed that patients with grade II acne had an excellent response in 56.25% and good response in 43.75%. Patients with grade III acne had an excellent response in 38.30% and good response in 56.66%. Thus, the combination of the 2 preparations is effective.\(^{6,26}\)

**MECHANISM OF ACTION FOR LEUKODERMA**

The drug appears to have a purely local action with a specific effect on the arterioles of the subcapillary plexuses, which are dilated so that the plasma is increased in this area. The skin becomes red and the melanoblasts (pigment-forming cells) are stimulated. In leukoderma, melanoblasts do not function properly and their stimulation by the drug leads them to form and exudate pigments, which gradually diffuse into the white leukodermic patches.\(^{10,56}\) Also, the phychochemically induced covalent binding of the drug to pyrimidine bases is responsible for its therapeutic effect. The photoconjunction involves thymine dimer adducts on the opposite strands of DNA. Psoralen has been found to intercalate into DNA, where they form mono- and di-adducts in the presence of long wavelength UV light and thus are used for the treatment of hypo-pigmented lesions of the skin, such as leukoderma.\(^{35}\)

**Dosage**\(^{6,26}\)

Seed powder: 1–3 gm
Oil: applied externally
Tincture: 3–15 mL/day

**Marketed formulations**

Algushadi yoga, Sarvangasundari gutika, Bhallatakawaleha, Dhatriyawaleha, Shashanglekhadileha, Maheshwara ghrita, Ayorajodi lepa, Sashishekara vati, Brihatsomaraji taila, Mahatrinaka taila, Kandarpasara taila, Somaraji ghrita, Bawchi tel, Bawchi churna, Shwitra vati, Khadirarista, Mahamanjistha kvatha, and so on.\(^{2,19}\)

**Suggested combinations**

Manjistha, neem, kutki for skin conditions; nutmeg, haritaki for chronic diarrhoea with cold symptoms and loose, watery stool; haritaki, gokshura for urinary frequency; ashwagandha and bala for reproductive imbalances; and pippali and ashwagandha for coughs.\(^{2,20}\) For vitiligo, powder of bakuchi seeds was administered with the decoction of Bibhitaka (Terminalia bellirica bark) and Kaakodumbara (Ficus hispida). For ringworm, one part of tila (sesame seeds), mixed with bakuchi was prescribed.\(^{16}\) In leukoderma, bakuchi is mixed with haratala bhasma and applied externally.\(^{3,26}\)

**Toxicity**

When psoralen and its derivatives are used for sun-tanning, residual edema of the legs, and cutaneous damage may occur. In some cases, acute dermatitis with blistering, edema, and possibly renal complications have been noticed. Other side effects observed were nausea and vomiting, insomnia, malaise, loose motions, headache, mental depression, and hepatotoxicity. Extensive chromosome damage was produced in mammalian cells by psoralen treatment and high-intensity long wavelength irradiations; therefore, caution should be exercised in the use of psoralen and light therapy because this could lead to later malignancy. Long-term therapy has been found to affect eyes, liver, and immune system.\(^{87}\) A mixture of psoralen, isopsoralen, and imperatorin caused hypertrophy of liver, kidney, and spleen in rats at a daily dose of 2.5 mg/75 g for 60 days.\(^{7}\)

**Acute Toxicity**\(^{11}\)

Psoralen:
LD50 oral in mice: 625 mg/kg; LD50 s.c. in mice: 480 mg/kg
LD50 oral in rat: 1330 mg/kg; LD50 s.c. in rat: 830 mg/kg

Isopsoralen:
LD50 i.m. in mice: 180 ± 29.6 mg/kg; LD50 i.p. in mice: 138 ± 10.9 mg/kg

**Treatment of Adverse Effects**

Emptying stomach by aspiration and lavage may treat overdose of the drug. The patient should be kept in a dark room for a minimum of 12 h.\(^{27}\)

**Precautions**

Use with caution in pregnancy. Excessive UV therapy causes high pitta.\(^{28}\) It is not given to patients suffering from liver diseases, lupus erythematosus, hydroa porphyria, or other diseases associated with light sensitivity. It is advised to avoid spicy diet, salt, and late nights during bakuchi regimen. Milk, ghee, and butter should be consumed in the diet.\(^{30}\) Seed oil should be avoided on eyes, and it should be mixed with coconut oil before application, because it is thermogenic.\(^{38}\)

**Safety**

No herb–drug interactions are known, but caution should be observed with external applications. The drugs in their prescribed doses may be considered safe.\(^{18,8}\)

**CONCLUSION**

P. corylifolia is commonly found as herb on the way side and at waste places throughout India. The plant has been used

---

**Pharmacognosy Reviews | January-June 2010 | Vol 4 | Issue 7**
since centuries in leukoderma, psoriasis, vitiligo, asthma, ulcers, kidney disorders, and as an aphrodisiac and an anti-inflammatory. It is reported to contain essential oil, coumarins, alkaloids, flavonoids, and terpenoids. Concentrated fruit and seed extract can be found in various herbal preparations that are in market today. The pharmacologic and clinical studies reported in the present review confirm the therapeutic value of *P. corylifolia*. It is an important source of various types of compounds with diverse chemical structures as well as pharmacologic properties. Presence of such a wide range of chemical compounds indicates that the plant could serve as a “lead” for the development of novel agents having good efficacy in various disorders in the coming years.

**REFERENCES**

29. The *Ayurvedic Pharmacopoeia of India*. 1st ed, Vol. 1. India: Govt. of India Ministry of Health and Family Welfare Dept. of Health; 1989. p. 25. The book has no author, it’s a publication of Govt. of India.

Source of Support: Nil, Conflict of Interest: None declared