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Review Article

Exploring The Cosmetic Benefits of *Psoralea Corylifolia*: A Review of the Literature

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ABSTRACT

Psoralea corylifolia Linn., commonly known as Bakuchi or Babchi, is a medicinal herb, traditionally valued in Ayurvedic and Chinese medicine. Historically, it has been used for managing a range of skin conditions, including vitiligo, leprosy, eczema, and acne. In addition, it has found applications in the treatment of respiratory disorders like asthma, as well as in conditions involving anemia and inflammation. The seeds, roots, leaves, and flowers of the plant possess therapeutic potential, with the seeds being particularly rich in phytoconstituents such as bakuchiol, psoralen, isopsoralen, flavonoids, and coumarins. Bakuchiol, a merotercosmepene found in the seeds and leaves, has emerged as a botanical alternative to retinol due to its comparable efficacy in anti-aging, anti-acne, and antioxidant applications, with reduced skin irritation. Beyond dermatological uses, the plant has shown pharmacological potential, exhibiting antibacterial, anti-inflammatory, hepatoprotective, cardioprotective, and antidiabetic properties. It is cultivated in various parts of India and other tropical regions, often thriving in well-drained, loamy soils with relatively low agricultural input. Recent developments in extraction technologies, including supercritical fluid and microwave-assisted extraction, have enhanced the efficiency of isolating its bioactive components, particularly bakuchiol. In cosmetic science, bakuchiol shows promise as a skin-conditioning agent, emollient, and antioxidant with applications in anti-aging formulations and treatments for hyperpigmentation. However, traditional detoxification methods and modern dosage control may be required to ensure safety. The review highlights the potential continued research and clinical evaluation will be essential to support the development of safe, standardized products rooted in both traditional and modern practices.

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INTRODUCTION

P. corylifolia, commonly called Bakuchi plant or Babchi plant, is an extremely useful plant from a pharmacological, ethnobotanical, and phytochemical point of view. The word Psoralea originates from the Greek psoraleos, which stands for "affected with the itch or with leprosy". [1]

Taxonomical Classification [2]

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

In Ayurvedic literature the properties of Bakuchi plant is well-recognized as the Sanskrit shloka states the use of Bakuchi in various Ayurvedic treatments as in Kushtha (skin disorders); Keshya and Tvchya (skin and hair treatments); Krumi (as a Germicidal); Shwasa & Kasa (Bronchial Asthma and Cough); Pandu (Anaemia); and Shotha (Oedema). [3]

Seeds of the plant are brownish black coloured, oblong, hard, thick, smooth, exalbuminous with straw-colored testa. It has an agreeable aromatic odour and a pungent-bitter taste. [4,5] The stems of the plant are grooved and gland-dotted. Leaves of the plant are simple, rounded, broadly elliptic and mucronate at apex. On both surfaces of the leaves white hairs and with numerous black dots are present. There are 5 main nerves emerging from the base. Flowers are dense, axillary, corolla being yellow or bluish purple, [6] 10–30 flowered racemes. [7] Flowering time starts from August and lasts upto December. [8] Fruit is small, 5 mm long, sub-globular, slightly compressed, pitted black, one-seeded pod, beaked without hairs, indehiscent, which is adhering to the pericarp. [9] Transverse section of fruit shows pericarp associated with prominent ridges and depressions. Features of collapsed parenchyma and large secretory glands containing oleo-resinous matter testa can be observed. An outer layer of palisade epidermis, thickened layer of bearer cells mostly present in the inner tangential and basal radial walls. 2-3 layers of parenchyma along with cotyledons of polyhedral parenchyma and three layers of palisade cells on the adaxial side can be observed microscopically. [10]



Figure 1: Plant species and seeds of *Psoralea corylifolia.*[11]

Traditional Uses

Psoralea corylifolia is widely used in Traditional Chinese Medicine and is officially listed in the Chinese Pharmacopoeia.[11] In the Garūṇa Purāṇa, Bakuchi is recommended for its medicinal properties, with instructions to prepare a hot decoction of Bākucī with milk to treat Kustha (a term generally referring to leprosy). Additionally, a decoction made from Āmalakī, Khadira, and Bakuchi is suggested for treating severe cases of Świtra, which is often associated with vitiligo or similar skin disorders. [12] The roots, stems, leaves, seeds, and flowers each serve different purposes. The plant is used to treat various inflammatory diseases, mucosal disorders, dermatitis, and edema. Its significant impact on leprosy has earned it the name "Kushtanashini" or "leprosy destroyer."[13] The powdered formulations are administered internally for leprosy and leukoderma, while the plant's paste and ointment are used externally. The oil is particularly effective against skin infections like Streptococci and is beneficial for treating vitiligo. In addition to their primary medicinal uses, Bakuchi seeds and extracts offer a range of other applications. [14,15] They function as diuretics, anthelmintic, laxatives, and aid in wound healing. [2,6] Research has demonstrated that P.corylifolia extracts possess antitumor, antihyperglycemic, antidepressant, and antioxidant properties. [16] The seeds are also beneficial in the management of scorpion stings and snake bites. [14,15] The plant's roots are used for dental caries, its fruits act as a laxative and aphrodisiac, and its leaves help with diarrhea**.** [3] Furthermore, the seeds serve as a stomachic, stimulant, aphrodisiac, and diaphoretic. [2,7] In addition to their medicinal uses, Bakuchi seeds are also used in producing perfumed oil. [15] In Japan, an ethanolic extract of the plant is used as a food additive to preserve certain processed foods and pickles. [17] Moreover, the seeds are rich in nitrogen and minerals, which serves as animal feed or manure. [18]

SYNONYMS: [10]

Sanskrit : Avalguja, Somariji
Assamese : Habucha
Bengali : Bakuchi, Somraji, Hakucha Veeja
Gujrati : Bavachi
Hindi : Babchi, Bavachi, Bakuchi
Kannada : Bauchige, Bhavantibeeja, Bhavanchigid, Baukuchi
Kashmiri : Babchi
Malayalam : Karkokil
Marathi : Bawchi
Oriya : Bakuchi
Punjabi : Babchi, Bavchi
Tamil : Karpokarisi, Karpogalarisi, Karbogalarisi
Telugu : Bavanchalu
Urdu : Babchi

Geographical Distribution, Cultivation and Collection

Psoralea corylifolia is found in tropical and subtropical regions around the world, as depicted in Figure 2. Although native to Asia, it is also cultivated in other continents, including Australia, North America, and Africa.[19] This annual herb grows in regions with warm climates and relatively low to moderate rainfall, reaching heights of 24 to 40 inches.[20]

In India, it grows wild in the cooler Himalayan regions and is found in various states including Bombay, Bengal, Uttar Pradesh, Rajasthan, Karnataka, Bihar, and Deccan.[1]

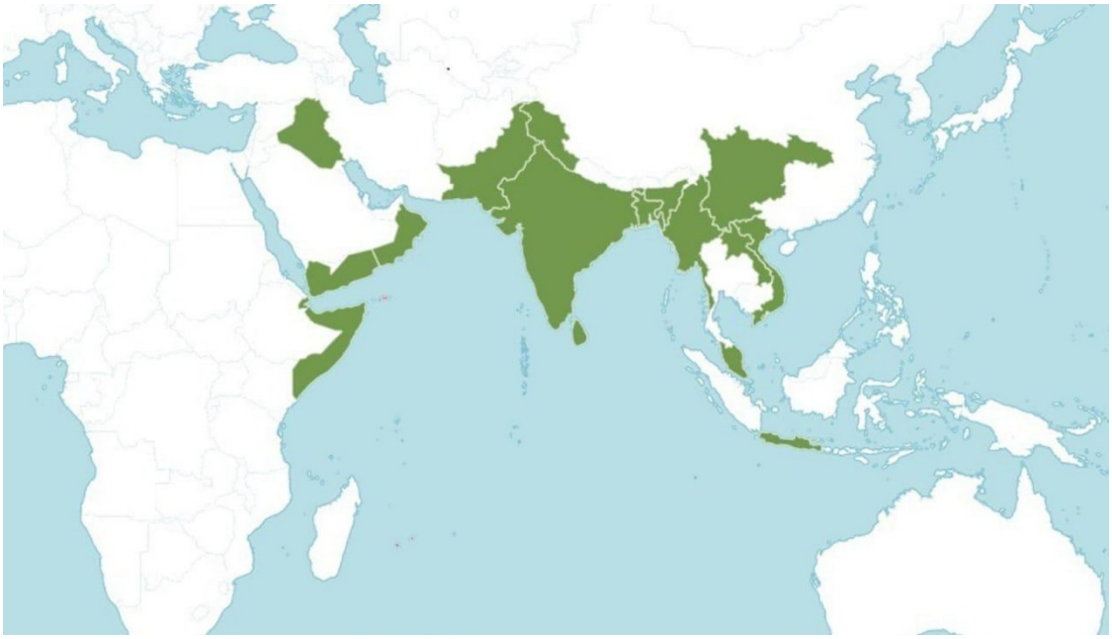


Figure 2: Geographical distribution of *Psoralea corylifolia* L. [19]

The plant prefers red loamy soil with high organic content and a soil pH range of 6.5 to 7.5. It does not require specific pre-treatment of seeds before sowing. For optimal seed yield (which can reach up to 1931 kg/ha) sowing should occur in November, with October also being a viable option.[21]The plant adapts well to various soil types including clay, sand, and loam, and can grow in acidic, basic, and neutral environments.The ideal sowing season is from March to April, with seeds mature by November.[1] Since seeds mature slowly, harvesting can be performed 4–5 times between December and March. To achieve maximum yield of up to 2404 kg/ha, it is recommended to apply nitrogen, phosphorus, and potassium (NPK) in a ratio of 100:60:50 kg/ha, with plants spaced 60 × 30 cm apart.[22] .With proper care, the plant can live for 5–7 years.[1] *Psoralea corylifolia* is a small, erect annual herb. It can grow up to 60-120 cm tall. With proper care, the plant can live for 5–7 years. The crop matures approximately 200 days after sowing, when the pods turn purple. After harvesting, Bakuchi seeds are dried and purified. The seeds undergo shade drying and are then purified using gravity and wind powered sieves. After sieving and proper inspection, seeds are stored and transported in gunny bags for marketing.[19] Traditional methods involve selectively grinding plant parts and extracting them into carrier oils or spirits.[23] These methods require large volumes of solvents and extended extraction times. Advanced extraction techniques, including various forms of chromatography,[24], supercritical fluid extraction, pressurized liquid extraction, and microwave-assisted extraction, offer shorter extraction times and reduced solvent usage, making them suitable for the mass extraction of bakuchiol. [25,26] [Figure 3]

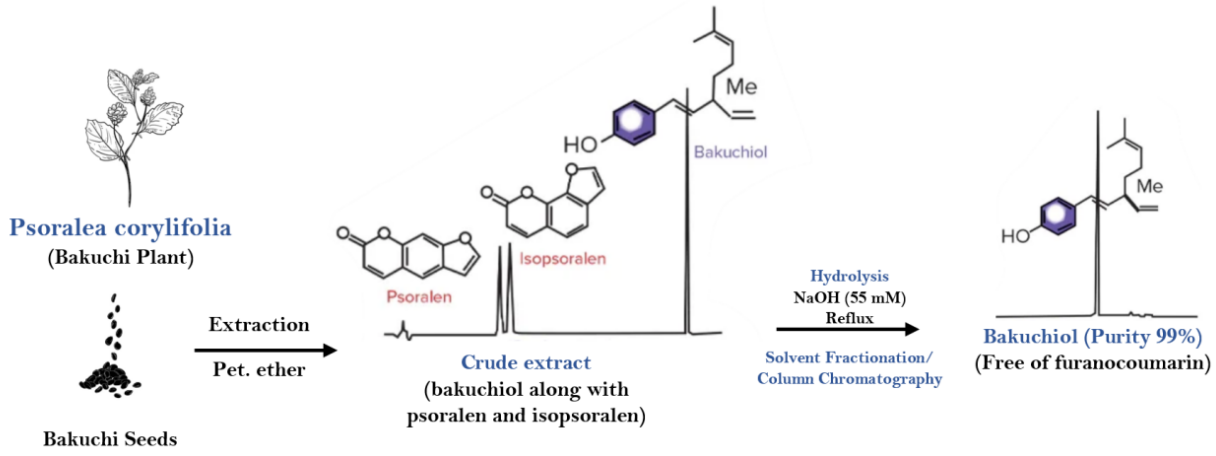
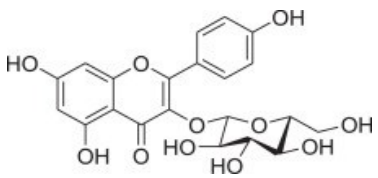
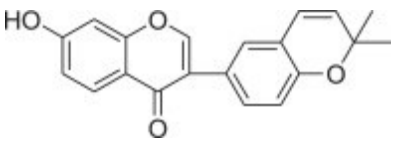
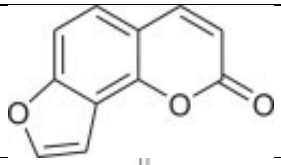
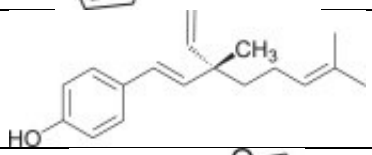
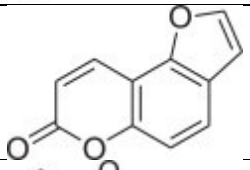
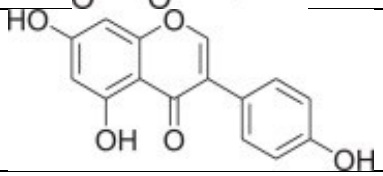
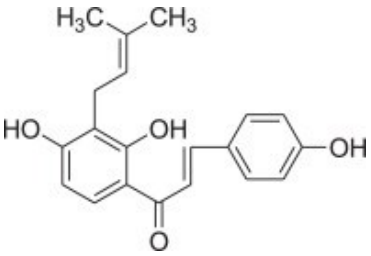
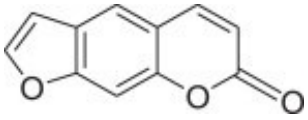
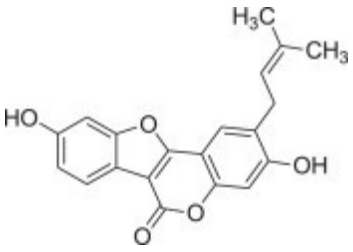


Figure 3: Extraction of major phytoconstituents of Bakuchi seeds [26]

Phytoconstituents:

The phytoconstituents appear to exert a localized effect specifically on the arterioles of the subcapillary plexuses, causing their dilation and increasing plasma flow in the area. When the plant extract is applied topically, it causes the skin to redden and stimulates melanoblasts, the cells responsible for pigment formation. This stimulation is particularly beneficial for conditions like leukoderma, as it encourages melanoblasts to produce and release pigments that gradually fill in the white patches. Additionally, the plant's constituents may contribute to its beneficial effects through covalent binding to pyrimidine bases. [18,27] Bakuchiol, derived from the leaves and seeds of *Psoralea corylifolia*, is a type of meroterpene that has gained significant attention for its contributions to both cosmetology and medicine. It has emerged as a popular alternative to retinol in the beauty industry due to its tolerability and effectiveness in treating skin conditions. Like retinol, bakuchiol exhibits antioxidant, anti-inflammatory, and anti-aging properties. [28] Additionally, it possesses a range of biological activities, including anti-cancer, hepatoprotective, cardioprotective, and hypoglycemic effects. [29] Furthermore, the seeds of *Psoralea corylifolia* are known to contain various phytoconstituents, including coumarins and flavonoids such as psoralen, isopsoralen, psoralidin, neobavaisoflavone, bavachin, corylin, and bavachalcone, which contribute to its therapeutic properties. [30,31]

Phytoconstituents	Chemical class	Chemical structure	Part of plant
Astragalin	Flavonoid		Seed [18]
Corylin	Isoflavone		Fruit [19]

Isopsoralen	Furocoumarin		Seed[19]
Bakuchiol	Meroterpene		Seed/Fruit [32]
Bakuchicin	Flavonoid		Seed [33]
Genistein	Isoflavone		Fruit [34]
Isobava chalcone	Chalcone		Seed [35]
Psoralen	Furanocoumarin		Seed/Fruit [36]
Psoralidin	Phenolic coumarins		Seed, leaves [37]

Cosmetic uses

Bakuchiol will replace retinol with much better safety. Bakuchiol and retinoids share similar cellular pathways, such as the regulation of retinoic acid, the expression of collagen, and extracellular matrix synthesis enzymes. Retinol can cause a burning feeling, itchy, dry skin, reddened skin, epidermal keratinization, and hypersensitivity to sunlight. In addition, retinol causes increased sweating and hair loss and causes the mucous membranes of the nose and eyes to dry out. [38] Cosmetic action bakuchiol is a safe component of cosmetic products. It is recommended for use as an ingredient that has antioxidant, antimicrobial and skin conditioning

properties. In addition, it can act as an emollient. [29]

1. Anti-ageing effect

After 12 weeks of using the product, the facial contours improved, the number of wrinkles decreased, the skin became more elastic and firm [29] Bakuchi has the potential to prevent skin aging through different pathways, delaying the appearance of signs of aging. While comparable to retinol, Bakuchi's efficacy surpasses that of this well-known compound. In addition, it should be noted that the antioxidant and anti-inflammatory activities of Bakuchi produced promising results, demonstrating an impact on the aging process. [39]

2. Anti-acne

Meroterpene, especially bakuchiol has been reported to exhibit strong antibacterial effects. Interestingly, the authors reported that Tazarotene-inducible gene 1 (TIG1) is significantly up-regulated by both bakuchiol and retinol, and the expression of TIG1 is found to be down-regulated in a variety of human cancers as well as acne, rosacea and psoriasis. [40]

3. Antioxidant

The antioxidant properties of Bakuchi result from the presence of hydrogen in the terpenoid chain, located conveniently adjacent to the trisubstituted alkene group and readily available for abstraction. Additionally, the antioxidant activity is influenced by the enthalpy of dissociation of the phenolic bond. [39] Oxidative stress caused by both internal metabolic processes and external environmental factors contributes significantly to skin aging. Bakuchiol activates erythroid nuclear factor 2 - (Nrf2) - a transcription factor that plays a significant role in preventing cells from oxidation. In addition, its antioxidant features include the ability to "scavenge" oxygen free radicals and prevent lipid peroxidation in the mitochondria. [41]

4. Anti-inflammatory effects

The fact that BGM complex enhances the anti-inflammatory potential of adapalene may be due to its antibacterial proper-ties on P. acnes as well as its anti-irritation potential. [42] apply bakuchiol cream to an inflammatory acne lesion and found that bakuchiol cream was efective in treating acne and acne-induced PIH (Post inflammatory hyperpigmentation) Inflammatory lesion count reduction of 35% after 12 weeks of treatment with topical bakuchiol.[43]

5. Action preventing skin hyperpigmentation

In vitro studies conducted on mouse skin melanoma cells (B16 cells) proved that the alcoholic extract of long pepper (*Piper longum*) showed a strong potential to inhibit the secretion of α-melanotropic hormone, which is responsible for the increased production of melanin. [41] Bakuchiol's suppressive effects on cutaneous melanin production prime the compound for use in both antiageing and antihyperpigmentation cosmeceuticals [44]

6. Antibacterial activity

Bakuchi also demonstrates significant antibacterial activity, as pointed out by Yin et al., who considered Bakuchi as a ''well-known natural antimicrobial agent''. In their study, Bakuchi was used as a positive control, with minimum inhibitory concentration values of 0.018 and 0.037 mm observed for *Staphylococcus epidermidis* and S. aureus, respectively [22] These compounds exhibit broad-spectrum antimicrobial activity against bacteria, fungi, and viruses. [45] Bakuchiol is a potent antimicrobial meroterpene obtained from some Psoralea (Fabaceae) species. [46]

Adverse Effects

An overdose of bakuchi seed powder can lead to nausea, vomiting, depression, headaches, and diarrhea. Therefore, it is advisable to treat with bakuchi seeds by soaking them in Gomutra or Ardraka swarasa for seven day [12]. In the cosmeceutical industry, bakuchiol is preferred over retinol due to its enhanced tolerability. However, it may initially cause redness and peeling in sensitive skin. When used in combination therapies, Bakuchiol may amplify its cytotoxic effects, so caution is required. Additionally, the oil extracted from the herb is potent, and excessive use can result in skin discoloration.[25]

CONCLUSION

Psoralea corylifolia, commonly known as Bakuchi, is a medicinal plant with significant therapeutic and cosmetic benefits. Traditionally recognized in Ayurveda and Traditional Chinese Medicine, it has been used to treat various skin disorders, microbial infections, and inflammatory conditions. The plant's key bioactive compound, bakuchiol, has gained attention as a natural alternative to retinol, offering anti-aging, anti-acne, antioxidant, and skin-brightening properties with fewer side effects. Furthermore, its broad-spectrum antimicrobial activity makes it a promising ingredient in dermatological formulations.

Despite its many benefits, excessive use of Bakuchi extracts can lead to side effects such as skin irritation and toxicity. Therefore, controlled usage and further clinical studies are essential to optimize its applications in modern medicine and cosmetics. With ongoing research, Bakuchi has the potential to be a valuable natural resource in skincare and pharmaceutical industries, bridging traditional wisdom with contemporary scientific advancements.

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