



“A Literature Review of Katuki (*Picrorrhiza kurroa royle ex benth.*) An Endangered plant species”

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Abstract- Medicinal plants can be used to successfully make both conventional and alternative medicines. It is challenging to standardize plant products because of their diverse composition, which can be found in whole plants, plant parts, or extracts made from them. To ensure the consistent quality of herbal medications, it is imperative to appropriately manage the starting material. *Picrorrhiza kurroa* (kutki/katuki) is a high-altitude Himalayan perennial valued in traditional medicine for hepatoprotective, anti-inflammatory and immunomodulatory properties. Overharvesting, habitat loss and poor cultivation practices have driven wild populations to threatened status, prompting conservation and cultivation research including in-vitro propagation and habitat modeling. This review summarizes current knowledge of its taxonomy, distribution, traditional uses, phyto chemistry, pharmacology, conservation status and management strategies, and highlights research gaps and priorities.

Keywords- Ayurveda, Medicinal plant, Katuki, *Picrorrhiza kurroa*

Introduction-

As the “oldest medical system known to man and the oldest and most comprehensive spiritual teachings in the world,” Ayurveda holds this distinction. The foundation of Ayurveda is in the idea that a person may lengthen their life by keeping their body, mind, and spirit in balance¹. Ayurveda uses natural therapeutic compounds that are safer for the human body than allopathy, which uses harsh chemical substances. Instead of using a "offensive strategy," Ayurveda focuses on strengthening the host body's ability to withstand a variety of physical and psychological strains. Ayurveda focuses on eating, breathing, digestion, thoughts, memory, and sleep in order to understand the underlying causes of disease. These are simple methods that can be used to improve one's health².

Picrorhiz akurroa Royal ex Benth, Kutki (*P. kurroa*) is an important medicinal plant, which has been traditionally recommended and used in Ayurveda for thousands of years with some precautions. The last few decades have witnessed a significant revival of interest in its pharmacology, pharmacognosy and phytochemistry. Kutki is a small perennial herb and rapidly decaying high-value medicinal plant that grows in the north-western Himalayan region of India, Pakistan and hilly parts of Nepal.³ The leaf, bark and underground parts of the plant, mainly the rhizome, are used in Ayurveda for their medicinal properties. Evidence of its hepatoprotective activity in several experimental and clinical studies has led to the correlation of specific phytochemical components of *P. kurroa* (e.g., iridoid glycosides, especially picrosides) with precise pharmacological activities, and the efficacy of *P. kurroa* in many diseases is done.⁴

Scientific Classification:⁵

Kingdom- Plantae

Division-Tracheophytes

Clade- Angiosperms

Clade- Monocots

Order- Lamiales

Old Family- Scrophulariaceae

New Family- Plantaginaceae

Genus- Picrorhiza

Species- *P. kurroa*

English Name: The gradually tapering Malaxis,

Sanskrit/ Hindi Name: Jeevak



Habit: A hairy herb with perennial bitter root stock leaves – 5-10cm, rather coriaceous, tip rounded base narrowed into a winged sheathing petiole.

Habitat: It is an indigenous plant of western Himalayan at 3000-5000 m of elevation⁶. Western Himalayan range includes Jammu and Kashmir, Himachal Pradesh and Uttarakhand. In Kashmir, it is mainly found in Gurez, Lolab, Karna, Sindh and Lidder Valleys. In Uttarakhand it is found in areas of Badrinath, Kedarnath and Chamba. In Himachal Pradesh it is wildy found in hilly districts such as Chamba, Pangi, Kullu, Shimla, Kinnaur and Lahaul valleys⁷

Botanical characteristic features:⁸ Small perennial herb Height 10-20 cm Stem Small, leafy, weak, creeping; erect at flowering Roots 6-10 inches long, hard, wrinkled, greyish to brown Rhizomes 2.5–12.0 cm long, 0.3–1.0

cm thick, cylindrical, irregularly curved, jointed nodes with branching and rooting Rhizome Appearance Externally greyish-brown Aerenchyma Presence Found in leaves, aerial stem, and rhizome Leaves Basal, alternate, 5-15 cm long, oval, acuminate, serrate, stalked, winged, oblanceolate/narrowly spatulate, coarsely toothed, Leaf Hairs Two types of glandular hairs present, Flowers White or pale purple, bisexual, on long terminal spikes Calyx 5 equal parts Corolla 4-5 lobed, actinomorphic Stamens 4, slightly didynamous, inserted on corolla tube Stigma Capitate, Fruits/Capsules Acute, ovoid, swollen, 6-10 mm, tapered at the top, splits into 4 valves, Seeds Numerous, pale brown, 1 x 0.8 mm, ellipsoid, thick transparent seed coat.

Flowering and fruiting :

Flowering and fruiting occure between October - December.

Active principles: D- mannitol, Kukiol, Kutkisterol, apocyanin, phenol glucosides, androsin, picrin iridoid, glycosides, kutkin, picroside I and picroside II, and III, kutkoside, minecoside, picrorrhizin, arvenin IV etc. ⁹

Chemical characteristics analysis⁻¹⁰

In Indian Herbal Pharmacopoeia, the quality control parameter for dry “Kutki” (Picrorhizakurroa) powder are mentioned as foreign matter should not be more than 2%, total ash should not be more than 7% and acid- insoluble ash should not be more than 1%. Also, alcohol soluble extractives should not be less than 20% and water-soluble extractives should not be less than 30% .

Ayurvedic Properties⁻¹¹

Properties	Katuki
<i>Picrorrhiza kurroa royle ex benth.</i>	
Family	Scrophuliriaceae
Rasa	Tikta,Katu
Guna	Ruksha, laghu
Veerya	Ushna
Vipaka	Katu
Dosa Karma	Vaat-pitta Shamaka
Karma	Bhedaniya,Prajasthapan,pitta shamaka

Medicinal use *Picrorhiza kurroa*-¹²⁻¹⁸

It is an important herb in the Indian medical system of Ayurveda. It has been found to possess hepatoprotective, antioxidant, anti-inflammatory, immunomodulatory properties along with antiallergic, antiasthmatic, anticancerous, cardiovascular, choleric, hypoglycemic, hypolipidemic, antiviral, purgative, anti-phosphodiesterase, neuritogenic, molluscicidal, and leishmanicidal activities. Its underground part has been used traditionally for Asthma, bronchitis, Malaria, chronic dysentery, viral hepatitis, upset stomach, Scorpion sting, as a bitter tonic (stimulating the appetite and improving digestion), and as a liver protectant. Besides, it has been used in the treatment of skin conditions, peptic ulcer and neuralgia, vitiligo and rheumatic arthritis. Recently its root and rhizome extracts have also shown to possess anti-malarial activity. There are several commercially available drug formulations of *Picrorhiza kurroa* in India which contain P-I and P-II, in different concentrations.

Part used: Root

Formulations: Astavarga churna, Chyavanprash rasayan, Chitrakadi taila, Vachadi taila, Mahakalyan ghrita, Mahamayura ghrita, Mahapadma taila, Jivaniya ghrita, Vajikaran ghrita, Brahini gutika and Himvana agada.

Substitutes: Guruchi (*Tinospora cordifolia* (Willd.) Miers), Safed behmen (*Centaurea behen* Linn.), and Vidarikand (*Pueraria tuberosa* (Willd.) DC). In substitute of Jeevak, two species of *Malaxis* found in the North-West Himalaya (Uttarakhand) are *Malaxis cylindrostachya* (Lindl.) Kuntze and *Malaxis mackinnoni* (Duthie) Ames.^{19,20}

Phytochemistry of *P. kurroa* -

- It has been extensively studied for its chemical properties, resulting in the extraction of numerous physiologically active compounds from its rhizomes, roots, seeds, stems, and leaves. This plant has produced over 65 secondary metabolites. The rhizomes and roots of *P. kurroa* yield a crystalline compound known as "Picroliv" or "Kutkin," which consists of two C9-IGs (C9-Iridoid Glycosides) referred to as kutkoside. Picroside-II and Picroside-I occur in a ratio of 2:1.²¹
- Using HPLC (high-performance liquid chromatography) methods, the IGs (Iridoid Glycosides) Picrosides I, II, and III, cucurbitacins, and kutkoside were identified in *P. kurroa* rhizomes.²²
- *P. kurroa* possesses a variety of bioactive compounds with pharmacological and therapeutic potential, including glycosides, iridoids, alkaloids, phenolics, terpenes, and cucurbitacins.²³
- Apart from its purgative and emaciating qualities, picrorhiza also possesses cholagogue, digestive qualities, appetizing qualities, and actions that stimulate the liver and heart. Kutkin, the active ingredient in *P. kurroa*, is a combination of picroside and kutkoside. Pharmacologically, kutkin (picrosides and kutkosides) has demonstrated hepatoprotective qualities. Two additional bioactive compounds that were separated from this plant are drosin and apocyanin. One catechol that might inhibit neutrophils' oxidative response is apocynin.²⁴

- *P. kurroa* contains cucurbitacins B, D, and R, which are well known for their cytotoxic and anti-tumorous qualities. Apocynin has anti-inflammatory and antioxidant qualities and is a strong inhibitor of NADPH (nicotinamide adenine dinucleotide phosphate) oxidase. There is an anti-asthmatic effect of androsin ²⁵.
- The 70 percent hydroalcoholic fraction has also been found to contain flavonoids like apocynin and vanillic acid, kutokoside, pikurosides, and picrosides I, II, III, and IV, according to LC ESI–MS/MS (liquid chromatography– electrospray ionization/multi-stage mass spectrometry) techniques ²⁶.

Pharmacological Activities of *P. kurroa*-

Hepatoprotective- In comparison to hepatoprotective substances like catapol, silymarin, and rographolide, picroliv, which was derived from *P. kurroa*, has been evaluated for its effects against ethanol-induced toxicity in rats. The findings indicated a minimal hepatoprotective effect, as evidenced by the reduced levels of marker enzymes such as alkaline phosphatase, glutamic-oxaloacetic transaminase, glutamic pyruvic transaminase, and aldehyde dehydrogenase ²⁷. A methanol extract derived from the rhizomes of *Picrorhizakurroa* Royle ex Benth. (Plantaginaceae) showed hepatoprotective properties against liver damage in mice induced by D-galactosamine (D-GalN)/lipopolysaccharide (LPS) ²⁸.

Antioxidant- Kant et al. (2013) investigated the antioxidant potential of *P. kurroa* leaves, aiming to discover a new natural source of antioxidants. Various solvent extracts, including ethanol, butanol, and ethyl acetate, along with an isolated compound, luteolin-5-O-glucopyranoside, were evaluated for their antioxidant activities using DPPH and ABTS assays. The results showed that luteolin-5-O-glucopyranoside exhibited an IC₅₀ value comparable to that of standard ascorbic acid, indicating that *P. kurroa* leaves may serve as a natural source of antioxidants ²⁹.

Anti-inflammatory-

Rohit Kumar et al. (2016) found that PKRE, a hydroalcoholic extract of *P. kurroa* rhizome, exhibited anti-inflammatory effects by attenuating paw oedema, granuloma formation, and proinflammatory mediator production in macrophages, achieved by inhibiting the iNOS and NF-κB signalling pathway ³⁰.

Anti-asthmatic-

Studies have shown that androsin, a constituent of *P. kurroa*, significantly reduced allergen-induced bronchial obstruction in guinea pigs. The plant extract also inhibited histamine release in vitro ³¹.

Anti-diabetic-

Research has found that *P. kurroa* extract reduces serum lipid peroxide levels and blood urea nitrogen in diabetic rats induced by alloxan, while also inhibiting weight loss and leukopenia. This suggests that *P. kurroa* extracts may mitigate metabolic damage caused by alloxan ³².

Anti-cancer-

A study investigated the antineoplastic and antioxidant properties of methanolic extracts and aqueous extracts of *P. kurroa* rhizomes. The extracts were tested for their cytotoxic effects on human breast carcinoma, human hepatocellular carcinoma, and human prostate cancer cell lines using the XTT assay. The results demonstrated that both extracts exhibited significant antineoplastic activity by inducing apoptosis in all three cancer cell lines, suggesting their potential as natural anticancer agents ³³.

Research updates:-

- Hepato-protective activity is noticed with decoction against CCl₄- induced hepatotoxicity in rats (Chaturvedi & Singh 1969)
- Alcoholic extract showed protection against CCl₄- induced hepatotoxicity marked regression of SGOT, SGPT & alkaline phosphate level noticed. (Pandey and Chaturvedi)
- Water soluble traction of 90% alcoholic extract exhibited smooth muscle relaxant laxative and choleretic activities. (Das & Raina 1967)
- Rats treated with alcoholic PE and chloroform extracts regressed the transaminase levels even while subjected to CCl₄ induced liver injury.
- Alcoholic extracts showed hydro choleretic action & stimulated biliary bilirubin, cholesterol and alkaline phosphatase in dogs.
- Apocyanin showed choleretic action. (Bara et. al. 1971)
- Ethanolic extract exhibited marked hydrochloric activity. (Vahora et, al, 1972)
- 50% Ethanolic extract revealed diuretic activity. (Dhar et. al, 1973)
- Kutkin an vanillic acid shows choleritic and laxative activities. (Das et, al, 1976)
- Aqueous extract shows antibacterial activity. (Vohora et al1972)
- *P. Kurroa* has led to beneficial result in the management of bronchial asthma. (Rajaram 1976)

Conservation status & threats

P. kurroa has been assessed as **Endangered** on the IUCN Red List (most recent assessments 2021) and is listed in CITES Appendix II / trade-control frameworks in various reports because of heavy trade and population declines. Overharvesting of rhizomes, habitat degradation, grazing pressure, and limited natural regeneration are principal threats.

Conservation, cultivation & management approaches

Several strategies have been explored or recommended:

- **Ex situ & in vitro propagation:** Tissue culture protocols (multiple shoot regeneration, micropropagation) have been developed to produce planting material and reduce pressure on wild stocks.
- **Domestication & cultivation trials:** Field cultivation at appropriate elevations and agronomic optimization can supply market demand; however, scale, genetic diversity and quality (phytochemical yield) must be addressed.
- **Regulatory controls & sustainable harvesting:** Implementation of legal procurement certificates, CITES controls, harvest quotas and community-based management (benefit sharing, controlled harvesting seasons) are recommended. Habitat protection, restoration and enforcement in collection hotspots are essential.

Discussion-

Millions of Dravya studying each and every dravya separately is impossible for a human Dravya guna being a science very much essential for therapeutics cannot omit any dravya. So in order to make the study of dravya easy and practicable; in one way or the other the dravyas with similar qualities are grouped and studied. Picrorhizakurroa, commonly known as Kutki, has been recognized as a medicinal plant in the three major Ayurvedic treatises, namely Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya. Kutki is used by various synonyms in classical literature, such as in Bhavprakash Nighantu. These synonyms describe biological activity or typical traits, i.e Kandaruha (The plant can grow from stem cuttings), Chakrangi (When cut, the stem appears like a wheel), Matsyashakala (Rhizome resembles fish scales), Ashoka (Relieves grief), Rohini (Protects organs with regenerative ability), Katurohini (Has regenerative action), Krushnabheda (Can cause black stools), Tikta (Has a very bitter taste) Katumbhara (Full of bitter principles) Matsyapitta (Bitter taste like fish bile and similar action).

Conclusion-

Picrorhiza kurroa is a medicinally important but threatened Himalayan herb. Conservation through a combined approach regulation, community engagement, cultivation and ex-situ propagation along with rigorous phytochemical standardization and clinical research, is essential to secure both biodiversity and sustainable therapeutic supply. Kutaki is the drug which has Kapha-Pittahara properties as well as Deepan, Bhedana and Hrudya karma along with Laghu and Ruksha guna. Laghu guna is easily digestible and ruksha guna which absorbs the Kleda of Medadusti, Pittadusti and relieves obstruction. So the drug was taken for the study and the study was conducted to know its effects.

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