Review Article

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Katuki (*Picrorhiza Kurroa*) -A promising Ayurvedic Herb

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ABSTRACT

Through much of human history, plants have been the basis for medical treatments and such traditional medicine is still widely practiced today. [1] India and China are one of such countries who boost their traditional systems of medicines and the respective Govt. of these countries also takes required measures from time to time. According to an estimate made by the World Health Organisation (W.H.O.) traditional medicine forms the basis of primary healthcare of about 80% population of the world. Primary reason for that being the inexpensive nature of herbal medicines as compared to modern pharmaceutics as these can be grown from seed or gathered from nature for little or no cost. Katuki (*Picrorhiza kurroa* Royle ex Benth) is a very popular hepatoprotective drug in Ayurvedic system of medicine. *P. kurroa* is mainly used for the treatment of hepatic disorders, but it is also known for its anti-inflammatory, anti-microbial, anti-diabetic, immunomodulator, anti-asthma and in the management of obesity. The most important of these bioactive compounds of plants are iridoids, cucurbitacin and acetophenones. The present review study is an attempt to provide reported detail information of this herb from various Samhitas and its study in modern area like its phytoconstituents and pharmacological activities.

Introduction

Katuki or Picrorhiza is a well-known herb for its hepatoprotective action and its wide range of pharmacological activities. Katuki is known to help in removing the excess fire energy from our body thus acting as a cooling agent. It balances pitta and kapha which can cause acidity, digestive problems and fat. So, it helps to improve digestion, metabolism of carbohydrates, proteins and fats. With improved metabolism various problems like increased level of urea, creatinine, diabetes, heat and hyperthyroidism can be managed. This drug is known to be in medicinal use since 5000 years ago.

Nirukti of Katuki

a. **Tikta:** Means bitter, it is bitter in taste thus called Katuki/ Katuka [2]

b. **Katuka:** Because it increases the bile secretion in our body [3].

Scientific Classification

i. **Scientific Name:** *Picrorhiza kurroa*

ii. **Kingdom:** Plant

iii. **Order:** Lamiales

iv. **Family:** Plantaginaceae

v. **Genus:** *Picrorhiza*

vi. **Species:** *kurroa*

Classification in Ayurvedic Texts [2, 27, 28]

Ghana

i. **Charaka:** Bhedaniya, Lekheniya, Stanyashodhana, Tikta skandhas

ii. **Sushruta:** Patolyadi, Pippalyadi, Mustadi

iii. **Vaghbhata:** Patolyadi, Mustadi, Pippalyadi

Part Used

Root and Rhizome.

Vernacular Names

The regional names of Katukiin India are shown below:

i. **Sanskrit:** Katuka, Tikta, Katurohini, Kaandrooha, Krishna bheda

ii. **Hindi:** Katuka

iii. **Bengali:** Kattki

iv. **Punjabi:** Kaundd

v. **Marathi:** Bal kadu, Kali katuki

vi. **Gujrati:** Kadu

vii. **Telugu:** Katukarohini

viii. **Tamil:** Katukarogini

Ayurvedic Properties [3]

i. Rasa: Tikta rasa

ii. Guna: Ruksha and Laghu

iii. Virya: Sheeta

iv. Vipaka: Katu

v. Karma: Kapha-pittahara property

Synonyms

i. Pradhana Nama (Main Name): Katuka, Tikta, Katurohini

ii. Upama(Representation): Matsyashakla

iii. Svarupa(Morpholoy): Chakrangi, Krishna bheda, Shat parva

iv. Due to regeneration from stem: Kaandrooha

v. Karma (Action): Amghani, Arishta

Botanical Description

P. kurroa is a hairy herb with perennial bitter rootstock. The rhizome has fishy scales, on transverse section a blackish circular ring is seen. Rootstocks as thick as the little finger, clothed with withered leaf-bases. Leaves :5-10 cm. rather coriaceous, tip rounded, base narrow into a winged sheathing petiole. Spikes: 5-10cm. long, sub-cylindric, obtuse, many flowered, sub-hirsute, bracts oblong or lanceolate, as long as the calyx. Sepals: - 6mm. long, ciliated. Corolla: It is of short stamened form 6mm. long with longer filaments 8mm. long, of the longer stamened from 6mm., with filaments 2cm. long. Capsule:1.3cm long. Rhizomes: straight or slightly arched cylindrical upto 12cm. long and 4 to 10mm. in diameter. Other surface is grey or creamish brown in colour, bearing impressions of round root scars and numerous scales. The rhizome terminates in scaly leaf, bud or stem. Fracture: short and clear Odour: faint or disagreeable Taste: very bitter and long standing (Figure 1).

Figure 1.

Distribution

Generally, occurs in Alpines, Himalayas from Kashmir to Sikkim at 9000-15000 ft. above sea level. In Jammu & Kashmir it can be collected from Galhar region of District Kishtwar having GPS location 33020’250N and 75055’590 E at an elevation of 1581masl (Figure 2).

Figure 2.

Phytochemical Properties

The major chemical constituents are D-mannitol, Kutkiol, Kutkisterol, apocyanin, phenol glucosides, androsim, and picein iridoid glycosides; kutkin, picroside I, II&III; Kutkoside, minecoside, picrorhizin, arveninIII. Kutkin is the active principle of *P. kurroa* and is comprised of kutkoside and the iridoid glycoside picrosides

I, II, and III. Other active constituents are drosin, apocynin, and nine cucurbitacin glycosides whereas catechol - apocynin has been found active as an anti-inflammatory agent and cucurbitacins for antitumor and cytotoxic effects. Chemical studies on the rhizomes of *P. kurroa* revealed acetophenones, cucurbitacins and iridoids presence in them. As per literature there are several bioassays on the constituents isolated from the rhizomes focused on hepatoprotective, immune-modulating and antioxidant activities [31].

Pharmacological Actions

Hepatoprotective Activity: Katuki has been widely known and used as hepatoprotective agent. In liver injury mainly Kuffer cells cause problems in regeneration process and it here when extract of this plant plays its role by suppressing cells [4]. Picroliva iridoid glucoside compound [mixture of Picroside-1 and Kutkoside (1.0: 1.5, w/w)] from rhizome and roots of this plant is prominently known to help in regeneration. This hepatoprotective activity of picroliv was studied in rats liver where hepatic injury was induced by ethanol [5]. This plant has been currently used in treating various liver diseases which includes fatty liver, viral hepatitis, ischemic injury, cirrhosis, radiation toxicity etc. Studies proved picroliv effective in hepatoprotective action against paracetamol, carbon tetrachloride, alcohol and aflatoxin Zhang, et al. [6].

Anti-Asthmatic Activity: Phenolic Glycoside named androsin is found prominently active in anti asthmatic effects. This glycoside activity in studied in guinea pigs where it inhibit allergen as well as Platelet-activating factor (PAF) induced obstruction in bronchia [7]. Inhibiting histamine release in chopped lungs of guinea pigs was also observed by exposing them to root powder of this plant [8].

Anticancer Activity: Picroliv, from *Picrorhiza kurroa* showed protective action against chemically induced tumour [9]. This purified iridoid glycoside mixture (100 and 200 mg/kg, p.o) showed promising anti-tumour response by inhibited the sarcoma development induced by 20-MC in a dose-dependent manner by 47 and 53% in BALB/c mice. Moreover oral as well as topical use of Picroliv inhibit papilloma formation in mice model induced by DMBA. Moreover, anti- invasion activity in MCF-7 cells (Human breast cancer) through the down regulation of matrix metalloproteinases (MMPs) by Kutkin, Picroside I, and Kutkoside has been reported Rathee, et al. [10]. These Picrosides are known to act as potential anti-carcinogenic agents by exhibiting different anticancer activities which includes metal ion chelator, free radical scavenging activity, detoxifying activity , cell cycle regulation and apoptotic induction [11].

Anti-Microbial Activity: The antibacterial and antifungal activity of Rhizome extract was evaluated by using cup plate method, where they found methanolic extract inhibit bacterial strains *E. coli, B. subtilis, S. aureus* and aqueous extract inhibit fungal strain *A. niger* and *C. albicans* [30]. In another study by using agar well diffusion method they found ethanolic extract of rhizome showed high antibacterial activity in the range 10.3 to 16.16mm against *S.aureus, B.cereus, E.coli, K.pneumoniae, S.typhi* and *S.pyogens* whereas the methanolic extracts showed high antibacterial activity against *S.aureus* (12.1 ± 0.13mm) and *P.aeruginosa* (13.06 ± 0.15mm) Kumar, et al. [12]. According to the literature there are vast diversity of microbial flora in this plant termed as endophytes and current findings suggest that these endophytes might be responsible for all its medicinal properties. One such report by Raina, et al. [13] where they investigated antibacterial and antifungal activities of *Picrorhiza kurroa* harboring endophytes and they identified two bacterial endophytes i.e., which were effective against several human pathogens.

Anti-Inflammatory Activity: Picroliv is also known for anti-inflammatory responses. Rhizome extracts was reported to be effective in a dose dependent manner in rats against carrageenan-induced paw edema and cotton pellet-induced granuloma formation [14]. Picroliv role was also studied for anti-inflammatory response in ulcerative colitis (UC) mice model which suggested that its administration could be a therapeutic approach [6]. Alcholic extract of kurroa and compounds kutkin, Picroside-1 and Kutkoside have been reported for their anti-inflammatory activity [15].

Anti-Diabetic Activity: Extract of this plant is providing beneficial results in diabetes also. Study has demonstrated that its administration increased insulin production in rats which had Streptozotocin Evoked β-Cell Damage [18]. *In vivo* studies in rats suggested that its extract played potential role in type-2 diabetes induced by streptozotocin-nicotinamide [16].

Anti-Oxidant Activity: Ethanolic extract of rhizome has been reported in scavenging free radicals which ultimately can prevent many ailments in humans. It has also its role in diseases related oxidative stress and it can also be given as natural antioxidants supplement [17].

Immunomodulator Activity: Aqueous and ethanolic extracts of *Picrorhiza kurroa* have been reported for stimulating humora; responses by various immune mechanisms which includes mediators releasing in hypersensitivity as well as tissue responses at the target site organ of these mediators Sharma, et al. [29]. One of the Biopolymeric fraction from this plant RLJ-NE-205 also showed cell-mediated immune response by stimulating CD4+ and CD8+ T cells Gupta, et al. [19].

Types of Katuki

The Nighantu works have described two varieties of Katuki viz., Katukarohini(*P. kurroa*)**,** Ashoka rohini(*E. paniculata*)

Samanya Karma of Katuki: (Table 1**)**

Adulteration: The stems and roots of the same plant are commonly used to adulterate the rhizomes of Katuka/katuki. *Gentiana kurroa Royle, Gentiana decumbens Linn. f., Gentianatenella Fries, Helleboursniger Linn.* are used as substitute for Katuka [20]. Roots of *Picrorhizascrophulariiflora Pennell, Actaea spicata, Cimcifugafoetida, Coptisteeta, Cosciniumfenestratum, Swertia chirata* are sold in the drug market under the name Kutaki or Karu. [21] Roots of *Lagotis glauca Gaertn.* are sometimes intentionally collected and mixed by the local sellers of Kashmir and Kullu regions [7].

Table 1: Actions mentioned in various Ayurveda text [2, 20, 23, 25-28].

Karma	C.S.	S.S.	A.H.	B.N.	SO.N.	SH.N.	R.N.	D.N.
Bhedniya(Purgative)	+			+				
Dipana(Digestive)		+		+				
Lekhaniya(Weight reducing)	+							
Hrudya(Cardiac Tonic)				+		+		
Stanyashodhana(Galacto Purifying)	+	+	+					
Jwaraghna(Anti-pyretic)		+		+	+	+	+	+
Shvashara(Bronchial Antspasmodic)				+	+	+	+	
Kaas hara(Bronchial Sedative)				+	+			
GulmaevumShoolaNashak(Pain Killer)		+						
Aamhar (Carminative)		+	+		+			+
Kushtaghna (Curative of Dermatosis)			+	+		+		
Kamlahara (Curative of Jaundice)			+	+		+		

Some Important Formulations

i. Arogyavardhini gutika

ii. Tiktaka ghrita

iii. Mahatiktaka ghrita

iv. Sarva jvarahara lauha

v. Katukadya ghrita

Therapeutic Uses

i. Hridroga- Katuki and Madhuka are taken with sugar dissolved in water in PittajHridroga [C.S. Ci. 26 &A.H.Ci. 6]

ii. Pandu-Katuki, sugar and Drona pushpi juice as Anjana [S.B.M.]

iii. Kushtha-Katuki, ativisha, ushira and Chandana are collectively given for internal usage [C.S.Ci. 7]

iv. Useful in diabetic diuresis

v. Useful in cough

Conclusion

Katuki has been one of the important sources of Ayurvedic medicine as well as modern medicine. Although it's majorly used for liver disorders, but its active components present in various parts of plant are providing relief and saving millions of life from the very ancient time. Due to wide spectrum of biological activities this plant is widely used in drug industries. Iridoids present in it is also widely known for antitumor, choleretic, hypolipidemic, antiphosphodiesterase, cardioprotective, neuritogenic, molluscicidal and leishmanicidal activities [22]. This plant also contain sveroniciside , phenol glycosides and pikuroside. Besides roots and rhizome leaf, stem and seeds are also a source of variety of components which makes this plant a remarkably promising herb [23-29].

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