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ENDANGERED AYURVEDIC MEDICINAL PLANT KUTAKI *(Picrorhiza kurroa)*

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Abstract: *Ayurveda- Its unique way of treating and concept of curing the diseased and maintaining the health of the healthy has been approved worldwide. Ayurveda is concerned regarding the herbs that are getting endangered. One such herb is Picrorhiza kurroa. The very herb is used since long, for various ailments in Ayurveda. It is known as Katuka, Katuki, Katurohini etc. in Ayurveda. Picrorhiza has been mentioned in Various Manuscripts of Ayurveda and it has also been tested by various Scientists for different diseases in which it has proved its efficacy.*
Key words: *Katuki, Picrorhiza, CITES.*

Introduction: Ancient Manuscripts brings us the knowledge of Ayurveda. No such old data is available in any civilization of the world apart from Hindu Civilization. More than 500 Plants have been mentioned in Ayurvedic texts. These Plants are being used by Ayurvedic Practitioners in many Preparations like Herbal, Herbo Mineral etc. But due to Ruthless and over harvesting of these herbs many extincted and many are about to. Serious steps should be taken to stop getting important herbs extict. Ayurveda depends on Nature in fact it is the Science which is could be taken as a Synonym of Nature. To Protect and Preserve Nature is to Protect and Preserve Ayurveda. Today the Kutaki, Picrorhiza kuroa is on the verge of getting extinct.It is an Endangered Plant. It is Kept under CITES Appendix 2. Its Export has been banned to keep a strict check over its Use.

Objectives: The present study is about the Endangered herb Katuki, Picrorhiza kurroa which is listed under Appendix-II of the convention on International Trade in Endangered species of wild fauna & flora (CITES). Its uses in Ayurveda and its Modern Aspect.

Katuki, Picrorhiza in Ayurveda : In Ayurveda Katuki is also called as Katuki, Katurohini, Kutki etc. It has a vast use throughout Ayurveda for all age groups. Such an effective drug is mentioned in Charak Samhita which dates back 5000 years ago (Lekhaniya, Bhedaniya & stanya shodnana gana). In Sushruta Samhita it has been mentioned in Pipplayadi Gana, Mustadi Ganaea etc. It has been mentioned in several other books also like Ashtang Samgraha, Rajnighantu, Bhavaprakash Nighantu, Shanker nighantu, Nighantu Adarsha etc. Therapeutic uses of Kutaki has been mentioned in Kamala, Swasa, Daha, Jvara, Kushta, Visamjvara & Arocaka[1]. Its effect on-

- Digestive System–Rochana, Deepana, yakrit uttejaka, Pittasaraka & Krimighana.
- Circulatory System–Shoth hara, raktashodhak, decreases palpitation
- Respiratory Sytem–Kaphanisarak & Kaphaghana
- Urinary Sytem / Excretory–Premehaghana
- Reproductive–Stanyashool hara
- Skin–Kushtaghana
- Temperature–Daha prashmana & Jvaraghana especially vishamajwara.[2]

It is an important part of various important formulations like Arogyavardhini Vati, Tikta ghrita, Sarvajwara hara lauha, Mahatikta Ghrita etc. [1].

About the Plant: Katuka consists of the dried Rhizome root of Picrorhiza kurroa Royle ex. Benth, a perennial more or less hairy herb common on the north western Himalayas from Kashmir to Sikkim [1].

- Botanical Name–Picrrorhiza kurroa
- Family-Scrophulriaceae

Properties and Action as per Ayurveda –

- Rasa-Tikta, Katu
- Guna-Laghu
- Virya-Usna
- Vipaka-Katu
- Karma-Dipani, Bhedni, Hrdya, Jvarahara
- Part used in Ayurveda-Rhizome, Whole Plant.

Several studies have been conducted to know more about this unique plant. In which it has shown its various uses. Today the scientists all over the world are trying to find out the various alkaloids of this unique plant for further medicine development. Natural products since starting have been the main focus point of many modern drugs. And this led to many researches worldwide. Some of its Studies have been cited below-

Pharmacological Aspects

1. Anti-allergic and Anti-Asthma Activity : Intragastric administration of a dose of 25.0 mg/kg body weight (bw) of a standardized iridoid glycoside fraction from an ethanol extract of the rhizome, inhibit passive cutaneous anaphylaxis in mice (82%) and rats (50-85%) and protected mast cells from degranulation (60-80%) in a concentration-dependent manner. Its effect was also studied in a sensitized guinea-pig ileum preparation in vitro and in normal guinea-pigs in vivo. The Schultz-Dale response was inhibited in sensitized guinea-pig ileum, but histamine-induced bronchospasm was not antagonized or prevented by the fraction, indicating the absence of a direct postsynaptic histamine receptor-blocking activity[3].

Mechanism of inhibition of mast cell anaphylaxis by P. kurroa-extract (PK) treatment in rats was investigated. Mast cell-1gE binding, assessed from induction of passive sensitization, was not affected. Calcium-independent early activation events in mast cell anaphylaxis indicated on inhibitory influence of PK-treatment. Inhibition of membrane-protease release by PK-treatment was suggested by study of gastric secretion and exhibition of saturable synergism with Divisopropyl fluoro phosphate on inhibition of anaphylactic degranulation. pH-independence of mast cell stabilizing effect negates any PK-influence on phospholipid transmethylation. The results complement findings of earlier studies on indirect effects of PK through alteration of membrane structure/function[4]

A dried chloroform (0.1 mg/ml) or dried ethyl acetate extract of the rhizome (0.01 mg/ml) inhibited histamine release in human polymorph nuclear leukocytes treated with rabbit antihuman IgE antibody, or the calcium ionophores A12387 or C5A in vitro. Intragastric administration of a dried ethyl acetate extract of the crude drug to guinea-pigs at a dose of 10.0 mg/kg bw 1 hour prior to challenge with platelet-activating factor or administration of ovalbumin reduced bronchial obstruction[3].

2. Anti-inflammatory Activity: Intragastric administration of a 95% ethanol extract of the rhizome to rats, at a dose of 100.0 mg/kg bw for 3 days, reduced carrageenan-induced pedal oedema. Co-administration of the anti-inflammatory antagonists, propranolol or timolol with the 95% ethanol extract of the rhizome reduced its effects [5].

3. Anticonvulsant Activity: The ethanolic extract of the roots of *Picrorhiza kurroa* was studied for its anticonvulsant effect on maximal electroshock-induced seizures and pentylenetetrazole, picrotoxin induced seizures in mice. The latency of tonic convulsions and the number of animals protected from tonic convulsions were observed. It has been observed in the present study that SPK (100 mg/kg) showed significant increase in latency to clonic convulsions and reduced mortality, however SPK (25 and 50 mg/kg) failed to show anticonvulsant activity against PTZ induced convulsions in mice. Further animals treated with SPK (25, 50 and 100 mg/kg) did not show any significant effect on the latency to THLE in MES induced convulsion. Thus we can conclude that *Picrorhiza kurroa* possess anticonvulsant activity against Pentylenetetrazone (PTZ), Maximal electroshock (M.E.S.) and Picrotoxin (PTX) induced convulsions in mice[5].

4. Anti-diabetic Activity of Picrorrhiza kurroa Extract: An alcoholic extract of *Picrorrhiza kurros* was found to lower blood glucose in basal conditions and after a heavy glucose load in normal rats. Maximum reduction in serum glucose was observed after 2 h at a dose level of 75 mg extract/kg of body weight. *P. kurroa* extract was also found to reduce the increase of blood sugar in alloxan-induced diabetic rats (43% at 75 mg/kg body weight and 60% at 150 mg/kg body weight). Chronic administration of the extract significantly reduced the blood sugar in alloxan-induced diabetic rats for several days (10 days). The extract was also found to reduce the increased blood urea nitrogen and serum lipid

peroxides in alloxan-induced diabetic animals and to inhibit the body weight reduction and leukopenia induced by alloxan administration. These results indicate that *P. kurroa* extracts are able to ameliorate biochemical damages induced by alloxan in diabetic rats[6].

5. Anti-Tumour & Anti-Cancer

Effect of *Picrorrhiza kurroa* Extract on Transplanted Tumours and Chemical Carcinogenesis in Mice: Anti-tumour and anti-carcinogenic activity of *Picrorrhiza kurroa* extract were studied in mice. Administration of 20-methylcholanthrene (20 MC) produced 100% induction of sarcoma in control mice, whereas the tumour incidence and tumour related deaths were significantly inhibited by the oral administration of *P. Kurroa* extract 150 and 750 mg/kg body weight, respectively. The extract was also found to reduce the volume of transplanted solid tumours induced by Dalton's lymphoma ascites (DLA) tumour cell lines and increased the life span of ascites tumour bearing mice. *P. Kurroa* extract inhibited yeast topoisomerase I and II enzyme activity when tested on *Saccharomycescerevisias* mutant cell cultures. The extract did not inhibit the enzyme involved in the activation of carcinogen and the cell cycle regulatory enzyme ced2 kinase[7].

Antioxidant Defense in Adriamycin-induced Cardiomyopathy: Adriamycin, and Anthracycline antibiotic, which is used in the treatment of various tumors, is known to cause severe cardiomyopathy. The present study examined the protective effects of *Picrorhiza kurroa*, an Ayurvedic medicinal plant, on myocardial antioxidant defense system in Adriamycin-induced cardiomyopathy in rats. Intraperitoneal administration of Adriamycin (1.5 mg/kg body weight/day, i.p. for 15 days) caused significant rise in the levels of diagnostic marker enzymes [alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LDH) and creatine phosphokinase (CPK)] in plasma and lipid peroxidation in the heart tissue of experimental rats. Concomitant decline in the level of reduced gluthathione (GSH) and the activities of gluthathione-dependent antioxidant enzymes (GPx and GST) AND ANTIPEROXIDATIVE ENZYMES (SOD and CAT) in the myocardial tissue were also observed. Oral administration of *P. Kurroa* extract (50 mg/kg body weight/day), for a period of 15 days) significantly prevented all these Adriamycin-induced adverse effects and maintained the rats at normal status. The protective effect of *P. Kurroa* might be ascribable to its membrane-stabilizing property and/or antioxidant nature.[8]

Apocynin and Cancer: Klees et al. reported that while apocynin itself is not effective, its derivatives inhibit migration of the breast cancer cell line MDAMB-435 at subtoxic concentrations and migration of nonmalignant MCF10A breast cells is unaffected. These compounds also cause a significant rearrangement of the actin cytoskeleton, cell rounding, and decreased levels of active Rac1 and its related G protein Cdo42. The possible link between apocynin and Rac1 inhibition suggests that apocynin may be a source of inhibitors of Rac1-mediated tumor cell migration. Klees et al. reports the application of an in vitro screening assay to identify apocynin-derived inhibitors of Rac1-based tumor cell migration. According to this study, apocynin, upon peroxidase-catalyzed metabolic activation, interferes with NADPH-oxidase and inhibits lymphocyte migration through a G-protein-regulated pathway without affecting adhesion. Reactive oxygen species generated by NADPH-oxidase also control actin structure. Apocynin or its metabolites have also been shown to affect the migration of polymorphonuclear granulocytes, suggesting that its mechanism of action is conserved throughout cell types. Active Rac1 is necessary for the translocation of p47-phox and p67-phox though it does not mediate it directly. Rac1 is role in NADPH-oxidase activation is not well understood, but it is able to bind p67-phox, and this binding may be what causes the final formation of the active NADPH-oxidase complex. When Rac1 is in its inactive form, there is a decreased level of O, signifying inactive NADPH-oxidase. NADPH-oxidase has also been shown to associate with the actin cytoskeleton, implicating another mode, by which Rac1 may manage cytoskeletal structure [9]

6. Immune Stimulatory Effects: A dried diethyl ether extract of the rhizome inhibited the classical pathway of complement (median inhibitory concentration (IC50) 1.9 µg/ml). Aqueous, petroleum ether, methanol or ethyl acetate extracts of the crude drug had inhibitory concentrations of 13, 17, 38 and 55µg/ml respectively (3). The diethyl ether extract of the crude drug also had moderate inhibitory activity against the activation of polymorphonuclear cells (IC50 53 µg/ml) in vitro, and reduced mitogen-induced proliferation of T lymphocytes (IC50 13 µg/ml) (3). Two cucurbitacins, picracin and deacetylpicracin, isolated from the rhizomes of

the crude drug were responsible for the inhibition of mitogen-induced human T-lymphocyte proliferation (39). Incubation of picracin and deacetylpicracin with peripheral blood lymphocytes inhibited interleukin-2 release by phytohaemagglutininactivated T cells. The IC50s were 5 and 16 μM, respectively. Both picracin and cucurbitacin E also inhibited the release of interleukin 1α and tumour necrosis factor α from monocytes (IC50s were 15 and 3 μM, respectively). Deacetylpicracin was not active at concentrations up to 100 μM (40). Intraperitoneal injection of picracin or deacetylpicracin, 1 hour prior to induction of delayed-type hypersensitivity significantly ($p < 0.001$) inhibited the delayed-type hypersensitivity response at doses of 100.0 mg/ kg and 30.0 mg/kg bw in mice (Lee EB,1982) [3].

7. Antioxidant

Free Radical Scavenging Potential of *Picrorhiza kurroa* Royle ex Benth: The antioxidant and free radical scavenging activities of alcoholic extract of *P. Kurroa* used as a hepatoprotective and immunomodulatory drug in the Indian System of Medicine were determined in *vitro.* The results obtained suggest that the use of this plant extract widely in the treatment of many diseases which include hepatic damage, immunomodulation etc. may be due to its antioxidant and free radical scavenging ability. Nitric oxide is implicated in inflammation, cancer and other pathological conditions. Thus the varied therapeutic activity of the plant extract may be in part due to its antioxidant activity [10].

Titova et. al (2007) found that apocynin and its oxidation products do not react with GSH. However, this thiol compound was efficiently oxidized by the apocynin radical during the MPO-catalyzed oxidation. The strong inhibitor effect of apocynin on the production of hypocholorous acid by stimulated neutrophils might be the result of an additive effect of NADPH-oxidase inhibition and, to a lesser extent in less extension, due to competition with chloride for the catalytic active site of MPO. This is a further evidence of the importance of apocynin as an anti-inflammatory drug. Titova et. al. verified that neither apocynin nor the dimer and trimer derivatives were able to conjugate with GSH, which is a common representative of thiol compounds. However, they obtained strong evidence that GSH is able to react with apocynin radical and/or its dimer radical, which are formed during MPO-catalyzed oxidation. [9]

Healing Potential of *Picrorhiza kurroa* (Scrofulariaceae) Rhizomes against Indomethacin-induced Gastric Ulceration: A Mechanistic Exploration: Tissue damage is always associated with oxidative stress leading to loss or impairment of protein synthesis and damages to lipids and the thiol-dependent antioxidant defense. Besides preventing lipid peroxidation, the sulphydryl compounds (thiols) may also protect mucus, since mucus subunits are joined by disulfide bridges that, if reduced, render mucus water-soluble. In addition, they also help in recycling antioxidants like vitamin E and vitamin C. The decrease in endogenous thiol (glutathione) in ethanol induced gastric injury, and its role in mucosal protection has been demonstrated. All these oxidants factors might lead to aggravated tissue damage during stomach ulceration.

The study established that PK possesses significant healing property against indomethacin-induced stomach ulceration in mice. Its healing action could be attributed to the antioxidant activity along with the ability to modulate mucin secretion, PG synthesis, and upregulation of the growth factors. These results along with its non-toxicity suggested PK as a promising anti-ulcerogenic formulation for further evaluation. Considering the importance of angiogenesis in ulcer healing, it would be of interest to study the effect of PK on the pro and anti-angiogenic factors. Investigation in this regard is currently in progress in our laboratory and the results will be reported latter.

In 1971, apocynin was identified during activity-guided isolation of immunomodulatory constituents from the root of Plcrorhiza kurroa (Scrophulariaceae), a native plant grown in the mountains of India, Nepal, Tibet and Pakistan, well known in traditional Indian medicine (Ayurveda). Apocynin is an acetophenone with a molecular weight of 166.17 and forms needles upon crystallization from water. It possesses a faint vanilla odor and has melting point of 115C.[11]

8. Hepatic and Gastric Effects

Picrorhiza kurroa and Non-alcoholic Fatty Liver Disease: Male Wistar rats were challenged with 30% high fat butter, for 2 weeks to induce NAFLD. A hydroalcoholic extract of *Picrorhiza kurroa* was adv. Study the possible reversal of fatty changes in the liver. The extract was given in two doses and 400 mg/kg b.i.d., p.o. for a period of 4 weeks. There were three control groups (n=6/gross) with a regular diet, vehicle

with HFD, and HFD with silymarin–a known hepatoprotective.

Histopathology showed that the *P. kurroa* extract brought about a reversal of the fatty infiltration liver (mg/g) and a lowering of the quantity of hepatic lipids (mg/g) compared to that in the High group (38.33 ± 5.35 for 200mg/kg; 29.44 ± 8.49 for 400mg/kg of *P. kurroa* vs. 130.07 ± 6.36 tissue in the HFD control group; P<0.001). Compared to the standard dose of the known hep. Silymarin, *P. kurroa* reduced the lipin content (mg/g) of the liver more significantly at the dose of 400mg/kg (57,71 ± 12.45mg/kg vs. 29.44 ± 8.49 for the silymarin group vs. 400mg/kg of *P. kurroa* P<0.001). In view of the increasing prevalence of metabolic syndrome and NAFLD, *P. kurroa* investigated by the reverse pharmacology path as a potential drug for the treatment of NAFL essential safety studies and pre-formulation research for concentration of the putative actives carried out.[12]

Hepatoprotective Actions: The active ingredient, picroliv, has been shown to produce hepatoprotective activity against thiocetamide, galactosamine, rifampicin and cadmium-induced liver toxicity in cell culture and in experimental animals [13,14]. At doses of 6 and 12 mg/kg, picroliv provided hepatoprotection against carbon tetrachloride induced alterations in biochemical parameters, viz. alanine transaminase, aspartate transaminase, bilirubin, protein, cholesterol triglycerides and lipoprotein X [15].

Choleretic and Anticholestatic Actions: Picroliv showed a dose-dependent (1.5–12 mg/kg x 7days) choleretic activity in conscious rats and anaesthetized guinea-pigs. It also possessed a marked anticholestatic effect against paracetamol and ethinylestradiol induced cholestasis. It antagonized the changes in bile volume as well as in bile salts and bile acids. Picroliv was found to be a more potent choleretic and anticholestatic agent than flavonolignan and silymarin [16]. Picroliv induces the bile salt-dependent fraction, thereby increasing the synthesis of bile salts and bile acids, and enhancing conjugation with proteins [14].

9. Neuroprotective Features: NADPH-oxidase-mediated superoxide plays and important role in the pathogenesis of brain injury and that inhibition of NADPH-oxidase by apocynin can attenuate brain injury following experimental ischemic stroke. It has been reported that apocynin protects against global cerebral ischemia/reperfusion-induced oxidative stress and injury in the gerbil hippocampus, and inhibiting superoxide production by NADPH-oxidase with apocynin protects blood-brain barrier constituents in ischemia-like injury in vitro. Wang et al. investigated that apocynin was able to protect against brain injury in a collagenase-induced rat model of intracerebral hemorrhage (ICH). Apocynin reduced cerebral and vascular injury inexperimental stroke models at doses similar to those used in present study.

Inflammation following ischemic stroke is known to contribute to injury. Apocynin has been studied as a potential treatment in experimental stroke. Tang et al. explored the effect of different doses of apocynin in a mouse model of 2-hour transient middle cerebral artery occlusion followed by 22-hour reperfusion. Apocynin, given at a dose of 2/mg/kg 30 minutes before reperfusion, improved neurological function, reduced infarct volume, and reduced the incidence of cerebral hemorrhage. Nevertheless, at higher doses of 3.75 and /mg/kg, it increased brain hemorrhage. Apocynin also tended to reduce mortality at the lower dose, but not at higher doses. This data suggest that apocynin can protect against experimental stroke, but with a narrow therapeutic window. [17]

10. Leptospirosis

In Silico Docking Analysis of Peptide Deformylase (PDF)-A Novel Target for Prophylaxis of Leptospirosis: The present analysis indicates that traditional drugs used in the treatment of leptospirosis canalso form a complex with PDF, with a significant binding efficiency. This swot builds a perceptive focus towards these drugs, that when administrated during the treatment of leptospirosis may block PDF along with their specific indigenous receptors. This creates a strong hypothesis that the combine effect of the complex formation with PDF and the inhibitory complex formed with respective receptors may alleviate the concerned prophylaxis. Hence PDF may become a prospective target for inhibition of pathogenic *leptospira* bacteria and may unlock a strong initiative in developing novel ligands which are specific towards it. Moreover the current drugs used can under go Me-Too specifications to improve its specificity towards PDF. In addition to this, Picroside analogues from *Picrorrhiza kurroa* have given away a promising corollary for developing a novel phytodrug. To strengthen the current investigation, further evidences both in vitro and in vivo are needed so as to use this

approach effectively for prophylactic treatment of leptospirosis.[18]

11. Visceral Leishmaniasis: *Picrorhiza kurroa* Royle ex. Benth (Family Scrophulariaceae), a small perennial herb, is found in the Himalayas from Kashmir to Sikkim at an altitude of 2700-4500 m. The plant is used as a bitter tonic in traditional medicine and hence commonly known as 'kutki'. The rhizomatous part of the plant and the root is used in dyspepsia, fever and also in the diseases of liver and spleen including jaundice. Arogyavardhini, a herbo-mineral preparation containing *P. kurroa* as the major ingredient has been tried in patients with viral hepatitis.

'Picroliv' isolated from this plant is an active hepatoprotective agent [19, 20]. It is useful as a laxative, liver-stimulant, improving lactation, appetite stimulant, and febrifuge. It also exhibits anti-inflammatory antidiabetic and immunoregulatory functions [21]. Picroliv has also been found to possess active hepatoprotective activity against different hepatotoxins [22].

Picroliv prevented paracetamol-induced lowering of low density lipo-protein (LDL) receptor cell surface expression and increased conjugated dienes in hepatocytes. In rats infected with Plasmodium berghei, picroliv restored depleted glutathione levels, thereby enhancing detoxification and antioxidation. Thus, picroliv maintains a normal oxidation-reduction balance and glutathione metabolism and reduces the increased levels of lipid peroxidation products in the liver [23].

Picroliv showed liver regenerative activity in rats, possibly by stimulating nucleic acid and protein synthesis [24]. Its hepatoprotective effect appears to result from a combination of membrane stabilizing, hypolipidemic and antioxidant properties. These properties may also be responsible for the effects on the immune system [23, 25].

12. Antiviral Actions: Picroliv was found to act against hepatitis B virus. It has anti-HBsAg like activity and inhibited purified HBV antigens prepared from healthy HBsAg carriers [26]. Anti-inflammatory action *P. kurroa* extracts have an inhibitory effect on proinflammatory cells such as neutrophils, macrophages and mast cells [27]. Apocynin, a catechol fraction from *P. kurroa*, has been found to exhibit powerful anti inflammatory actions on a variety of inflammatory models. It was found to inhibit neutrophil oxidative burst *in vitro* without affecting beneficial activities such as chemotaxis, phagocytosis and intracellular killing of bacteria. [19]

14. Anti Fungal: The antifungal potential of alcoholic extract of P. kurrooa was tested against the yeast Candida albicans. The extract of this plant and its major constituents exhibited significant activity against fungi [28]

On the Verge to be Extinct: Picrorhiza kurroa& species with the Globalization of Ayurveda and increased demand of Ayurvedic Medicines and Interest of the Scientists worldwide in the Ayurvedic Herbs, Minerals & Plant Products the consumption of the products has increased. Due to increased demand Nationally & Worldwide has led to Explanation of the Plants from their natural habitat apart from this other factors like overgrowing, tourism development, Explanation of the habitat. Deforestation is responsible for uncontrolled Explanation leading to the Extinction of very important, rare and useful herbs. One such important, useful & going to be rare herb is Picrorhiza kurroa, which is used since ages in Ayurveda and has avast description in the texts of Ayurveda and as we can see from the above description of the herb regarding its uses it is the quality of this herb that it is not possible to mention it in small. It has been included in the CITES Appendix-II. This Appendix includes species in which trade must be controlled and cultivation & Presentation should be looked up on seriously.

High market demand of Picrorhiza kurroa has caused ruthless extraction from the wild and illegal trade controlling to endangerment of the species. The species is connected by the law income groups in an unscientific manner, which adversely affects the availability of plant.

When the data regarding the medicinal plants was computed and a comparison carried out with the studies and the data published after camp workshop on Medicinal Plant assessment 2003 & 2004, it showed similarity in terms of destruction of National habitat which is continuously causing the species extraction of much important plant at present are as the risk of extinction. Picrorhiza kurroa is endangered [29].

There is an urgent need to safeguard this plant from getting extinct as we know Ayurveda is Shashvata & Ananta but if the useful drugs like this will be endangered then how will Ayurveda work.

Concern Regarding Storage: The area concentration of kutkoside and picroside of Kutki churna at 0 (zero) month is 298651 and

1700726respectively. After 2 months the changes noted inpolythene pack for these two constituents were 179965and 1101023; and in case of foil pack after 2 monthsconcentration were 291248 and 1429390 respectively.

Thus kutkoside degradation in case of polythene packafter 2 months is 39.74% and that of picroside is 35.26%.In case of foil pack the percentage degradation of kutkoside and picroside after 2 months was found to be2.47% and 15.95%. Therefore it is apparently clear that the degradation is more in case of polythene pack than foil pack. Comparison of K4F to K4P shows the value of kutkosideas 243094:176302 whereas values of picroside for the same comparison are 907103:782006. It is further observed that picroside constituent degrades 43.51% in foil packing in 4 months where as kutkoside degrades72% in a foil packing after 4 months. This indicates thatkutkoside is more prone to degradation when stored andpacked in foil packing.

In case if the matter is examined with reference topolythene packing it is observed that picroside degradesto the level of 51.3% after 4 months time whereaskutkoside degrades to the level of 79.56 %. This againclearly indicates that kutkoside is more susceptible tostorage dependent degradation. It is further observed that in both cases i.e. foil as well as polythene packing undersimilar conditions kutkoside is more susceptible todegradation than picroside. However, both kutkoside andpicroside are degraded during prolonged storage. On the basis of the values of the area concentration of the peaksdue to kutkoside and picroside, it can be vary well statedthat these major constituents of Kutaki start degradegradually after a period of two months in both types ofpacking. But the degradation is comparatively more inpolythene pack than the foil pack. This lowers the kutkoside and picroside dependent efficacy of the drug.[30]

Discussion: Overall, the present study established that Picrohizakurroa, katuki of Ayurvedic medicines is a very important herb being used by Ayurvedic Physicians. It has a wide use in Ayurveda and so, it is showing in Modern Pharmacologies actions. It is an important constituent of an important Ayurvedic preparation called “Arogyavardhini Vati” which is used in several disorders ranging from skin, metabolic, viral etc. to reproductive disorders as it helps in “Arogyavardhan” which means helps in Health & curing diseases. From the pharmacologies aspect mentioned above we can see that lots of in vivo, in vitro & CR has been done of Picrorhiza for many diseases involving its different different alkaloids which have shown promising results. It has anti-allergic, anti-asthmatic, anti-diabetic, anti-inflammatory, anti-convulsant activities. Apart from this it even works on tumor and reduces the stress of chemotherapy used in cancer treatment. It has anti-oxidant properties which makes it a scavenger of free radicals and heals gastric ulcers. It has a wide range of use from being neuro-protective to effective in leptospirosis.

The greedless great saints of Ayurveda which contributed to Medicinal knowledge in Ayurveda has mentioned several poly herbal, poly herbo-mineral and single drug that acts on various conditions all together leaving to improved health. Such formulations and single herbs are being tested by the Modern Scientists according to their parameters and age old Ayurvedic concept and its formulations are proving their efficiency in all respect. As the demand of Ayurvedic herbal preparations and its single drugs in increasing worldwide there is a need to conserve and protect the species which have Medicinal properties and are endangered. If strict action and efforts are not taken soon then we should even loose such valuable herbs which are a cure of several diseases. There should be awareness regarding species which are near to exchange and pressure should be reduced on such herb. Mother Nature has given everything to us to carry out our life and important medicinal herbs are also a part of nature which require nothing just conservation and protection that to for us only because at the end they cure our diseases. Masses should be educated regarding important herb like this.

References

1. API, Part-I. (1999). First Edition, Ministry of Health & Family Welfare, Govt. of India, Vol-II
2. Sharma, P.V. (2011). Dravyaguna Vigyan Edition, Chaukhambha Bharati Academy, Vranasi
3. Hall, H., Sällemark, M., Wedel, I. (1984). Acute effects of atypical antidepressants on various receptors in the rat brain. *Acta Pharmacol Toxicol (Copenh)*. 54(5):379-84.
4. Prasad, Bajarang, Pandey, L., Das, Prasun K. & Gambhir, Surendra S.Gambhir, Department of Pharmacology, Institute of Medical Sciences, Banaras Hindu University,Varanasi 221005 (1989). Immunopharmacological Studies on Picrorhiza Kurroa Royle Ex Benth Part VI :

Effect on Anaphylactic Activation Events in Rat Peritoneal Mast Cells, *Ind. J. Physiol. Pharmac*, 33(1): 47-52.

5. Dilnawaz, Pathan and Shirish, Ambavade. (2014). Anticonvolsant Activity Ethanolic Extract Of *Picrorhiza Kurroa. Pharmacophore* 5(1):141-146
6. Joy, K.L. and Kuttan, R. (1999). Anti-diabetic activity of Picrorrhiza kurroa extract. *Journal of Ethnopharmacology***.** 67(2): 143-148.
7. Joy, K.L., Rajeshkumar, N.V., Kuttan, Girija, Kuttan, Ramadasan. (2000). Effect of *Picrorrhiza kurroa* extract on transplanted tumours and chemical carcinogenesis in mice. *Journal of Ethnopharmacology.* 71(1-2) : 261-266.
8. Rajaprabhu, D.**,** Rajesh, R., Jeyakumar, R., Buddhan, S., Ganesan, B. and Anandan, R.. (2007). Protective effect of *Picrorhiza kurroa* on antioxidant defense status in Adriamycin-induced cardiomyopathy in rats. *Journal of Medicinal Plant Research* 1(4): 080-085,
9. Stefanska, J. and Pawliczak, R. (2008). *Apocynin:Molecular Aptitudes*. Hindawi Publishing Corporation, Mediators of Inflammation, Article ID 106507, 10 pages, doi:10.1155/2008/106507.
10. Govindarajan, R., Vijayakumar, M., Rawat, A. K. S. & Mehrotra, Shanta. (2003). Free radical scavenging potential of *Picrorhiza kurroa* Royle ex Benth. *Indian Journal of Experimental Biology*, 41: 875-879.
11. Banerjee, Debashish, Maity, Biswanath, Nag, Subrata K., Bandyopadhyay, Sandip K and Chattopadhyay, Subrata. (2008). Healing Potential of *Picrorhiza kurroa* (Scrofulariaceae) rhizomes against indomethacin-induced gastric ulceration: a mechanistic exploration. *BMC Complementary and Alternative Medicine*, 8:3 dol:10.1186/1472-6682-8-3.
12. Sapna, N. Shetty, Sushma, Mengi, Rama, Vaidya and Ashok, D. B. Vaidya. (2010). A study of standardized extracts of *Picrorhiza kurroa* Royle ex Benth in experimental nonalcoholic fatty liver disease**.** *Journal of Ayurveda and Integrative Medicine*. 1(3) : 203-210.
13. Dwivedi, Y., Rastogi, R., Garg, N.K and Dhawan, B.N. (1991). Prevention of paracetamol-induced hepatic damage in rats by picroliv, the standardized active fraction from Picrorhiza kurroa. *Phytotherapy Research*. 5: 115-119.
14. Yadav, N. and Khandelwal, S. (2006). Effect of Picroliv on cadmium-induced hepatic and renal damage in the rat. *Human Exp. Toxicol., 25: 1-11.*
15. Dwivedi, Y., Rastogi, R., Chander, R., Sharma, S.K., Kapoor, N.K., Garg, N.K. (1990). Hepatoprotective activity of *Picroliv* against carbon tetrachloride induced liver damage in rats. *Indian J Med Res*, 92, 185-200
16. Shukla, B., Visen, P.K., Patnaik, G.K., et al. (1991). Choleretic effect of picroliv, the hepatoprotective principle of Picrorhiza kurroa. *Planta Med*. 57:29-33.
17. Stefanska, J. and Pawliczak, R. (2008). Apocynin: Molecular Aptitudes. *Mediators of Inflammation*, Article ID 106507, 10 pages, doi:10.1155/2008/106507
18. Bastikar, Virupaksha, A., Fulsundar, Shweta, R., Nair, Jagdish, S. (2008). *In Silico* Docking Analysis of Peptide Deformylase (PDF)- A Novel Target for Prophylaxis of Leptospirosis. (Nature Proceedings, Middle East)
19. Scott, Luper, N.D. (1998). A review of plants used in the treatment of liver disease: part1. *Altern. Med. Rev.* 3: 410-421.
20. Eds Satyavati and Gupta, A. K. (1987). Medicinal Plants of India. *Indian council of Medical Research*, volume 2, New Delhi.
21. Lunger, J.G., Gupta, O.P. and Atal C.K. (1981). Clinical trails on *Picrorhiza kurrooa*. *Indian J. Pharmacol.* 13, 98-103.
22. Saraswat B, Visen PKS, Patnaik GK, Dhawan, BN. Anticholestic effect of picroliv, ... chloride induced cholestatis, Indian J Exp. Biol. (993); 31:316.
23. Arvind, S. Negi, J.K. Kumar, Suaib, Luqman, Karuna, Shanker, M.M. Gupta, S.P.S. Khanuja. (2007). Recent Advances in PlantHepatoprotectives: AChemical and Biological Pro¢le of Some Important Leads. *Recent Advances in Plant Hepatoprotectives*, 646-772.
24. Singh, V., Visen, P.K.S., Patnaik, G.K., Kapoor, N.K., Dhawan, B.N. (1992). Effect of picroliv on low density lipoprotein receptor binding of rat hepatocytes in hepatic damage induced by paracetamol. *Ind J Biochem Biophys*. 29:428–432.
25. Shraddha A. Sane. (2010). *Antileishmanial treatment using chemotherapy in combination with immunomodulators in experimental Visceral Leishmaniasis.* Thesis of Division of Parasitology, Central Drug Research Institute (Council of Scientific and Industrial Research) Lucknow-226001, INDIA.
26. Mehrotra, P., Rawat, S., Kulshreshtha, D.K., Patnaik, G.K., Dhawan, B.N. (1990). Invitro studies on the effect of certain natural products against hepatitis B virus. *Indian J. Med. Res.*92: 133–8.
27. Pandey, B.L., Das, P.K. (1989). Immunopharmacological studies on Picrorhiza kurroa Royle-ex-Benth. Part IV: Cellular mechanisms of anti-inflammatory action. *Indian J Physiol Pharmacol.* 33:28-30.
28. Jit Narayan Sah, Vinay Kumar Varshney. (2013). *Chemical constituents of Picrorhiza genus: a review*, American Journal of Essential Oils and Natural Products 2013; 1 (2): 22-37.

29. Rubaya Sultan, Manzoor Ahmad Wani and Irshad A. Nawchoo. (2013). Unabated loss of medicinal plant diversity in B Himalaya: a serious socio-economic concern and urgency to salvage whatever is left. Global Advanced Research Journal of Medicinal Plants (GARJMP) Vol. 2(1) pp. 012-021.
30. Anand S Kahalekar. (2013). Evaluation of Storage Dependent Stability of *picrorhiza Kurroa*powdered Drug(Kutki Churna) by Hplc Study. *Int. J. Res. Ayurveda Pharm. 4(2).*