

Full Length Research paper

## Studies on natural resources, trade and conservation of Kutki (*Picrorhiza kurroa* Royle ex Benth., Scrophulariaceae) from Kumaun Himalaya

Deepshikha Arya<sup>1</sup>, Deepika Bhatt<sup>1</sup>, Ravi Kumar<sup>1</sup>, Lalit. M. Tewari<sup>2\*</sup>, Kamal Kishor<sup>2</sup> and G. C. Joshi<sup>1</sup>

<sup>1</sup>Regional Research Institute of Himalayan Flora, CCRAS, Tarikhet, Ranikhet-263663, India.

<sup>2</sup>Department of Botany, DSB Campus, Kumaun University, Nainital-263 001, India.

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The present study deals with populations, trade and conservation aspect of *Picrorhiza kurroa*. It is a rare and endangered medicinal plant useful in curing many diseases. The study reveals poor relative density of the species in almost all the populations, suggesting the need of careful and immediate conservation of the plant. It is dubious that the species can perform well *ex-situ*, due to its narrow ecological range, and therefore *in-situ* conservation is the best option.

**Key words:** *Picrorhiza kurroa*, conservation, population.

### INTRODUCTION

In India, 814 plant species have been identified as threatened and of these over 113 taxa occur in Indian Himalaya (Nayer and Sastry, 1987, 1988, 1990). Besides these a number of plant taxa deserve attention on account of their dwindling population.

*Picrorhiza kurroa* Royle ex Benth. (Scrophulariaceae) is one such taxon with restricted distribution in sub-alpine regions/ alpine region where its occurrence is limited to specific habitats (Figure 1) and is presently being exploited from the wild on a commercial scale. *P. kurroa* is a well known herb in the Ayurvedic system of medicine and mentioned as an important remedy by Kashyap (1970), Charak (1949) in ancient Ayurvedic literature. It is considered as cholagogue, stomachic, laxative in small doses and cathartic in large doses. Until recently Indian pharmacopoeia also listed *P. kurroa* as an official drug (The pharmacopoeia of India, 1970) Kutki has been used in the indigenous system of medicine since a long time,

the well known drug is spoken 'Dharvantarigrasta'. The plant eaten by Dhanvantari the name 'Kutki' seems to have been derived from Sanskrit name 'Katuka' which means bitter taste. According to the earlier research literature, its roots possess much bitterness and are used medicinally by the natives (Kumar et al., 2012). The root has been described in Ayurvedic texts as an acrid, stomachic and in large doses moderately cathartic and is used in fever dyspepsia and also in purgative preparation (Figure 2).

There are various synonyms of the *P. kurroa*- Kutki, Katuka, Tikta, Katui - means bitterness of taste, Krishnabheda -means blackishness internally when broken, Matsya shakala- means that outer surface of the plant is covered by thin scales as overfish, Chakrangi-means with circular scars. The *P. kurroa* is also bitter in taste marked on its outer part with scaly leaves and cork exfoliates exposing in the black cortex. Although herbs

\*Corresponding author. E-mail: [l\\_tewari@rediffmail.com](mailto:l_tewari@rediffmail.com). Tel: 9412362085 or (05942)237088.



Figure 1. Habit of *Picrorhiza kurroa* Royle.



Figure 2. Dry roots (Raw drug) of *Picrorhiza kurroa* Royle.

had been priced for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. Nowadays, there is a revival of interest with herbal-based medicine due to the increasing realization of the health hazards associated with the indiscriminate use of modern medicine and the herbal drug industries is now very fast growing sector in the international market.

But unfortunately, India has not done well in this international trade of herbal industry due to lack of scientific input in herbal drugs. So, it would be appropriate to highlight the market potential of herbal products and that would open floodgate for development of market potential in India (Satakopan, 1994). Therefore the aim of present work is to study natural resources, trade and conservation aspects of rare and endangered kutki from Kumaun Himalaya.

## MATERIALS AND METHODS

### Study area

A study area (30°6' to 39°15' N latitude and 70°55' to 80°5' E longitude) under investigation is a part of Greater Himalaya in Kumun, India. Altitudes ranges from 2700 to 3500 masl. The area covers two sites Johar valley and Chaudus valley at District Pithoragarh, Uttarakhand. The Market survey was carried out in Ramnagar, Pithoragarh and Tanakpur region of Himalayas.

### Sampling

For the natural resources assessment Johar valley and Chaudus valley area of Pithoragarh district was surveyed. The study area was surveyed extensively and ten populations (7 in Johar valley, 3 in Chaudus valley) were identified (Table 1) on the basis of (a) Habitat attribute (Altitude), (b) Population size and, (c) accessibility for data collection. The total area covered in each site was: Johar valley, 661 ha, Chaudus valley, 326 ha, intensive study of selected populations was carried out during July-August 2009. The herbaceous species was studied by laying 30 quadrats of 1m X 1m (1sq m) size randomly in each study site (Misra, 1968). The size and the number of quadrates were determined by the species curve (Misra, 1968) and the running means methods (Kershaw, 1973). In each quadrat, trees were recorded with >31.5 cm cbh (circumference at breast height that is, 1.37 m above the ground) individually measured. Individuals within the cbh range of 10.5 to 31.4 cm were considered as shrubs +saplings and individuals < 10.5 cm cbh were considered as herbs + seedlings. Individuals of all species were counted in each quadrat. During the field survey of nearby area, knowledgeable people of the village were interviewed for gathering the information on Ethno-medicinal uses of *P. kurroa*.

### Market data

Market survey was carried out in Ramnagar, Pithoragarh and Tanakpur region of Kumaun Himalayas during year 2003 to 2007 during the market survey crude drug samples were collected from Traders and mandis and information on source, rate quality etc were gathered.

Uttarakhand forest department has established government mandis in Ramnagar, Tanakpur, Rishikesh. Marketing is only allowed at these mandis but besides of these Government mandis some Traders, contractors are also working in this field during these studies it was observed that some these imported through Indo-Nepal Border. It is one of the important trade drugs of Kumaun Himalayan region. Because of less availability and high demand of this important crude drug there is a gap between supply and demand. On basis study in of inform gathered by interviewing the traders it is found that *P. kurroa* is collected from Pithoragarh and Champawat District through Bhesaj Sangh, Kumaon Mandal Vikas Nigam Limited and Uttarakhand Forest Development Corporation (UAFDC). Dates of auction have been fixed permanently in these forest depots open auction system is being followed at government mandis.

## RESULTS AND DISCUSSION

Quantitative evaluation of the population of *P. kurroa* is done through quadrat method. Individuals of all the species were counted in each quadrat. Analytical features such as density, abundance and frequency were calculated following Misra (1968). *P. kurroa* commonly traded drug, as Kutki is the substitute of *Gentiana kurroa* Family Gentianaceae (Anonymous, 2000). The density and relative density of the taxon was considerably low (Table 2, Figure 3) indicating the poor viability of the

**Table 1.** Site characteristics of the selected population.

Code	Location	Area covered (ha)	Altitude (masl)	Habitat
P <sub>1</sub>	Laspa	103	3270	<i>Rhododendron</i> forest margin
P <sub>2</sub>	Burfa	90	3330	Alpine slopes
P <sub>3</sub>	Bilju	88	3330	Mixed forest opening.
P <sub>4</sub>	Martoli	130	3500	<i>Betula</i> , <i>Taxus</i> forest.
P <sub>5</sub>	Ganghar	131	3580	Mixed forest opening.
P <sub>6</sub>	Milam I	179	3600	<i>Juniperus</i> mixed forest.
P <sub>7</sub>	Milam II	85	3680	<i>Juniperus</i> mixed forest.
P <sub>8</sub>	Shimdum I	120	2740	<i>Quercus-Abies</i> forest.
P <sub>9</sub>	Shimdum II	98	2780	<i>Rhododendron</i> forest margin.
P <sub>10</sub>	Shimdum III	108	3300	<i>Quereus</i> forest.

**Table 2.** Phytosociological attributes of the saluted population.

Code	Density (Plant/m <sup>2</sup> )	A/F Ratio	RD of <i>P. kurroa</i>	Dominant associates
P <sub>1</sub>	3.7	0.058	4.49	<i>Rumex nepalensis</i> (D.Don) Hook, <i>Danthonia cachemyriana</i> Taub, <i>Anaphalis contorta</i> (D.Don) Hook, <i>Polygonum nepalensis</i> Meissn.
P <sub>2</sub>	1.7	0.046	3.99	<i>Thalictrum pauciflorum</i> Royle, <i>Anemone rupicola</i> Camb., <i>Phoebe lanceolata</i> (Nees) Nees, <i>Rumex nepalensis</i> (D.Don) Hook.
P <sub>3</sub>	1.8	0.05	4.66	<i>Rumex nepalensis</i> (D.Don) Hook, <i>Elsholtzia cristata</i> (Thunb)Heylander, <i>Nepeta elliptica</i> Royle ex Benth, <i>Anaphalis contorta</i> (D.Don) Hook.
P <sub>4</sub>	1.6	0.043	4.60	<i>Agrostis pilosula</i> Trinius, <i>Anaphalis contorta</i> (D.Don) Hook, <i>Danthonia cachemyriana</i> Taub, <i>Saxifraga pulvinaria</i> H Smith.
P <sub>5</sub>	1.3	0.035	3.42	<i>Rumex nepalensis</i> (D.Don)Hook, <i>Danthonia cachemyriana</i> Taub, <i>Poa alpina</i> , <i>Polygonum polystachyum</i> Wall.
P <sub>6</sub>	1.4	0.028	4.20	<i>Poa alpina</i> , <i>Agrosistis</i> sps, <i>Polygonam polystachyum</i> Wall, <i>Anemone</i> Sps.
P <sub>7</sub>	1.2	0.033	3.97	<i>Anemone</i> Sps. <i>Origanum vulgare</i> Linn., <i>Geum alatum</i> Wall, <i>Potentilla</i> sps.
P <sub>8</sub>	1.8	0.036	5.48	<i>Rumex nepalensis</i> (D.Don)Hook, <i>Anaphalis contorta</i> (D.Don) Hook, <i>fragaria nubicola</i> Lindley, <i>Potentilla</i> Sps.
P <sub>9</sub>	2.1	0.025	4.90	<i>Nepeta elliptica</i> Royle ex Benth, <i>Anaphalis contorta</i> (D.Don) Hook, <i>Phoebe lanceolata</i> (Nees) Nees., <i>Rumex nepalensis</i> (D.Don)Hook
P <sub>10</sub>	1.3	0.026	4.49	<i>Rumex nepalensis</i> (D.Don) Hook <i>Polygonum nepalensis</i> Meissn, <i>Artemisia, maritima</i> Linn., <i>Dryopteris barbiger</i> a (Moore) Kuntze.

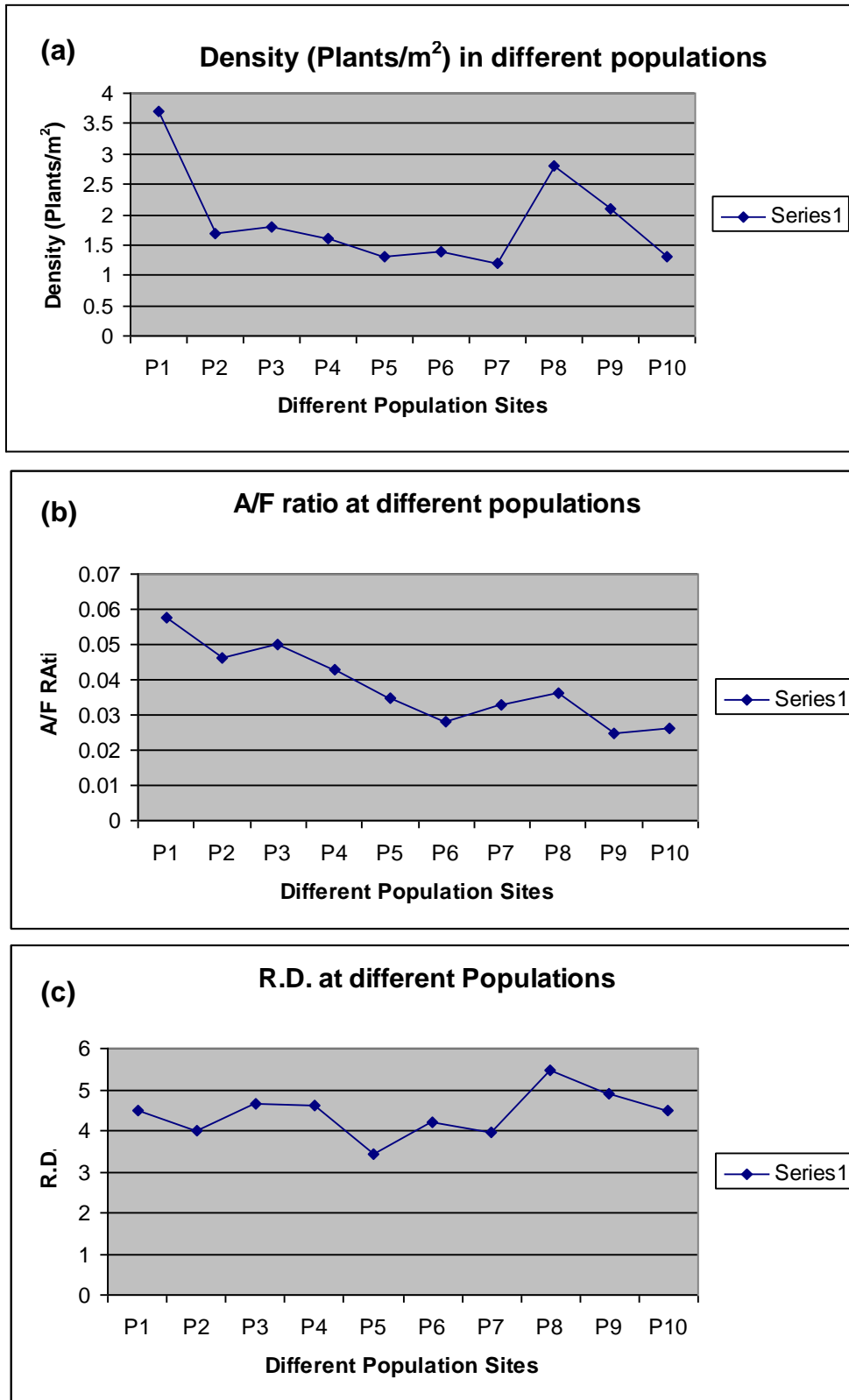
R.D= Relative density, A= Abundance, F = Frequency

species in the area, species showed either contiguous or random distribution. The taxon has been considered rare and threatened in the Himalayan region, particularly due to the destruction of its natural habitats and overexploitation (Collett, 1921; Gupta and Sethi, 1983; Samant, 1994; Tewari et al., 2010). The present study reveals that the species occurs in considerably low densities. Furthermore, the preferred habitat of the taxon is Alpine forest zone and in the Himalaya this zone is

experiencing rapid loss of natural habitat (Anonymous, 1992; Joshi et al., 2010; Pant and Sharma, 2011; Kala, 2000).

### Trades and marketing

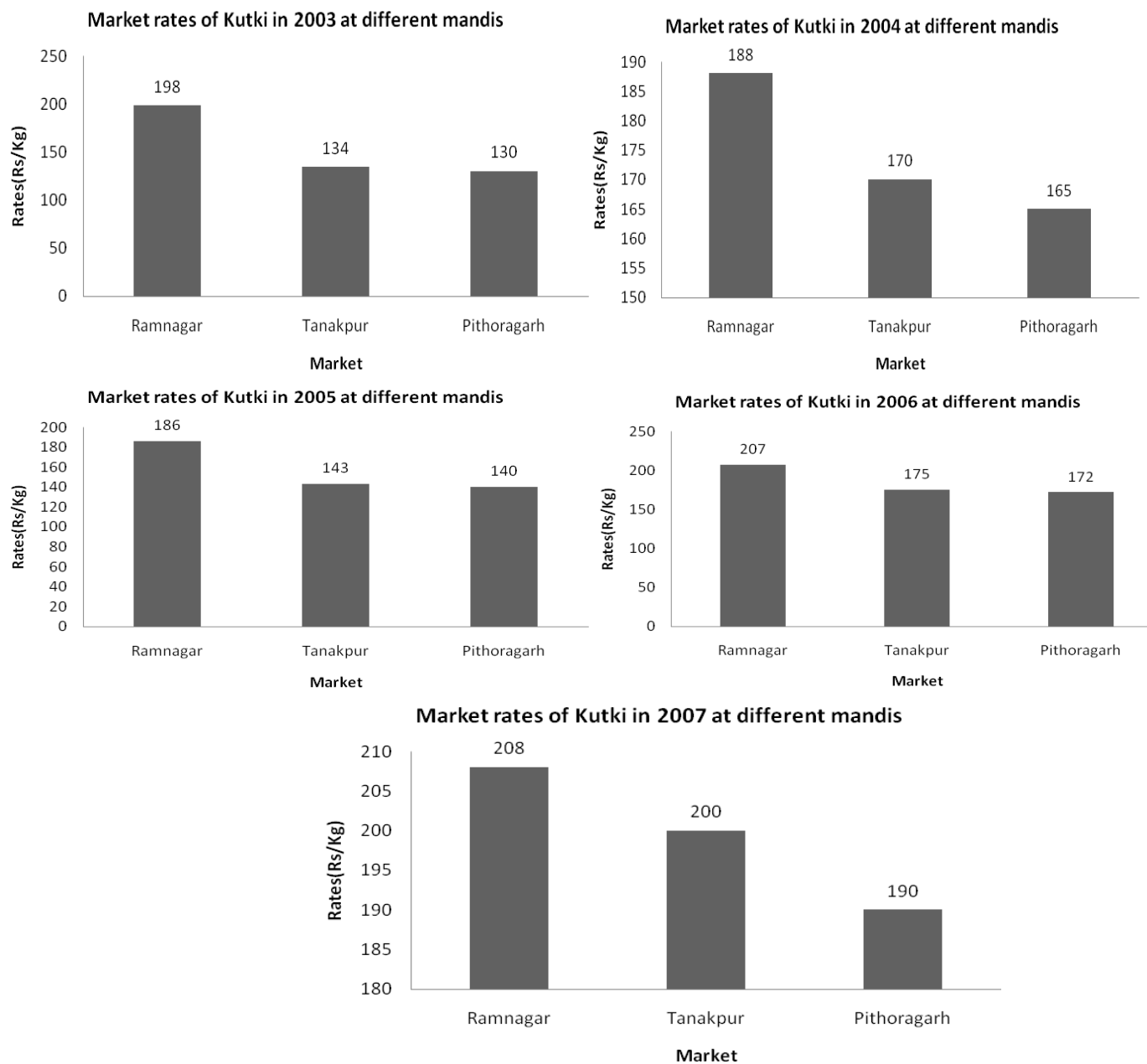
In recent year the medicinal plant products value is increasing worldwide. Medicinal plants are traded



**Figure 3.** Population density, frequency and relative density of Kutki in different sites (a) Density of species in different sites, (b) A/F Ratio of species in different sites, (c) Relative density of species in different sites.

internationally and nationally as dried herbs. Both wild and cultivated varieties are traded mostly in "Crude" or unprocessed forms. The international trade is increasing

for the herbs. Likewise wholesale market for organic herb is increasing particularly in Germany and Switzerland and price premium for such herbs exceeds 25%. The



**Figure 4.** Market rates of Kutki (2003 to 2007).

cultivation, handling, drying, collection, storage and adulterants of the *P. kurroa* is followed before proceeding through different market channels in different forms from crude raw materials to improved raw materials or semi processed material through consumer products to gather information on the medicinal plants in trade, the local Traders and contractors of crude drugs were identified and interviewed, during the course of the present study crude drug samples were collected from different traders and dealers. The information was gathered after extensive market study of crude drug market of Kumaon region. Kutki roots are sold in Rs 375 per kg in the mandi (Figure 4 and Table 3).

During the market survey of Kumaon region it is found that Ramnagar (Nainital District) and Tanakpur (Champawat District) are two established government

mandis for the marketing in Kumaon region. On basis of study and information gathered by interviewing the traders, it is found that *P. kurroa* is collected from Pithoragarh, Champawat District through Bhesaj Sangh, Kumaon Mandal Vikas Nigam Limited and Uttarakhand Forest Development Corporation (UAFDC). Dates of auction have been fixed permanently in these forest depots open auction system is being followed at these mandis (Arya et al., 2012). The medicinal plant produced from their allotted region either from forest or from cultivating source is taken to this existing mandis because marketing is only allowed at these mandis but besides of these government mandis some traders, contractors are also working in this field. During this study it was observed that species were also imported through Indo-Nepal Border. It is one of the important trade drugs

**Table 3.** Rates of *Picrorhiza kurroa* Royle in different markets.

Traded drug	Botanical name	Part used	Market	Years				
				2003	2004	2005	2006	2007
Kutki	<i>Picrorhiza kurroa</i> Royle.	Root	Ramnagar	198	188	186	207	208
			Tanakpur	134	170	143	175	200
			Pithoragarh	130	165	140	172	190

of Kumaon Himalayan region. Because of less availability and high demand of this important crude drug there is a gap between supply and demand.

### Harvesting, drying, collection

The plant should be collected after full maturity. The underground part collected like root, rhizome is done by digging out the entire plant. Sand, dirt and foreign organic particles are removed and plant part should be dried in shady places till it completes dry.

### Storage

Preservation of crude drugs needs sound knowledge of their physical and chemical properties. To maintain the good quality of drug, it should be stored in the premises, which are waterproof and rodent proof. The dried material should be stored in cool dry places. Airtight, moisture proof and lightproof containers should be used in place of wooden boxes and paper bags.

### Ethno-medicinal uses of *P. kurroa*

The species is found valuable among locals in curing the diseases like stomachache and high fever data. Ten gram mildly boiled root decoction flavored with honey is given to cure stomachache for adults; for curing fever 10 g root powder mixed with 1 g black piper and honey is given to the adult patient. 1/4 g powder of Kutki with mother's milk advised for infants to cure stomachache.

### Conclusion

Poor relative density of the species in almost all the population suggests the need of careful and immediate conservation of the plant. It is not very sure that the species can perform well *ex-situ*, owing to its narrow ecological range, and therefore *in-situ* conservation is the best option. Identification of preferred habitats, altitudinal range and the elite populations with respect to below ground biomass will pave the way of re-introduction of the species.

Furthermore, to preserve the important medicinal flora, it is necessary to grow the awareness about the value and uses of the plant among local people and to restrict over exploitation of species from the natural habitats.

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