

Full Length Research Paper

Status and trade of crude drug in Uttarakhand

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The present study deals on crude drug marketing in Tanakpur market, a virgin mandi of Uttarakhand. Survey of Tanakpur mandi was carried out in 2005 and 2008. A complete data of crude drugs in trade was gathered, 65 crude drug samples were collected from different traders of Tanakpur for authentication on taxonomical basis. After critical evaluation, it was found that some of the crude drugs were substituted/adulterated and some crude drugs were imported through Indo-Nepal Borders.

Key words: Crude drugs; Uttarakhand; marketing.

INTRODUCTION

Herbal medicines have been used for treating human ailments from time immemorial. It is well accepted that drugs derived from plants have negligible side effects as compared to their chemical counter parts; therefore, there is a growing global demand for medicines, pharmaceuticals, tonics, cosmetics and other products based on herbal raw material because of their efficacy, safety and minimal side effects. Nearly 75 to 80% of global populations still rely on herbal medicine for primary health care. The unprocessed material or crude drug, as it is commonly known is employed chiefly in the medicines on over-the-counter products (OTC), based on Ayurvedic, Unani, Siddha and other traditional system of medicine practiced in the Indian sub continent (Table 1).

The raw material consist of either the whole plant or one of its vegetative parts, an exudate, fatty or volatile oil having specific therapeutic properties of yielding a physiologically active chemical compound.

Trade in herbal raw material is flourishing day by day. The medicinal and aromatic plants from higher Himalayan Mountains and their products have a very long history of being utilized and traded in the lower Himalayan regions and plains of India.

Uttarakhand State is a part of North Western Himalaya; it shares international boundary with china in the north and Nepal in the east. The nascent state has an area of 5.35 million ha (77°34'27" E to 81°02'22" E Longitudes and 28°53'24" N to 31°27'50" N Latitudes) and is very rich

in vegetation wealth (65% vegetation cover), which comprises of a vast range of important medicinal plants in natural condition. There is a flourishing market of crude drug material in this state. The setup consists of local, regional and central markets.

The medicinal plant sector in the state is peacefully developing. Survey of available literature reveals that about 2500 medicinal plants from Indian sub continent are in local medical use and/or in commerce/trade, especially in the pharmaceutical industries; out of these, 1748 species are from Indian Himalayan region, most of which are found in Uttarakhand region (Anonymous, 1982, 1999; Bentley and Trimer, 1980; Bisht et al., 2008; Kala, 2008; Kirtikar and Basu, 1993; Nadkarni, 1954; Chopra et al., 1956, 1959; Nandarni, 1954; Sarin, 2003, 2008; Singh and Kumar, 2005).

Study area

The present study was carried out across the borderline between India and Nepal in Tanakpur Distt Champawat of Uttarakhand. It is one of the important entry points to India from Nepal. Some of medicinal plants brought to Tanakpur, Champawat district, are from Nepal. Tanakpur is a small town and a municipal board in Champawat distt in Uttarakhand State of India, located at 29.08° N 80.12° E on riverside of Sarda river banks (Figure 1).

METHODOLOGY

To gather information on quantity, rate, source etc, of the medicinal plants in trade, local traders and contractors of crude drugs were

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Table 1. The frequency of occurrence of plant in 1145 important herbal formulation.

S. no.	Botanical name	Common name	No. of herbal formulations
1	<i>Terminalia chebula</i> Retz.	Triphala (Haritaki)	219
	<i>Terminalia bellirica</i> Roxb	(Bibhitaka)	
	<i>Emblica officinalis</i> (Gaertn) Triphala	(Amla)	
2	<i>Glycyrrhiza glabra</i> Linn	Yashtimadhu	141
3	<i>Piper longum</i> Linn	Pipali	135
4	<i>Adhatoda vasica</i> Nees	Vasaka	110
5	<i>Withania somnifera</i> Dunal	Ashwagandha	109
6	<i>Cyperus rotundus</i> Linn	Mustaka	102
7	<i>Tinospora cordifolia</i> (willd) Miers.	Guduchi	88
8	<i>Berberis aristata</i> DC.	Daruharidra	65
9	<i>Tribulus terrestris</i> Linn	Gokshura	65
10	<i>Holarrhena antidysenterica</i> Wall	Kutaja	59
11	<i>Boerhaavia diffusa</i> Linn	Punarnava	52

**Figure 1.** Location of Tanakpur in Uttarakhand.

identified and interviewed. Crude drug samples were collected from different traders and dealers. The field studies were carried out in 2005 and December 2008. The information was gathered after extensive market study of Tanakpur.

A complete check list of all crude drugs and plant parts used in trade was compiled from each traders shop. The information related to their, common trade name, part, rate and their source (that is, the region from where they have been collected) were gathered.

RESULTS AND DISCUSSION

During the course of the present study, 65 crude drug samples were collected from different traders of Tanakpur region for identification on taxonomical basis (Table 2) Figure 2, 3 and 4. The Uttarakhand Forest Development Corporation (UAFDC) has established a

crude drug mandi at Aamwala Depot. Date of auction has been fixed permanently in these depots. Open auction system is being followed at this mandi.

The Uttarakhand Forest Development Corporation was involved in the trade of medicinal and aromatic plant in 2003 to 2004. Collection agencies (UAFDC, Bhesaj Sangh and KMVN) collected the medicinal plant produce from their allotted region either from forest or farmers and bring it to existing mandis because marketing is only allowed at this mandi. The detail of the area, species permitted and royalty rate were to be conveyed to the Bhesaj Sangh, Kumoun Mandal Vikas Nigam, which were to get the medicinal plant parts collected through their registered members/village level cooperatives societies. These agencies receive the plant parts collected by the registered member against payment at specified rates. The forest department then verifies the material, charge royalty and issue transport permit. In Tanakpur forest depot mandi, the medicinal plant comes through KMVN, Pithoragarh, Champawat, Van Vikas Nigam, and Bhesaj Sangh. This approach helps farmer for cultivation of medicinal plant. In Uttarakhand in particular, the National Plant Board has sanctioned 45 projects under commercial scheme during 2003-2004, out of which about 50% of the projects have been sanctioned directly to individual farmers for the cultivation of medicinal plants and remaining are sanctioned to government institutions and NGOs for production of planting material of medicinal plants and research in this sector. Herbal Research and Development Institute (HRDI), which is the nodal agency for medicinal plant sector in the state is working closely with several departments for the development of medicinal plants in the state in the basis of existing climatic conditions in the state and market potential of the species, 14 species have been identified by HRDI as focus species in Uttarakhand. The species are: Kuth (*Saussurea lappa*), kutki (*Picrorhiza kurroa*), chirayata

Table 2. Description of collected crude drugs from Tanakpur mandi of Uttarakhand.

S. no	Trade name	Sanskrit name	Botanical name	Diagnostic character
1 (2 samples from different traders)	Satawar	Satamuli	<i>Asparagus racemosus</i> Willd	Roots are cream to light brown in color and show a number of scars and protuberances of lateral rootlets beside numerous minute wrinkles on the external surface.
2	Charila	-	<i>Parmelia perforata</i> .	Thallus consist of a flattened foliosa structure with a more or less deeply inside upper surface, yellowish white on top and black on the lower surface, leathery to touch; dedicated rhizoid arises from lower surface; odour and taste not distinct.
3 (2 samples from different traders)	Talish patra	Talish	<i>Taxus baccata</i> Linn.	Leaves 15 to 25 mm long and 1 to 2 mm broad, with a prominent midrib and pointed apex occurring free or attached to twigs. Upper surface dark green, waxy, lower pale green in color and somewhat mealy. Taste astringent; odour turbenthinate.
4 (3 samples from different traders)	Meethi Vach	Satwa	<i>Paris pollyphylla</i> J. E. Smith.	Root stock annulate, sometime as large as potato and are odour less
5 (3 samples from different traders)	Manjistha	Manjistha	<i>Rubia cordifolia</i> Linn.	The drug occurs as hard woody pieces of cylindrical root up to 1 cm in diameter. Outer surface of root is smooth, faintly striated longitudinally and rusty brown in colour. Surface of transversely cut root shows a closely adhering bark followed by reddish brown tissue full of minute pores and a hollow center.
6 (2 samples from different traders)	Kapur kachri	Karchura	<i>Hedychium spicatum</i> Buch-Ham	Occurs as whole rhizome or its transversely cut pieces. The rhizome is tuberous, divided into nodes and internodes, reddish brown in colour, with round root scars or rootlets attached at the some places. In market it occurs with a mealy white and starchy cut surface.
7 (3 samples from different traders)	Sikakai	Soptala	<i>Acacia concinna</i> DC.	Pod thick, succulent, strap shaped straight, 3 to 4 by $\frac{3}{4}$ in., depressed between the seeds, the broad sutures narrowed to a short stalk.
8 (3 samples from different traders)	Jatamansi	Jatamansi	<i>Nardostachys jatamansi</i> DC.	Stout, woody, frequently arched rhizome, 2.5 to 8 cm long and up to 1 cm thick, dark grey in colour; densely covered with reddish brown silky fibers which are matted together to form a network. Odour strong, with valerianaceous note; taste aromatic.
9 (2 samples from different traders)	Dalchini	Tamalaka	<i>Cinnamomum tamala</i> Nees	Ovate-oblong coriaceous leaves, strongly three nerved from the base, up to 18 cm long and 6 cm broad. Upper surface leathery, shining olive green in colour. Lower surface rough, bluish-green. The leaf becomes hard and brittle on drying. Odour resembling that of cinnamoum; taste aromatic and astringent.

Table 2. Contd.

10 (2 samples from different traders)	Gur Vach	Bhadra	<i>Acorus calamus</i> Linn.		The whole rhizome is sub-cylindrical or laterally compressed, up to 20 cm long and 1 to 5 cm broad, having a light brown colour. The upper surface shows triangular leaf scars, while lower surface bears small raised circular remnants of roots.
11 (2 samples from different traders)	Retha	Phenila	<i>Sapindus</i> Gaertn.	<i>mukorossi</i>	Dry globular fruits, around 2 cm in diameter. Outer surface shriveled, soapy translucent, golden brown or light brown in colour. There is a heart shaped scars of grayish white or yellowish colour on the attached side. The fruit encloses a loose round or oval seed of black colour.
12	Indrayan seed	Mahendra-Varuni	<i>Citrullus</i> Schrad.	<i>colocythis</i>	Dry light and spongy piece of fruit. Outer surface smooth, yellowish brown in colour in which a number of seed are embedded. The dry pulp breaks into thin flakes. The seed ovoid, flattened, grayish brown in colour. Odour none.
13	Tagar	Sameva, Tagar	<i>Valeriana wallichii</i> DC.		The drug occurs as sub-cylindrical, slightly arched and unbranched rhizomatic rootstock, yellowish brown to dark grey in colour with prominent ring like scars. The under surface is covered with thin tubular roots. Odour strong.
14 (4 samples from different traders)	Daruhalidi	Daruharidra	<i>Berberis aristata</i> DC.		Stem hard pale yellow hard, distinctly radiated with medullary rays. Bark pale yellow brown, closely and deeply furrowed and internally smooth.
15 (3 samples different traders)	Timur	Tumburu	<i>Zanthoxylum</i> Roxb.	<i>alatum</i>	Small spherical fruits of dark brown colour, upto 7 mm in diameter. The outer surface is covered with prominent oily tubercles, frequently dehiscent half way exposing an oily globular seed of shining black colour lined with white papery membrane. Odour acrid and aromatic.
16 (3 samples from different traders)	Pappali	Tikshnata ndula	<i>Piper longum</i> Linn.		Fruit cylindrical, blunt, straight twisted or slightly curved spikes with a rough beady surface of grayish brown or greenish black colour. Odour strong and spicy taste aromatic and pungent, leaving burning sensation in the mouth.
17 (4 samples from different traders)	Kutki	Katuka	<i>Picrorhiza kurroa</i> Royle		Straight or slightly arched, cylindrical rhizome. Outer surface, grey or creamish brown in colour, bearing impressions of round root scars and numerous scales. Odour faint agreeable; taste very bitter and long lasting.
18 (4 samples from different traders)	Amla	Adiphala, Amalki	<i>Emblica</i> Gaertn.	<i>officinalis</i>	Pieces of dry sub hexagonal fruit with hard fleshy and a wrinkled surface of yellowish brown or grayish green colour. The drug often contains triangular seeds of yellowish brown colour. Odour mid characteristic; taste acidic and astringent.

Table 2. Contd.

19 (2 samples from different traders)	Bidarikand	Vidarikand	<i>Pueraria tuberosa</i> DC.	Partially dry tuber or its dried transversely sliced pieces. The tuber is globular or pear shaped. The outer surface of the tuber is yellowish brown in colour, wrinkled and transversely fissured bearing beady spots. The pulp is a white spongy, highly fibrous tissue. Taste sweet mucilaginous. Sliced pieces are rough with creamish white fibrous pulp, which exfoliates in papery flakes.
20 (4 samples from different traders)	Nepali chirayita	Kairata	<i>Swertia chirayita</i> (Roxb. Ex Fleming) Karst.	Occurs as whole herb consisting of a short taproot, pieces of stem and leaves. The stems are topped with branched corymbose panicles bearing dry flowers or shining brown or dark green capsules. Stem cylindrical at lower and middle portion but bluntly quadrangular in upper parts having a smooth surface of rust brown or purplish green colour. Leaves broadly lanceolate, cordate at base. Taste bitter.
21 (3 samples from different traders)	Kuth	Kustha	<i>Sassurea lappa</i> C. B. Cl	Dry root slightly arched or twisted with a rough surface of dull or light brown colour brown colour bearing longitudinal wrinkles and small tubercles. Surface of transversely sliced root is brownish white in colour with a thin ring representing periderm, followed by a woody portion with fine radial striations and central pith, which is hollow in some older roots.
22 (2 samples from different traders)	Sarpagandha	sarpagandha	<i>Rauvolfia serpentina</i> Benth ex Kurz.	Stout, cylindrical, tortuous, somewhat crooked roots, occurring whole or as transversely cut pieces. The external surface is rough, longitudinally fissured, yellowish brown in colour, bearing occasional root scars. In older roots, the bark becomes thick, corky and friable, and constitutes a substantial part of root biomass. Taste very bitter.
23 (2 samples from different traders)	Pashan bheda	Pashan bheda	<i>Bergenia ciliata</i> (Haworth) Sternb.	Rhizome solid, barrel shaped, cylindrical, 1.5 to 3 cm long, and 1 to 2 cm in diameter with small root scars brown in colour.
24 (3 samples from different trader)	Guduchi	Guduchi	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook. f & Thoms	Cylindrical soft stem, outer surface, grayish brown to almost black in colour, longitudinally wrinkled, warty and covered with raised lenticles. The bark peels off in thin papery flakes. Transversely cut surface of the stem shows a wedge shaped structure formed by radiating medullary rays. Very bitter taste.
25	Bail	Bilva	<i>Aegle marmelos</i> Correa ex Roxb.	Peeled and dried unripe fruits cut into halves or quarters, the cut surface show a hardened sticky or glutinous pulp of light orange or honey colour, having a number of radially arranged cells in each of which an oblong, compressed and hairy seed is embedded. Odour-faintly aromatic, taste mucilaginous, astringent and agreeable.

Table 2. Contd.

26 samples from different traders)	(3 from Rohini kampillaka	<i>Mallotus philippinensis</i> (Lam.) Muell.-Arg.	The drug occurs as course resinous powder of crimson or brick red colour consisting of numerous spherical glands, thick walled stellate hair and cellular fragments of cell wall. Taste gritty and oily, the powder is inflammable and resists admixture with water.
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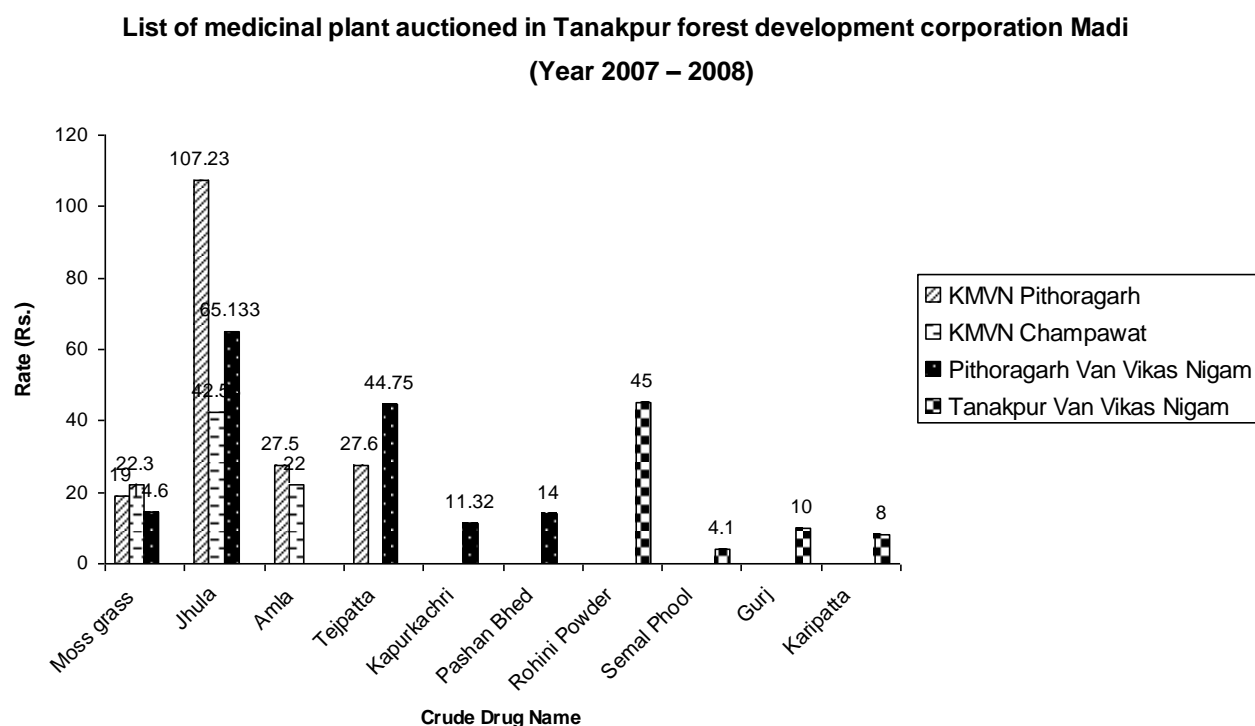


Figure 2. List of medicinal plant auctioned in Tanakpur forest development corporation Mandi.

(*Swertia chirayata*), lavender (*Lavender angustifolia*), sargandha (*Rauvolfia serpentina*), tagar (*Valeriana wallichii*), atish (*Aconitum heterophyllum*), kalihari (*Gloriosa superba*), jatamansi (*Nardostachys jatamansi*), bankakri (*Podophyllum hexandrum*), pangar (*Aesculus hippocastanum*), honeyplant (*Ammi majus*), holy thistle (*Silybum marianum*) and *Herracleum candicans*. Initially, HRDI had taken 7 Districts namely Uttarkashi, Chamoli, Dehradun, Nainital, Udham singh Nagar, Haridwar and Pithoragarh for cultivation of selected species under Agri Export Zone (AEZ). Availability of planting materials is the basic challenge in promotion of cultivation of medicinal plants in the state. To find out the solution, three herbal gardens at Muni-ki reti, Rishikesh, Selaqui (District Dehradun) and Mandal, Gopeshwar have been established by HRDI and establishment of many small nurseries and herbalgardens is being undertaken with the help of the Forest Department and others. However, during the course of study, it was observed that this was not being followed. Besides, these government agencies,

a number of traders, stockholders in the medicinal plant trade sector, also engage local people in collection of the medicinal plant. They get cash payment by selling medicinal plant. Due to this, the local collectors did not get this actual share due to the lack of right information about the price of the medicinal plant. After detail studies, it was observed that some of these crude drug like *Nardostachys jatamansi*, *Picrorhiza kurroa*, *Arnebia benthami*, *Swertia chirata*, *Zanthoxylum armatum* etc, are imported through Indo-Nepal borders. After collection of crude drug sample, to ensure correct identification (on Taxonomic bases) and authentication, detailed comparative studies of samples were carried out. And, it was observed that substituted and adulterated drug is also available in trade. Consequently, due to less availability of medicinal plants and to meet the growing demand of these plants, there is a gap in demand and supply that lead to adulteration and substitution for genuine material.

Result obtained after critical study of the crude drug sample received for identification is shown in Table 3, 4,5

Crude drug Traded in Tanakpur Mandi during 2008

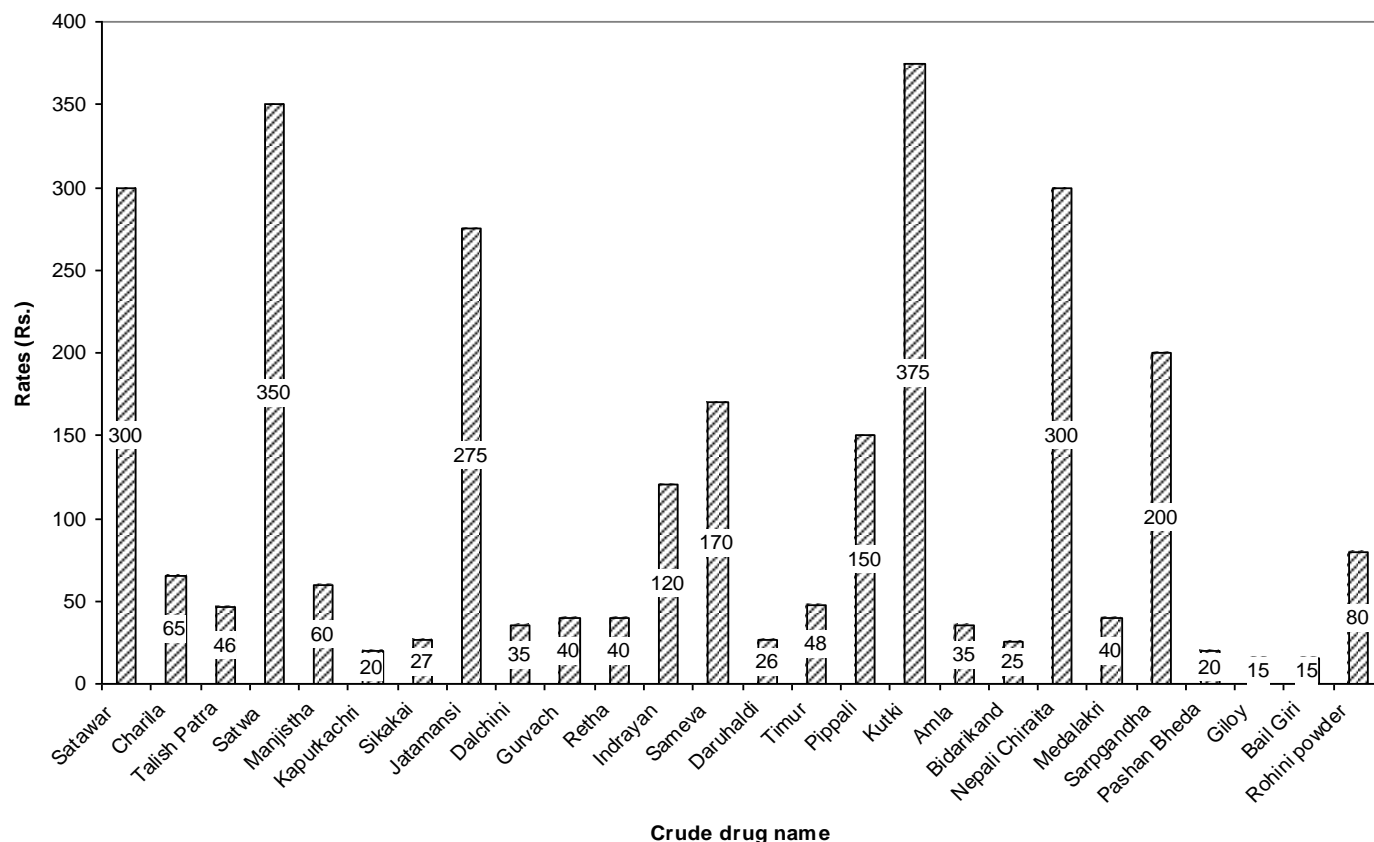


Figure 3. Crude drug Traded in Tanakpur Mandi during 2008

and 6.

Daruharidra

The root or root bark of *Berberis aristata* DC. is considered the true source of 'daruharidra' in Ayurvedic text. The root in this case is hard, cylindrical, and more or less karkarled.

Outer surface of this material is corky and greyish-brown. *Berberis lycium* Royle is a usual adulterant. It has smooth grayish white bark with deep yellow wood. The alkaloid content in this material is comparatively low. Part used: Root and root bark. Action and uses: The drug is credited with diaphoretic, bitter tonic alterative and stomachic properties. It is used in the treatment of jaundice, hemorrhoids, urino-genital disorders and skin diseases.

Chirayata

S. chirata (Roxb ex Fleming) Karst. is an 'endangered'

plant in India. Stem of the plant is smooth, externally yellowish or purplish brown, it is quadrangular, it has bitter taste, and stem is porous. The market drug is mixed with other species *Swertia angustifolia* Buch-Ham, having winged quadrangular stems, is less bitter and possesses no pith in their square stem. Part uses: Whole plant.

Action and uses: The drug is credited with bitter tonic febrifuge and stomachic properties. It is used in fever urinary disorders anorexia.

Jatamansi

Nardostachys jatamansi DC. is the true source of Jatamansi, it has dark grey rhizome crowned with reddish brown tufted fibrous basal portions of petioles in old radical leaves. Roots of various species of *Selinum* are used as jatamansi. The root in this case is covered with stiff leaf base of dusty green color which has camphoraceous odour.

Part used: Root stock. Action and uses: The drug is credited with sedative antispasmodic and anti-arrhythmic



Figure 4. A) Market sample of Chirayata (*Swertia chirata* (Roxb ex Fleming) Karst); B) Original sample of Chirayata (*Swertia chirata* (Roxb ex Fleming) Karst); C) Market sample of Jatamansi (*Nardostachys jatamansi* DC.); D) Original sample of Jatamansi (*Nardostachys jatamansi* DC.); E) Original sample of Hemvati vaca (*Paris polyphylla* J.E. Smith); F) Market sample of Hemvati vaca (*Paris polyphylla* J.E. Smith); G) Market sample of Indrayan seed (*Citrullus colocynthis* Schrad); H) Original sample of Manjistha (*Rubia cordifolia* Linn); I) Market sample of Manjistha (*Rubia cordifolia* Linn.); J) Market sample of Daruharidra (*Berberis aristata* DC); K) Original sample of Daruharidra (*Berberis aristata* DC.).

Table 3. Major trade companies in Tanakpur.

S. no	Trading company
1	Agrawal Trading Company; Ward No- 1 Tanakpur
2	Ratan Lal and Sons; G. B. Pant Marg, Tanakpur Distt. – Champawat.
3	Jagdish Narayan Hari Mohan, Ward No- 2, Tanakpur Distt – Champawat.
4	Himalayan Jari Booti Centre, Bus Station Road, Tanakpur
5	A. S. Sarda Enterprises, Nehru Marg, Tanakpur Distt. – Champawat
6	Sharda Brothers, Tanakpur
7	Uttarakhand Forest Development Corporation (UAFDC), Aamwala Depot Punagiri Road, Tanakpur

Table 4. List of herbal material auctioned from Tanakpur Forest Development Corporation Mandi year 2007-2008.

Medicinal plant name	Rate (Rs.)	Collected by
Moss Grass	19/-	KMVN Pithoragarh
-do-	22.30/-	KMVN Champawat
-do-	14.60/-	Pithoragarh Van Vikas Nigam
Jhula	107.23/-	KMVN Pithoragarh
-do-	42.58/-	KMVN Champawat
-do-	65.133/-	Pithoragarh Van Vikas Nigam
Amla	27.50/-	KMVN Pithoragarh
-do-	22/-	KMVN Champawat
Tejpatta	27.60/-	KMVN Pithoragarh
-do-	44.75/-	Pithoragarh Van Vikas Nigam
Kapurkachri	11.32/-	Pithoragarh Van Vikas Nigam
Pashan Bhed	14/-	-do-
Rohini Powder	45/-	Tanakpur Van Vikas Nigam
Semal Phool	4.10/-	-do-
Gurj	10/-	-do-
Karipatta	8/-	-do-

Table 5. Crude drugs traded from the Tanakpur mandi.

S. no.	Trade name	Botanical name	Local name	Part used	Rate
1	Satawar	<i>Asparagus racemosus</i> Willd	Satawar	Root	300/-
2	Charila	<i>Parmelia perforata</i>	Charila	Whole plant	65/-
3	Talish patra	<i>Taxus baccata</i> Linn	Talish patra	Leaves	46/-
4	Satwa/Meethi vach	<i>Paris polyphylla</i> J.E Smith	Satwa	Rhizome	350/-
5	Manjistha	<i>Rubia cordifolia</i> Linn	Manjistha	Stem	60/-
6	Kapur Kachri	<i>Hedychium spicatum</i> Buch-Ham	Kapur kachri sathi	Rhizome	20/-
7	Sikakai	<i>Acacia concinna</i> DC	Sikakai	Fruit	27/-
8	Jatamansi	<i>Nardostachys jatamansi</i> DC	Jatamansi	Root	275/-
9	Dalchini	<i>Cinnamomum tamala</i> Nees & Ebern	Dalchini	Bark	35/-
10	Gurvach	<i>Acorus calamus</i> Linn	Vach	Rhizome	40/-
11	Retha	<i>Sapindus mukorossi</i> Gaertn	Retha	Fruit	40/-
12	Indrayan	<i>Citrullus colocynthis</i> Schrad	Indrayan	Seed	120/-
13	Sameva	<i>Valeriana wallichii</i> DC	Tagar, Sameva	Root	170/-
14	Daruhaldi	<i>Berberis aristata</i> DC	Kilmora, Daruhaldi	Stem	26/-
15	Timur	<i>Zanthoxylum alatum</i> Roxb	Timur	Fruit	48/-
16	Pippali	<i>Piper longum</i> Linn	Pippali	Fruit	150/-
17	Kutki	<i>Picrorhiza kurroa</i> Royle ex Benth.	Kutki	Root	375/-
18	Amla	<i>Embllica officinalis</i> Gaertn.	Amla	Fruit	35/-
19	Bidarikand	<i>Pueraria tuberosa</i> DC.	Bidarikand	Tuberous root	25/-
20	Nepali Chiraita	<i>Swertia chirata</i> Buch-Ham	Chiraita	Whole plant	300/-
21	Kustha	<i>Saussurea lappa</i> C.B. Cl	Kuth	Root	300/-
22	Sarpgandha	<i>Rauwolfia serpentine</i> Benth ex Kurz	Sarpgandha	Root	200/-
23	Pashan Bheda	<i>Bergenia ciliata</i> (Haworth) Sternb.	Pashanbhed	Rhizome	20/-
24	Giloy	<i>Tinospora cordifolia</i> (Willd) Miers ex Hook	Giloy, Gurj	Stem	15/-
25	Bail giri	<i>Aegle marmelos</i> Correa ex Roxb	Bail giri	Fruit	15/-
26	Rohini power	<i>Mallotus philippinensis</i> Muell Arg.	Rohini	Fruit Power	80/-

Table 6. Sample name with part used and substitute adulterant.

S. no.	Sample name	Part	Sample expected as	Substitute/adulterant
1	Methi voch, satwa	Rhizome	<i>Paris polyphylla</i> J.E. Smith	<i>Acorus calamus</i> Linn
2	Manjistha	Stem	<i>Rubia cordifolia</i> Linn	<i>Rubia cordifolia</i> Linn stem
3	Indrayan Seed	Seed	<i>Citrullus colocynthis</i> schrad	<i>Trichosanthes palmata</i> Roxb
4	Daruharidra	Stem	<i>Berberis aristata</i> DC	<i>Berberis lycium</i> Royle
5	Nepali Chiraita	Whole plant	<i>Swertia Chirata</i> Buch-Ham	<i>Swertia angustifolia</i> Buch-Ham
6	Jatamansi	Root	<i>Nardostachys jatamansi</i> DC	<i>Selinum</i> sps.

properties. It is used in high blood pressure, palpitation of heart hysteria.

Manjistha

Rubia cordifolia Linn is the truly traded manjistha; outer surface of root is smooth, rusty brown, and is faintly striated longitudinally. The drug is adulterated with pieces of stem of *R. cordifolia* Linn which are 4 angular, scabrid angles.

Part used: Root

Action and uses: The drug is credited with alterative expectorant and emmenagogue properties. It is used for curing cough, rheumatism and hepatic affections.

Hemvati vaca

Paris polyphylla J. E. Smith rootstock is annulate, sometimes as large as a small potato and is substituted by *Acorus calamus* Linn, rhizome is woody branched, light, aromatic with distinct nodes and internodes, nodal region are broad with leaf scars.

Part used: - Rhizome

Action and uses: Rhizome is used as anthelmintic and tonic.

Indrayan seed

Citrullus colocynthis Schrad is truly traded Indrayan seed which is compressed ovoid, yellowish seeds, odour slight, intensely bitter. The drug is adulterated by *Trichosanthes palmata* Roxb whose seed are reddish brown and compressed.

Part used: Fruit

Action and uses: *Colocynthis* is in moderate dose, drastic hydrogogue cathartic, diuretic, in large doses emetic, and gastro intestinal irritant. It is used in puerperal disorders, abortifacient, and dropsy; oil from seed is useful in hair growth.

Conclusion

The present studies show the market strategies of

medicinal and aromatic plants in Uttarkhand in general, and Tanakpur in particular. It revealed the importance of market studies on crude drugs and to the primary processing industries where value addition is done, and the chain of flow of raw materials up to the mandis. The marketing opportunities and means of accessing the market have also been sorted out in the study from which both planning and operation of marketing can be developed. Detail market information makes the market more transparent, so that the traders can make more informed on choice of product and sale. It will also help in availability of genuine crude drug material in these markets, and it further strengthens the potency of herbal product as well as improves the efficacy of the indigenous health care practices.

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