



## ADULTERATION AND SUBSTITUTION IN ENDANGERED, COSTLY HERBAL MEDICINAL PLANTS OF INDIA, INVESTIGATES THEIR ACTIVE PHYTOCHEMICAL CONSTITUENTS

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### ABSTRACT

Indian herbal medicinal plants used from last several decade as a traditional and alternative medicine. In 21th and 22th century generation are becoming aware of the side effect and adverse reaction of synthetic drugs and so there is an increasing interest, Scope of innovate in herbal medicinal plants based branded, patent, Sashetra-oshadhi, proprietary Ayurvedic, Sidha, Unani (ASU.) herbal medicines for their natural effective standard quality medicated cure. But the adulteration and substitution in endangers and rare costly medicinal raw herbs are the burning problem in herbal pharmacy and modern pharmaceutical industry. It has caused a major treat in the research and development on commercial natural products. The deforestation of high altitude, interior forest areas and extinction for hill areas resort and hotel construction in interior forest. Resulted many high altitude endangered and rare costly original medicinal species such as are Vatsnabh, (*Aconitum Chasmanthum stap fex. Haimes*), Ativisha or Atis, (*Aconitum heterophyllum Wall.Ex.Royal*), Kutki, (*Picrorhiza kurroa royleex*), Kuth or Kustha, (*Saussurea lappa C.B.CL.*), Puskarmool, (*Inula racemosa Hook.F.*), Riddhi, (*Ho benariaintemedia D.Don*), Vriddhi, (*Habenaria edgeworthii Hook.f.ex.Collett*), Kakoli, (*Rosea purpurea Smith*), Kshirakakoli, (*Fritillaria roylei Hook*) and (*Lilium polyphyllum D.Don*), Jeevak, (*Crepipium acuminatum D.Don.*)Szlach.), Meda, (*Polygonatum verticillatum (Linn.) Allioni*), Mahameda, (*Polygonatum cirrhifolium (wall.) Royal*) and (*Polygonatum Verte cillatum Alloi*), Rakta Chandana, Sandal Surkh, (*Pterocarpus santalinus Linn.*), Sveta Chandana, Sandal Safed, (*Santalum album Linn.*), Kesar, Keshar or KumKum, Zafran, (*Crocus sativus Linn.*) etc. completely endangered and incorrect identification intestinally or unintentionally of many endangered and costly, ASU. herbal medicinal plants of India has effectively adulterated and substituted in condition. In the present communication research review has investigates and reported with their active phytochemical constituents, taxonomical as well as extensive ethnobotanical authentication in selective several endangered and costly medicinal plants.

**Key Words:-** Adulteration, Substitution, intestinally or unintentionally endangered, costly, spurious, Ayurvedic, Sidha, Unani (ASU.).

### INTRODUCTION

Natural sources of medicinal plants are after

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unable to meet demand for popular herbal products. Populations of many species have limited distribution in their natural habitats, requiring conservation strategies for protection. Unavailability of such medicinal plants has led to arbitrary substitution and adulteration in raw drug market. Adulteration it is a practice of substituting the

original crude drug partially or fully with other substances which is either free from or inferior in therapeutic and chemical properties or addition of low grade or spoiled or spurious drugs or entirely different drug similar to that of original drug substituted with an intention of enhancement of profits. A adulteration may also be defined as mixing or substituting the original drug material with other spurious, inferior, defective, spoiled, useless other parts of same or different plant or harmful substances or drug which do not confirm with the authenticated official standards. a drug shall be deemed to be adulterated if it consists, in whole or in part, of any filthy, putrid or decomposed substance. A treatise published two centuries ago (in 1820) on adulterations in food and culinary materials is a proof for this practice as an age-old one. Due to adulteration, faith in herbal drugs has declined. Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products. Many researchers have contributed in checking adulterations and authenticating them. It is invariably found that the Adverse Event or side effects Reports are not due to the intended herb, but rather due to the presence of an unintended herb. Medicinal plant dealers have discovered the scientific methods in creating adulteration of such a high quality that without microscopic and phytochemical and physicochemical analysis, it is very difficult to trace these adulterations. Medicinal plants constitute an effective source of traditional (e.g., Ayurvedic, Chinese, Homeopathy and Unani) and modern medicine. Herbal medicine has been shown to have genuine utility. Germany and France, together represent 45% of the \$23 billion global retail market as per current expect 2013 year. In India, about 80% of the rural population depend on medicinal herbs and/or indigenous systems of medicine. In fact today, approximately 70% of "synthetic" medicines are derived from plants. Popularity among the common people increased the usage of medicinal plants/herbal drugs. Herbal adulteration is one of the common malpractices in herbal raw material trade.

## MATERIAL AND METHODS

Complete Information about the plant of Adulteration and Substitution in endangered, costly Ayurvedic Siddha Unani (ASU.) Indian medicinal plants (Actual confirmation of Plant Occurrence, Harvesting, Cultivation, authenticated plant species and family, photographs etc, ) were collected of source from standard, authenticated online world encyclopedia, High altitude medicinal plants Archie and flora online Google searching engine or authenticated text, Wealth of India 1948-1976 (CSIR.), Anonymous, 2000, Quality control methods for medicinal plant materials, World Health Organization,

Geneva, ( Anonymous The Ayurvedic Pharmacopeia of India, part-I, Volume I to VI, First Edition., Anonymous The Unani Pharmacopeia of India, part-I, Volume I to VI, First Edition.) and authenticated literature survey by the scientific help of botanical, taxonomists expertise researchers of Research council (ISM.,AYUSH.) and another's extensive, authenticated related literature survey has done from FRI., Deheradun, Uttarakand state, PLIM. (AYUSH.), Ghaziabad, Utterperdash state, NIPER., Mohali, Chandigarh, Punjab state, India. Adulteration and substitution in medicinal plants has also conformably reported by several related references mention as ; (Vasudevan, 1983; Uniyal, 1987; Tewari. 1991; Sunita. 1992; ,1993, 1997; Sarin, 1996; Pandeya, 1997; Afaq, 1999; Saraswathy, 2001; Mukhrjee, 2002; Mishra *et al.*, 2002; Gupta, 2003; Dubcy, 2004; Chunekar, 2004; Shastri, 2005; Kokate *et al.*, 2007; Poornima, 2010; Balkrishna *et al.*, 2012; Roy *et al.*, 2013) for identification and conformity of endangers, original Herbs adulteration and substitution appearance found in various plant, species naturally growing in Himachal and Nothen Himalayan higher altitude from 1200 to 4500 m asl. hill valleys and dense forest areas of Himachal and Uttarakhand state, various region of India. Selective and reported plant species were confirmed and identified with the help of standard flora, standard Ayurvedic and Unani pharmacopoeia Govt. of India, various reported volume in part fist- Single drugs, Standard connected text books authenticated references, noted were prepared on their morphological attributes (Krishnamurthi *et al.*, 1969; Zalkaw 1984; Soler *et al.*, 1988; Paraschas, 1990; Wang *et al.*, 1991; Okugawa *et al.*, 1995; Angers *et al.*, 1996; Divivedi *et al.*, 1997; Rastogi *et al.*, 1998; Chouhan, 1999; Sabinsa, 2000; Singh *et al.*, 2004; Joshi *et al.*, 2005; Chatterjee *et al.*, 2005; Kant *et al.*, 2005; Tahir *et al.*, 2007; Robinson *et al.*, 2008; Shah and Seth, 2010; Mohan *et al.*, 2010; Rehman *et al.*, 2011; Javed *et al.*, 2012; Sarkar *et al.*, 2012; Bohuguna *et al.*, 2012&2013; Andola *et al.*, 2013). As well as another authenticated reference has reported in research survey or references (Ved *et al.*, 2003; Venkatachalam *et al.*, 2006; Burdock *et al.*, 2008; Warnke *et al.*, 2009; Kareparamban *et al.*, 2010; Nulu *et al.*, 2010; Srivastava *et al.*, 2010; Mandalari *et al.*, 2010; Shah *et al.*, 2013; Sharma *et al.*, 2013;) for identification and conformity of extensive authenticated selective and reported plant species were confirmed and identified with the help of standard ethnobotanical flora, species, family as well as these reported active phytochemical constituents of rare and costly raw medicinal plants of India.

**Types of Adulterants presence in endangered and costly herbal raw drugs**

Drugs are generally adulterated or substituted with substandard, inferior or artificial drugs.

#### **Using substandard commercial varieties**

Adulterants resemble the original crude drug morphologically, chemically, therapeutically but are substandard in nature and cheaper in cost. This is the most common type of adulteration.

#### **Using superficially similar inferior drugs**

Inferior drugs may or may not have any chemical or therapeutic value. They resemble only morphologically, so due to its resemblance they are used as adulterants.

#### **Using artificially manufactured substance**

The drug is adulterated with the substance which has been prepared artificially. The artificially manufactured substance resembles the original drug. This method is followed for the costlier drugs.

**Using exhausted drug:** The same drug is admixed but that drug is devoid of medicinally active substance as it has been extracted already. Mainly volatile oil containing drugs like clove, coriander, fennel, caraway are adulterated by this method. As it is devoid of colour and taste due to extraction, natural colour and taste is manipulated with additives.

**Using of synthetic chemicals to enhance natural character:** Synthetic chemicals are used to enhance natural character of the exhausted drug. Examples: citral is added to citrus oils like lemon and orange oils.

**Presence of vegetative matter of same plant:** Some miniature plants growing along with the medicinal plants are added due to their colour, odour, and constituents.

**Harmful adulterants:** Some are harmful materials as the adulterant, are collected from market waste materials and admixed with the drug. It is done for the liquid drugs.

**Adulteration of powders:** The drugs which are in the form of powders are frequently adulterated. Examples: dextrin is added in ipecacuanha, exhausted ginger in ginger, red and white sandal wood powders in red and white capsicum powders and powdered bark adulterated with brick powder.

**Reason of adulteration of endangered and costly herbal raw drugs**

**Confusion in vernacular names**

**Lack of knowledge about authentic source:** Nagakesar

is one of the important drugs in Ayurveda. The authentic source is *Mesua ferrea*. However, market samples are adulterated with flowers of *Calophyllum inophyllum*. Though the authentic plant is available in plenty throughout the Western Ghats and parts of Himachal or J&K State, Himalaya's valleys, suppliers are unaware of it. There may also be some restrictions in forest collection. Due to these reasons, *C. inophyllum* (which is in the plains) is sold as Nagakesar. Authentic flowers can be easily identified by the presence of two-celled ovary whereas in case of spurious flowers they are single celled.

#### **Similarity in morphology**

*Mucuna pruriens* is adulterated with other similar Papilionaceae seeds having similarity in morphology. *M. utilis* (sold as white variety) and *M. deeringiana* (sold as bigger variety) are popular adulterants. Apart from this *M. cochinchinensis*, *Canavalia virosa* and *C. ensiformis* are also sold in Indian markets. Authentic seeds are up to 1 cm in length with shining mosaic pattern of black and brown color on their surface. *M. deeringiana* and *M. utilis* are bigger (1.5-2 cm) in size. While *M. deeringiana* is dull black and *M. utilis* is white or buff colored.

#### **Lack of authentic plant**

*Hypericum perforatum* is cultivated and sold in European markets. In India, availability of this species is very limited. However, the abundant Indo-Nepal species *H. patulum*, sold in the name of *H. perforatum*. Market sample is a whole plant with flowers and it is easy to identify them taxonomically. Anatomically, transverse section of *H. perforatum* stem has compressed thin phloem, hollow pith and absence of calcium oxalate crystals. Whereas *H. patulum* has broader phloem, partially hollow pith and presence of calcium oxalate crystals.

#### **Similarity in color**

It is well known that with course of time, drug materials get changed to or substituted with other plant species. 'Ratanjot' is a recent day example. According to the suppliers and non-timer forest product (NTFP.) contractors, in the past, roots of *Ventilago madraspatana* were collected from Western Ghats, as the only source of 'Ratanjot'. However, that has not been practiced now. It is clearly known that *Arnebia euchroma* var *euchroma* is the present source. Similarity is in yielding a red dye, *A. Euchroma* substitutes *V. madraspatana*. Recently *V. madraspatana* is not found in market. Whatever is available in the market, in the name of Ratanjot is originated from *A. euchroma*.

### Careless collections

Some of the herbal adulterations are due to the carelessness of herbal collectors and suppliers. *Parmelia perlata* is used in Ayurveda, Unani and Siddha. It is also used as grocery. Market samples showed it to be admixed with other species (*P. perforata* and *P. cirrhata*). Sometimes, *Usnea* sp. is also mixed with them. Authentic plants can be identified by their thallus nature.

### Unknown reasons

'Vidari' is another example of unknown authentic plant. It is an important Ayurvedic plant used extensively. Its authentic source is *Pueraria tuberosa* and its substitute is *Ipomoea digitata*. However, market samples are not derived from these two. It is interesting to know that an endangered gymnosperm *Cycas circinalis* is sold in plenty as Vidari. The adulterated materials originated from Kerala, India. Though both the authentic plant and its substitute are available in plenty throughout India, how *C. circinalis* became a major source for this drug is unknown. *P. tuberosa* can be easily identified by the presence of papery flake like tubers and *I. digitata* by the presence of its concentric rings of vascular bundles and their adulterant

*C. circinalis* by its leaf scars and absence of vessel elements.

### Need for Substitution and Adulteration

Guggulu (Exudate), *Commiphora wightii* (Arn.) Bhand and *Commiphora mukul* is substituted and adulterated by Babul, Kikar (Exudate), *Acacia nilatica* (L.) Willd and Myrrha gond or myrrh gum, (Exudate), *Commiphora myrrha*, Hing or Hingu (Exudate) (*Ferula foetida* Regal) and (*Ferula narthex* Boiss) is substituted and adulterated by Kikar or Babul Gond, Hashab (Exudate), (*Gum Accasia* or *Acacia senegal*), and Shittim Gond, Talha, Karaya (Exudate), (*Acacia seyal*). Uncertain identity of the drug: For the herb Lakshmana different species such as *Arlia quinquefolia*, *Ipomea sepiaria* etc are considered Cost of the drug: Rumi Mastagi (Exudate), (*Pistacia lentiscus* Linn) is substituted and adulterated by Salai guggul or Gum olibanum (Exudate), (*Frankincense indica*), Kumkuma or Keser, KumKum, Zafran, (*Crocus sativus* Linn.) Styles and Stigmas of arial parts of flowers is substituted and adulterated by Kusumbha or Kusum, (*Carthamus tinctorius*) Styles and Stigmas of aerial parts of flowers), Rakta Chandana, Sandal Surkh, (Hard wood powder), (*Pterocarpus santalinus* Linn.) is substituted and adulterated by Red Capsicum, Lal shimla mirch, (Fruit powder), (*Capsicum annum* Linn., *Capsicum baccatum* Linn. and *Capsicum frutescens* Linn.) as such Sveta








Chandana, Sandal Safed, (Hard wood powder), (*Santalum album* Linn.) is substituted and adulterated by White Capsicum, Safed shimla mirch, (Fruit powder), (*Capsicum annum* Linn.) largely used in Ayurvedic and Unani compound formulation being costly herb. Non-availability of the drug: Substitution and adulteration for Ashtvarga part (group of 8 crude drugs - Riddhi or Vriddhi, Kakoli, Kshirakakoli, Jibhaka, Rsabhaka, Meda and Meha meda). these endangers and rare drugs are found in high altitude reason 2000 to above 4500 meter height Himachal and Himalaya northan reason of high altitude dense valleys. Riddhi (Tubers), (*Hobenaria intermedia* D. Don) is substituted by Varahikand (Tubers), (*Dioscorea bulbifera*) or Chiriya Musali (Tubers), (*Asparagus filicinus* Buch. Ham. ex. D. Don), Vriddhi (Tubers), (*Habenaria edgeworthii* Hook. f. ex. Collett) is substituted by Varahikand (Tubers), (*Dioscorea bulbifera*) or Salam Panja (Tubers), (*Dactylorhiza hatagirea* (D. Don) Soo) or Maha bala, (*Sida acuta* Burm. f.), Kakoli (Rhizomes and Buelbs), (*Roseea purpurea* Smith) is substituted by Ashwagandha, Asrol, Asgandh Nagori (root), (*Withania somnifera* Dunal) or Kali Musali (root), (*Corculigo orchioids* Gaerth), Kshirakakoli (Pseudobulbs), (*Fritillaria roylei* Hook) and (*Lilium polyphyllum* D. Don) is substituted by Ashwagandha, Asrol, Asgandh Nagori (root), (*Withania somnifera* Dunal) or Safed Musali (root), (*Chlorophytum arundinaceum* Boker) Jeevak (Pseudobulbs), (*Crepipium acuminatum* (D. Don.) Szlach.) is substituted by Varahikand (Tubers), (*Dioscorea bulbifera*) or Safed behman (*Centaurea behen* Linn.) or Guruchi (*Tinospora cordifolia* Willd), Rishbhak (Pseudobulbs), (*Malaxis muscifera* (Lindl.) Kuntze) is substituted by Varahikand (Tubers), (*Dioscorea bulbifera*) or Lal behmen, (*Centaurium roxburghii* (D. Don) Drue.), Meda (Rhizomes and roots), (*Polygonatum verticillatum* (Linn.) Allioni) is substituted by Satavari (root bulbs), (*Asparagus racemosus* Willd) Royle) or Salam mishri (root), (*Eulophia campestris* Wall.), Maha meda (Rhizomes and roots), (*Polygonatum cirrhifolium* (Wall.) Royal) and (*Polygonatum Verteci llatum* Alloi) is substituted by Satavari (root bulbs), (*Asparagus racemosus* Willd) Royle) or Shakakul mishri (root bulbs), (*Polygonatum multiflorum* (Linn.) All.) or Prasarani, (root bulbs), (*Paederia foetida* Linn.) are largely used in Ayurvedic compound formulation being endangers and rare herbal singal drugs as a Ashtvarga part like manufacturing of Avelah (Semi soiled form) Chaymenprash formulated composition ingredients. Geographical distribution of the drug: Rasna (*Pluchea lanceolata*) is used in Northern India while in southern parts *Alpinia galanga* is considered as the source. The adverse reaction of the drug: Vasa is a well known Rakta-Pittahara (cures bleeding

disorder) drug, but due to its abortifaciant activity its utility in pregnant women is limited, instead drugs such as Laksha, Ashoka etc. Above these reported and investigated research detail of endangered, costly, actives drugs are substituted. Mention with authenticated reported photos used parts pictures, authenticated species, family with their active Phytochemical constituents mention as respectively in Table-1 and Table-2.











#### Types of substitution presence in endangered and costly herbal raw drugs












- ◆ Using totally different drug.
- ◆ Substitution of the Species Belonging to Same Family.
- ◆ And Using different species.,
- ◆ Using different parts of the plant
- ◆ Due to same in action.














**Table 1. Adulterated and substitute parts used in endangered, costly herbal drugs of India**

S.No	Original Endanger and costly Raw Drugs	Substitute Used
1.	<p><b>Vatsnabh</b> (Dried Root), (<i>Aconitum Chasmanthum stapf ex.Haimes</i>)</p> 	<p><b>Mohri or Vatsnabh substitute,</b> (<i>Aconitum ferox wall</i>)</p>  <p><b>Mohri or Vatsnabh substitute,</b> (<i>Aconitum falconeri Stapf.</i>)</p> 
2.	<p><b>Ativisha</b>, (root), (<i>Aconitum heterophyllum</i>)</p> 	<p><b>Mustaka</b>(root),(<i>Cyperus rotundus</i>)</p> 
3.	<p><b>Kutki</b>, (rhizome), (<i>Picrorhiza kurroa royle ex</i>)</p> 	<p><b>Kuth or Kout</b> (root),(<i>Saussurea castus</i>)</p> 















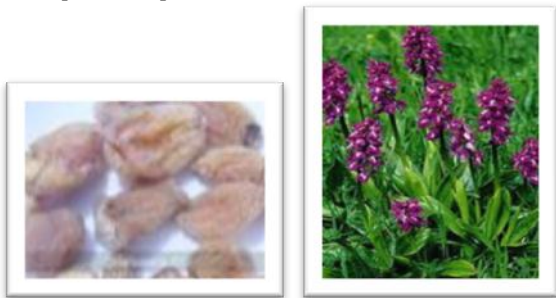
4.	<p><b>Kuth or Kustha</b>, (root), (<i>Saussurea lappa</i>)</p> 	<p><b>Kuth or Kout</b> (root), (<i>Saussurea castus</i>)</p> 
5.	<p><b>Puskar mool</b>, (root), (<i>Inula racemosa</i>)</p> 	<p><b>Kustha</b>(root), (<i>Saussrealappa</i>)</p>  <p><b>b- Eranda</b> (root), (<i>Ricinus communis</i>)</p> 
6.	<p><b>Jatamansi</b> (root), (<i>Nardostachys Jatamansi D C</i>)</p> 	<p><b>Bhootkeshi</b> (root), (<i>Selinum vaginatum</i>)</p> 
7.	<p><b>Guggulu</b> (Exudate), <sup>[7,21-22,26,46-50,83]</sup> <i>Commiphora wightii</i>(Arn.)Bhand And <i>Commiphora mukul</i></p> 	<p><b>a- Babul, Kikar</b> (Exudate), <i>Acacia nilatica</i>(L) willd</p>  <p><b>Myrrha gond or myrrh gum</b> , (Exudate), <i>Commiphora myrrha</i></p> 

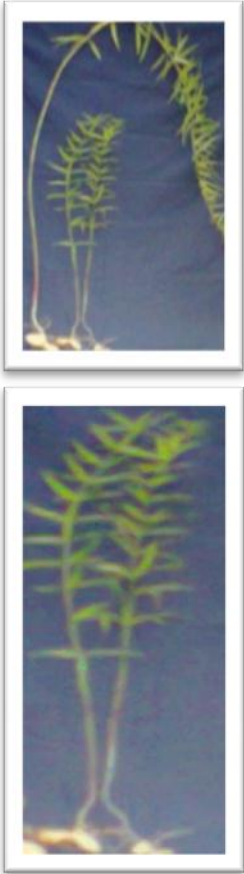







8.	<p><b>Hing or Hingu</b> (Exudate), (<i>Ferula foetida regal</i> ) And (<i>Ferula narthex boiss</i>)</p>  	<p><b>a-Kikar or Babul Gond, Hashab</b> (Exudate), (<i>Gum Accasia or Acacia senegal</i> )</p>  <p><b>b-Shittim Gond, Talha, Karaya</b> (Exudate), (<i>Acacia seyal</i> )</p> 
9.	<p><b>Rumi Mastagi</b>, (Exudate), (<i>Pistacia lentisecus Linn</i>)</p>  	<p><b>Salai guggul or Gum olibanum</b> (Exudate), ( <i>Frankincense indica</i> )</p> 
10.	<p><b>Riddhi</b>, (Tubers), (<i>Hobenaria intermedia D.Don</i>)</p>  	<p><b>Varahikand</b>(Tubers), (<i>Dioscorea bulbifera</i>)</p>  <p><b>Chiriya Musali</b> (Tubers), (<i>Asparagus filicinus Buch.Ham.ex.D.Don</i>)</p> 

<p>11.</p>	<p><b>Vridhi</b>, (Tubers), ( <i>Habenaria edgeworthii</i> Hook.f.ex.collett )</p>  	<p><b>Varahikand</b>(Tubers), (<i>Dioscorea bulbifera</i>)</p>   <p><b>Salam Panja</b> (Tubers), ( <i>Dactylorhiza hatagirea</i>(D.Don) Soo )</p>   <p><b>c- Maha bala</b>, (<i>Sida acuta</i> Burm.f.)</p> 
<p>12.</p>	<p><b>Kakoli</b>, (Rhizomes and Bulbs) ( <i>Rosea purpurea</i> Smith)</p>  	<p><b>Ashwagandha, Asrol, Asgandh Nagori</b> (root), (<i>Withania somnifera</i> Dunal)</p>   <p><b>Kali Musali</b> (root), ( <i>Corculigo orchiods</i> Gaerth )</p>  




13.	<p><b>Kshirakakoli</b>, (Pseudobulbs), ( <i>Fritillaria roylei</i> Hook) and (<i>Lilium polyphyllum</i> D. Don)</p> 	<p><b>Ashwagandha, Asrol, Asgandh Nagori</b> (root), (<i>Withania somnifera</i> Dunal)</p>  <p><b>Safed Musali</b> (root), (<i>Chlorophytum arundinaceum</i> Boker)</p> 
14.	<p><b>Jeevak</b>, (Pseudobulbs), (<i>Crepipium acuminatum</i> (D. Don.) Szlach.)</p> 	<p><b>Varahikand</b> (Tubers), (<i>Dioscorea bulbifera</i>)</p>  <p><b>Safed behman</b> (<i>Centaurea behen</i> Linn.)</p>  <p><b>Guruchi</b> (<i>Tinospora cordifolia</i> (willd))</p> 

<p>15.</p>	<p><b>Rishbhak</b>, (Pseudobulbs), (<i>Malaxis muscifera</i> (Lindl.) Kuntze)</p> 	<p><b>Varahikand</b> (Tubers), (<i>Dioscorea bulbifera</i>)</p>  <p><b>Lal behmen</b> (<i>Centaurium roxburghii</i> (D. Don) Drue.)</p> 
<p>16.</p>	<p><b>Meda</b>, (Rhizomes and roots), (<i>Polygonatum verticillatum</i> (Linn.) Allioni)</p> 	<p><b>Satavari</b> (root bulbs), (<i>Asparagus racemosus</i> willd) Royle )</p>  <p><b>Salam mishri</b> (root), (<i>Eulophia campestris</i> wall. )</p> 

17.	<p><b>Maha meda</b>, (Rhizomes and roots), ( <i>Polygonatum cirrhifolium</i>(wall.)Royal) and( <i>Polygonatum Vertecillatum</i> Alloi)</p> 	<p><b>Satavari</b> (root bulbs), ( <i>Asparagus racemosus willd</i>)Royle )</p>  <p><b>Shakakul mishri</b> (root bulbs), ( <i>Polygontatum multiflorum</i>(Linn.) All.)</p>  <p><b>Prasarani</b>, (root bulbs), ( <i>Paederia foetida</i> Linn.)</p> 
18.	<p><b>Rakta Chandana or Sandal Surkh</b>, (Hard wood powder), ( <i>Pterocarpus santalinus</i> Linn.)</p> 	<p><b>a- Red Capsicum, Lal shimla mirch</b>, (Friut powder), (<i>Capsicum annuum</i> Linn., <i>Capsicum baccatum</i> Linn. and <i>Capsicum frutescens</i> Linn.)</p> 
19.	<p><b>Sveta Chandana or Sandal Safed</b>, (Hard wood powder), (<i>Santalum album</i> Linn.)</p> 	<p><b>a-White Capsicum, Safed shimla mirch</b>, (Fruit powder), (<i>Capsicum annuum</i> Linn.,)</p> 



20.	<p><b>Kesar, Keshar or KumKum, Zafran,</b> (Styles and Stigmas of Aerial part of flower ) (<i>Crocus sativus</i> Linn.)</p> 	<p><b>a-Kusubh, Kusum,</b> (Style and Stigma of Aerial part of flower ), (<i>Carthamus tinctorius</i>)</p> 
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**Table 2. Active phytochemical constituents of endangered , costly ASU. herbal drugs of India.**

Sr. N0.	Local name and Botanical name	Family and Part used	Investigates and reported Active phytochemical constituents
01	<b>Vatsnabh ,</b> ( <i>Aconitum Chasmanthum stapf ex.Haimes</i> )	Ranunculaceae, (Dried root)	Aconite alkaloid contained - 2.85% to 3.11%, <i>Aconitum Chasmanthumstapf ex.Haimes</i> - Aconite alkaloid -3.092 %.
02	<b>Ativisha,</b> ( <i>Aconitum heterophyllum</i> )	Ranunculaceae, (Dried tuberou )	<i>Aconitum heterophyllum</i> – Aconitve alkaloid contained -0.16% to 0.27%, Atisine alkaloid - 0.19 % to 0.35%.
03	<b>Kutki ,</b> ( <i>Picrorhiza kurroa royle ex</i> )	Serophulariaceae, (Dried rhizome)	Kuthoside, Glycoside - Picroside, Andrasin & Apocynine, Active Iridoid glycoside contained - Picrotin-1.50% to 3.10% , Picrotoxin-0.83 to 1.70%.
04	<b>Kuth or Kustha ,</b> ( <i>Saussurea lappa</i> )	Compositae, (Asteraceae), (Dried root)	Hexadectarinol-2.5%-5%, Dehydro costus lactone 16.7%,Elemol-5.84%, $\gamma$ -costol-1.80% , Valerenol-4.29% and terpinen-4-ol-1.60%, Sesquiterpene, $\beta$ -cyclocostunolide, Dihydro constunolide and Dehydro constuslactone.
05	<b>Puskar mool ,</b> ( <i>Inula racemosa</i> )	Compositae, (Asteraceae), (Dried root)	Trinosesquiterpene, Lactones, Alanto- lactone, Isoalloalantolactone essential oil.
06	<b>Chirata,</b> ( <i>Swerita chirata Buch. Ham.</i> )	Gentianaceae, (Whole plants)	Seco-iridoid glycoside, Enicoflovene, Gontia -mine & Gentiocrucine tri terpenoid alkaloid, Lupeol, Triterpene alcohol, Swertanone & Swertanol Tri terpenoid, Swertaianin Xan-thone , $\beta$ -sitosterol-3- $\beta$ -D-glucoside sterol .
07	<b>Jatamansi,</b> ( <i>Nardostachys Jatamansi DC</i> )	Valerianaceae, (Dried rhizomes)	Sesquiterpene acid, Nardin and Coumarins, Pyranocoumarin, Volatile oil % - 0.5% to 2.5%.
08	<b>Guggulu or Guggul</b> <i>Commiphora wightii</i> (Arn.) Bhand and <i>Commiphora mukul</i> Engl.	Burseraceae, (Exudate, natural resin)	Lignons, Lipids, Diterpens and Steroids, Z-Guggulsterone and E-Guggulsterone, Quercetinpalmitic and stearic acids, Campesterol, Cholesterol , $\beta$ -sitosterol, $\alpha$ -Spinosterol (seedoil) , Comphorene, polymyrcene and caryaphyllene (essential oil) etc., Total % of Guggulsterones - 0.75 to 2.35%, Volatile oil - 1.0 to 5.0% .



09	<b>Hing or Hingu,</b> ( <i>Ferula foetida regal</i> ) And ( <i>Ferula narthex boiss</i> )	Umbelliferae, (Exudate, natural resin)	Resin- 40 to 65%,Gum - 20 to 25%, Volatile oil - 4 to 20%,Sesquiterpene, Assafoetidnol A & B, Umbellifeone, Feselol, Azulene, $\alpha$ -pinene, $\alpha$ -terpineol, $\alpha$ -Zulene, Vanillin, Ferulic acid, Dially Idisulfide, Diallyl disulphfide,Luteolin.
10	<b>Rumi Mastagi or Mastagi (Resin),</b> (Exudate), ( <i>Pistacia lentisecus</i> Linn)	Anacardiaceae, (Exudate, natural resin)	Resin, Volatile oil, $\alpha$ -bicycliterpenoid, Triterpenic and Fatty acid compound- Oleanonic acid, Moronic acid,242-masicadienolic acid, 242-iso-mastica dienolic acid, Triucallol,Dammarodie none, 28-naroleon-12-en-3- one, Oleonolic aldehyde.
11	<b>Riddhi,</b> ( <i>Hobenaria intermedia</i> D.Don )	Orchidaceae, (Tuber)	Dried Tuber contained Starch and Minerals with bitter Substances, Also reported Taxol compound.
12	<b>Vriddhi,</b> ( <i>Habenaria edgeworthii</i> Hook.f.ex.collett )	Orchidaceae, (Tuber)	Dried Tuber contained Starch and Minerals with bitter Substances, Also reported active Phenolic compounds.
13	<b>Kakoli,</b> ( <i>Roseea purpurea</i> Smith)	Zingiberaceae, (Rhizome and Tuberous root)	Dried Rhizome and tuberous root cont ained Flavonoids, Alkaloids, Tannins, Saponin. Glycoside and Active phenolic compounds.
14	<b>Kshirakakoli,</b> ( <i>Fritillaria roylei</i> ) and ( <i>Lilium polyphyllum</i> D.Don)	Liliaceae, (Pseudobulb),	Dried pseudobulb contained Linalool and $\alpha$ -terpineol, $\beta$ -sitosterol-3-glyceryl -2-linoleiy1-3-linoleiate,Glyceryl-1-n-octadec-9- enoyl-2-n-decomoyl-3-n- decanoadte and Glyceryl-1-octadec-9 -enoyl-2-octadec-9,12-dienoyl-3-tetra cosanote and alkaloids Kashmirine (imperialine), peimine, Peimisine, Propeimine, Peimiphine and Peimitidine.
15	<b>Jeevak,</b> ( <i>Crepipium acuminatum</i> (D.Don.) <i>Szlach.</i> )	Orchidaceae, (Pseudobulb)	Dried pseudobulb contained alkaloid, glycoside, flavonoids, $\beta$ -sitosterol, piperitone, O- methylbatatasin,1,8-cineole ,citoenoll, engenol, glucose,rhamnose, coline, limonene, p-cymene and ceryla lcohol.
16	<b>Rishbhak,</b> ( <i>Malaxis muscifera</i> (Lindl.)Kuntze)	Orchidaceae, (Pseudobulb)	Dried pseudobulb contained bitter substances alkaloid, glycoside, flavonoids with active derivate compounds.
17	<b>Meda,</b> ( <i>Polygonatum</i> <i>verticillatum</i> (Linn.)Allioni )	Liliaceae, (Rhizome and root )	Dried Rhizome and root are contains Lysine, Serine,Aspartic acid, Threonine,Diosgenin, $\beta$ -sitosterol, Sucrose and Glucose.
18	<b>Maha meda,</b> ( <i>Polygonatum cirrhifolium</i> (wall.) Royal )	Liliaceae, (Rhizome and root)	Dried Rhizome and root are contains Steroid terpenoide, Polysaccharides phenol and stannin , $\alpha$ -L-rhamno- pyranosyl, $\beta$ -D-glyco-pyranoside, Dauvosterol, $\beta$ -sitosterol, Sucrose and Glucose,steroidal saponins -sibiricoside A and B, Di asgenin steroidal saponins, proteins, resins.

19	<b>Rakta Chandana or Sandal Surkh,</b> ( <i>Pterocarpus santalinus</i> Linn.)	Papilionaceae, (Hard wood powder)	Dried hard wood contained Santalol, Essential oil - 1.0 to 3.5%, Glycosides, colouring matter. As well as Dried seeds contained 50% fixed oil.
20	<b>Sveta Chandana or Sandal Safed,</b> ( <i>Santalum album</i> Linn.)	Santalaceae, (Hard wood powder)	Dried hard wood contained 80 to 93 % $\alpha$ - Santalol, and $\beta$ - Santalol, Essential oil- 3 to 6 %, Glycosides, colouring matter. As well as Dried seeds contained 50% fixed oil.
21	<b>Keshar or Kesar, KumKum, Zafran,</b> ( <i>Crocus sativus</i> Linn.)	Iridaceae, (Style and Stigma of arial part of flower)	Dried styles and stigmas of arial part of flowers contained active phyto-chemical constituents - Gums - 10%, Pentosans-8.0%, Polypeptides-11-14%, Carotenoids-1%, Lipids -12 %, Starch-6%, Non volatile oils -6.0 %, Volatile oils-12%, Water-10%, Fibers-(crude)-5.6%, $\alpha$ -Crocine-2.0%, Crocetin, Crocin, Picrocrocine, Safranin.
22	<b>Badam or Badam shireen,</b> ( <i>Prunus amygdalus</i> Batsch. var. <i>dulces</i> and <i>Prunus cammunis</i> fritch, <i>Amygdalus communis</i> Linn.)	Rosaceae, (Seeds part)	Badam seeds parts or Almonds contained polyphenols, flavanols, flavon-3-ols, hydroxybenzoic acids and flavan-ones, protein, fat, sugar, glycoside, daucostrin, sito-sterol, Vitamin-E, Essential oil - 36% -60%.
23	<b>Gulab or Gul-e-Surkh,</b> ( <i>Rosadamascena</i> Mill.)	Rosaceae, (Dried flower)	Gulab flowers parts or Roses contained $\beta$ -phenethyl-B-D-glycopyranoside, Diglucoside, phenylethanol-2-hydroxy ursolic acid, $\beta$ -amyrin, methyl ursalate, Geraniol, Cyanidin-3.5%, Essential oil - 0.02% -0.05% of Citranellol and Nerol active chemical constituents.

## RESULT AND DISCUSSION

It is find out focus point on the aspects of conclusive view or scientific observation that all adulterations are intentional malpractice as stated in many authenticated literatures. With our technical expertise experienced observation and investigation. It's communicated that the ASU. Herbal drugs are adulterated unintentionally also. Suppliers and cultivators, vendors are illiterate and not aware about their spurious as well as collection of substitute, adulterations supply. Major reasons are name confusion, non-availability and lack of knowledge about authentic plant. Even scientific community and traditional physicians (Hakeems and Vads from production ends) which has attached or deputed in production sites are unaware of it and consumed intestinally or unintentionally using as a oreganolaptic test (Panchiyainderiya parikshen) malpractice in large scale levels for achieve manufacturing target of Government and Private sector Herbal Pharmaceuticals and Pharmacies, organizations. Now today's demand herbal drug industries follow, high quality standards using modern techniques and instruments such as Auto-UPLC, HPTLC, GC-MS, C<sup>13</sup> and H<sup>1</sup> NMR Chromatography

and Spectroscopy techniques etc. to maintained and monitored their standard quality and determine extracts, separated and fractionated, isolated investigation drugs research data's concussively investigate purity percentage of active ingredients, and developed extensive authenticated standard data's of active phytochemical constituents in consumed formulated classical as well as patent, proprietary ASU. herbal products. The future research and development require of the Pharmacognostic and Phytochemical analysis, cross check of active phytochemical constituents concentration applies as the aspects of investigates medicinal potency, purity, safety of the final finished goods products as well as pharmacovigilance aspects with of conclusively decides and complies of it's medicinal values, potency, purity, product stability for the detect and investigated changes, decay of active phytochemical constituents by the using their references standards. It's should be follows update and modify guideline which has issued by Drug Quality control, Quality assurance guideline of Indian Government authority -AYUSH., WHO-GMP approval certified drug authority, Food Drug regularity authority (FDA.) and Director General Drug Regularity authority (DG.-DRA.),

World Health Organization (WHO) authority for controlling adulteration, substitution, spurious drugs in ASU.

### Herbal products

World Health Organization in its publication on quality standards for medicinal plant materials, recommends rejecting any batch of raw material, which has more than 5% of any other plant part of the same plant (eg. stem in leaf drugs), even though they derived from the authentic plant. Based on these standards, adulteration whether, intentional or unintentional, should be rejected. Also, suppliers and traders should be educated about the authentic sources. As the resulted conclusion and existing scientific observation, it's also must be need to considering high ethno botanical as well as industrial, commercial values and the endangered status of the species for conservation and sustainable utilization of critically endangered, rare costly species having preserve of high medicinal values of active phytochemical constituents., and defiantly very important should be need equally identified, climatically cultivated, officially protected for harvesting and conservation of high altitude region based growing endangered, rare species of northern region of Himachal Pradesh, Jammu & Kashmir and Uttarakhand state, northern Himalayas region. As the scientific ethnobotanical and innovated demand of protect critically endangered, costly medicinal plant species. It should be very important need to using cell culture techniques development, propagation and conservation ,cultivation, motivate forming and growing of these endangered, rare species. Also need to be tested and standardized, developed authenticated reference standard,

increase and protect for large scale forming, conservation, cultivation and sustainable utilization in climatically low temperature, high altitude growing endangered medicinal species that's a today needful demand for the aspect of preserve our cultural health care heritage and traditional, folk medicinal sashtra oshadhi therapy and developed, served as well as provide standard quality traditional and alternative original medicinal plant based standard quality ASU. Products to our stream nation.

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