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## ADULTERATION AND SUBSTITUTION IN ENDANGERED, ASU HERBAL MEDICINAL PLANTS OF INDIA, THEIR LEGAL STATUS, SCIENTIFIC SCREENING OF ACTIVE PHYTOCHEMICAL CONSTITUENTS

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Adulteration, Substitution, Spurious drugs intestinally or unintentionally endanger, costly, Ayurvedic, Siddha, Unani (ASU.), The Indian system of medicine (ISM)

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**ABSTRACT:** Endangered Indian medicinal plants have used as traditional and alternative Indian system of medicine (ISM) from last several ancient time. In 20<sup>th</sup> and 21<sup>th</sup> - century generation are becoming aware of the side effect and adverse reaction of synthetic drugs and so there is an increasing interest, Scope of innovating in herbal medicinal plants based Ayurvedic, Siddha, Unani (ASU) medicinal products. In the continuously using of Adulteration and Substitution, Spurious drugs on the place of original Indian endangered and costly ASU. Herbal medicinal plants hence today generate the major task of Indian drug regularity affaire, drug controlling approach, as well as herbal industries, face the burning problem. Resulted growing high altitude region many endangered and rare, costly original medicinal species such as these are Vatsnabh, (*Aconitum Chasmanthumstapfex*. Haimes), Ativishaor Atis, (*Aconitumheterophyllum* Wall. Ex. Royal), Kutki, (*Picrorhiza kurroa* royleex), Kuth or Kustha, (*Saussurea lappa* C.B.CL.), Puskarmool, (*Inularacemosa* Hook.F.), Riddhi, (*Hobenariainte media* D. Don), Vriddhi, (*Habenariaedge worthii* Hook.f.ex.Collett), Kakoli, (*Roseea purpurea* Smith), Kshirakakoli, (*Fritilliar oylei* Hook) and (*Lilium polyphyllum* D. Don), Jeevak, (*Crepipiuma cumina* tum D. Don.) Szlach.), Meda, (*Polygonatum verticillatum* Linn.) Allioni), Mahameda, (*Polygonatum cirrhifolium* (wall.) Royal) and (*Polygonatum Vertecillatum* Alloi), Rakta Chandana, Sandal Surkh, (*Pterocarpus santalinus* Linn.), Sveta Chandana, Sandal Safed, (*Santalum album* Linn.), Kesar, Keshar or Kum Kum, Zafran ,(*Crocus sativus* Linn.), etc. completely endangered and incorrect identification of their intestinally or unintentionally, Finally they become effectively adulterated and substituted in condition. The present communication investigates research review has reported their drug regularity affaire and drug controlling, pharmacovigilance approach of Adulteration and Substitution, Spurious drugs with active phytochemical constituents, extensive taxonomical and ethnobotanical authentication, medicinal properties of these several endangered and costly medicinal plants.

**INTRODUCTION:** Natural medicinal plants are after unable to meet the demand for popular of patent, Shastra oushadhee, preparatory ASU.

Herbal products as well as used as Alternative and Traditional medico care therapy in ISM.

Populations of many species have limited distribution in their natural habitats, requiring conservation strategies for protection<sup>1</sup>. Unavailability of such medicinal plants has led to arbitrary substitution and adulteration in the raw drug market<sup>4, 6</sup>. Adulteration it is a practice of substituting the original crude drug partially or fully with other substances which is either free

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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<sup>6,7</sup>. A adulteration may also be defined as mixing or substituting the original drug material with other spurious, inferior, defective, spoiled, useless other parts of the same or different plant or harmful substances or drug which do not conform 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<sup>7</sup>. 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<sup>7,9</sup>.

Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products. Many researchers have contributed to checking adulterations and authenticating them<sup>3-10</sup>. In the health aspects as drug regularity affaire and drug controlling approach and burning problem of herbal industries of Adulteration and Substitution, Spurious drugs used in place of Indian original endangered and costly ASU.

Herbal medicinal plants have used as traditional and alternative medicines of ISM from last several ancient time in India. 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<sup>11</sup>. Medicinal plant dealers have discovered the scientific methods in creating adulteration of such high quality that without microscopic and phytochemical and physicochemical analysis, it is very difficult to trace these adulterations<sup>12</sup>. 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 markets as per current expect 2013 year. In India, about 80% of the rural population depends on medicinal herbs and indigenous systems of medicine. 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<sup>13,24</sup>.

**MATERIAL AND METHODS:** Authentic complete Information about the plant of Adulteration and Substitution in endangered, costly Ayurvedic Siddha Unani (ASU.) Indian medicinal plants (Actual confirmation of Plant Occurrence, Hearbesting, Cultivation, authenticated plant species and family, photographs, *etc.*) were collected of source from standard, authenticated online world encyclopaedia, 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 by botanical, taxonomists expertise researchers of SMPU. Research Council (ISM, AYUSH) and another’s extensive, authenticated related literature survey has done from FRI., Dehradun, Uttarakhand state, PLIM. (AYUSH.), Ghaziabad, Utterperdash state, NIPER, Mohali, Chandigarh, Punjab state, India.

Adulteration and substitution in medicinal plants have 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; Mukherjee 2002; Mishra *et al.*, 2002; Gupta 2003; Dubey 2004; Chuneekar 2004; Shastri 2005; Kokate *et al.*, 2007; Poornima 2010; Balakrishnan *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 Northern Himalayan higher altitude from 1200 to 4500 m asl. hill valleys and dense forest areas of Himachal and Uttarakhand state, a various region of India.

Selective and reported plant species were confirmed and identified with the help of standard flora, standard Ayurvedic and Unani pharmacopeia Govt. of India, variously reported volume in part

fist- Single drugs, Standard connected textbooks 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 a 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.

**GMP Rules & Act in Schedules-T for ASU Drugs:** In according to Indian Drugs and Cosmetics Act and drug regulatory affairs aspects for ASU. Drugs as per The Drugs and Cosmetics Rules, 1945, The Drugs and Cosmetics (tenth amendment) Rules, 2003) for mandatory controlling rules of Misbrand, Adulterated or Substituted, Spurious drugs use in any Herbal or polyherbal ASU. Forme single and formulated compound, coded, sashtra ousheedhi, preparatory, patent herbal medicines under mention respectively as follows:

**TABLE 1:**

Item	Section	Criteria of GMP Rules & Act under Schedules-T for ASU. Drugs	Reference
Misbranded drugs	33E	ASU drugs are deemed to be misbranded	2
Adulterated drugs	33EE	<ul style="list-style-type: none"> <li>If colored or coated to conceal the damage or made appear better than therapeutic value.</li> <li>If it is not labeled in a prescribed manner.</li> <li>If label or container is accompanying drug bears any false claim or misleading.</li> </ul>	2
		ASU drugs are deemed to be adulterated	
Spurious drugs	33EEA	<ul style="list-style-type: none"> <li>If it consists filthy, or decomposed material.</li> <li>If prepared, packed or stored under unsanitary conditions.</li> <li>If its container contains any poisonous or deleterious substance.</li> <li>Colour other than one which is prescribed.</li> <li>Harmful or toxic substance.</li> <li>If any substance mixed to reduce its quality or strength.</li> </ul>	2
		ASU drugs are deemed to be Spurious	
		<ul style="list-style-type: none"> <li>If it is sold or offered under another name.</li> <li>If it is an imitation or substitute for another drug.</li> <li>If the label or container bears the name of an individual or company which is factious.</li> <li>If it has been substituted by other drugs.</li> </ul>	

In the challenging task of Drug controlling and Drug regularity affairs and pharmacovigilance authority on the aspects for used Misbrand, Adulterated or Substituted, Spurious drugs in ASU. herbal products that are a major punishable offense which has Government or private industrialist or pharmacy manufacturer blindly used malpractice of Misbrand, Adulterated or Substituted, Spurious drugs as intestinally or unintentionally in our various type of ASU. Herbal products hence finally effected and suffer ignescents national peoples due to their continues using and without having any

medicinal values, Quality and Efficacy as well as decrease the product shelf life. Resulted in their showing the adverse and side effect to humankind.

**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. This is the most common type of adulteration<sup>13, 21-22, 24</sup>.

**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<sup>13, 21-22, 24</sup>.

**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 by costlier drugs<sup>13, 21-22, 24</sup>.

**Using Exhausted Drug:** The same drug is admixed, but that drug is devoid of the 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 color and taste due to extraction, natural color and taste are manipulated with additives<sup>13, 21-22, 24</sup>.

**Using Synthetic Chemicals to Enhance Natural Character:** Synthetic chemicals are used to enhance the natural character of the exhausted drug. Examples: citral is added to citrus oils like lemon and orange oils<sup>13, 21-22, 24</sup>.

**Presence of Vegetative Matter of the Same Plant:** Some miniature plants growing along with the medicinal plants are added due to their color, odor, and constituents<sup>13, 21-22, 24</sup>.

**Harmful Adulterants:** Some are harmful materials as the adulterant are collected from market waste materials and admixed with the drug. It is done for liquid drugs<sup>13, 21-22, 24</sup>.

**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 sandalwood powders in red and white capsicum powders and powdered bark adulterated with brick powder<sup>13, 21-22, 24</sup>.

**Reason of Adulteration of Endangered and Costly Herbal Raw Drugs:**

**Confusion in Vernacular Names:**

**Lack of Knowledge about the 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, Himalayas 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<sup>13, 21-22, 24</sup>.

**The 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 wider 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 a 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<sup>13, 21-22, 24</sup>.

**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*. The 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<sup>13, 21-22, 24</sup>.

**The Similarity in Color:** It is well known that with 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 the Western Ghats, as the only source of 'Ratanjot'. However, that has not been practiced now. It is known that *Arnebia euchroma* var *euchroma* is the present source. The similarity is in yielding a red dye, *A. Euchroma* substitutes *V.*

*madraspatana*. Recently *V. madraspatana* is not found in the market. Whatever is available in the market, in the name of Ratanjot is originated from *A. euchroma*<sup>13, 21-22, 24</sup>.

**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<sup>13, 21-22, 24</sup>.

**Unknown Reasons:** 'Vidari' is another example of an 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.<sup>13, 21-22, 24</sup>

**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*)<sup>7, 21-22, 24, 26, 51-54, 83</sup>. 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 lentisecus* 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 aerial parts of flowers are substituted and adulterated by Kusumbha or Kusum, (*Carthamus tinctorius*) Styles and Stigmas of arial 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 annuum* Linn., *Capsicum baccatum* Linn. and *Capsicum frutescens* Linn.) as such Sveta Chandana, Sandal Safed, (Hardwood powder), (*Pterocarpus santalinus* Linn.) is substituted and adulterated by White Capsicum, Safed shimla mirch, (Fruit powder), (*Capsicum annuum* Linn.,) largely used in Ayurvedic and Unani compound formulation being costly herb<sup>7, 21-22, 24-26, 55-58, 63, 83</sup>.

**Non-Availability of the Drug:** Substitution and adulteration for Ashtvarga part (a group of 8 crude drugs - Riddhi or Vriddhi, Kakoli, Kshirakakoli, Jibhaka, Rsabhaka, Meda and Meha meda). These endanger 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), (*Habenaria 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 orchiods* 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 Varahik and (Tubers), (*Dioscorea bulbifera*) or Safed behman (*Centaurea behen* Linn.) or Guruch (*Tinospora cordifolia* (willd)), Rishbhak (Pseudobulbs), (*Malaxis muscifera* (Lindl.) Kuntze). is substituted by Varahikand (Tubers), (*Dioscorea bulbifera*) or Lal










behem, (*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 verticillatum* 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 single drugs as an Ashtvarga part like manufacturing of Avelah (Semi-soiled form) Chaymenprash formulated composition ingredients<sup>7, 21-22, 26, 29, 59-62, 83</sup>.

**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 abortifacient 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, active drugs are substituted. Mention with authenticated reported photos used parts pictures, authenticated species, family with their active Phytochemical constituents mention as respectively in **Table 2** and **Table 3**<sup>7, 13, 21-22, 24-29, 51-84</sup>.

**Types of Substitution Presence in Endangered and Costly Herbal Raw Drugs:** Using different drug, Substitution of the Species Belonging to the Same Family and Using different species, using different parts of the plant and Due to the same in action.

**TABLE 2: ADULTERATED AND SUBSTITUTE PARTS USED IN ENDANGERED, COSTLY HERBAL DRUGS OF INDIA**

S. no.	Original Endanger and costly Raw Drugs	Substitute Used
1	<b>Vatsnabh</b> (Dried Root), <sup>7, 21-22, 24, 26, 32-33, 83-84</sup> ( <i>Aconitum Chasmanthum</i> Stapf ex. Haimes)	<b>a- Mohri or Vatsnabh substitute,</b> ( <i>Aconitum ferox</i> Wall.)
		
		
		<b>b- Mohri or Vatsnabh substitute,</b> ( <i>Aconitum falconeri</i> Stapf.)
		
2	<b>Ativisha</b> , (root), <sup>7, 21-22, 24, 26, 34-35, 83-84</sup> ( <i>Aconitum heterophyllum</i> )	<b>a- Mustaka</b> (root), ( <i>Cyperus rotundus</i> )
		
		

3 **Kutki**, (rhizome), <sup>7, 21-22, 24, 26, 36-38, 83-84</sup>  
(*Picrorhiza kurroa* royle ex)



a- **Kuth or Kout** (root),  
(*Saussurea castus*)



4 **Kuth or Kustha**, (root), <sup>7, 21-22, 24, 26, 39-40, 83-84</sup>  
(*Saussurea lappa*)



a- **Kuth or Kout** (root),  
(*Saussurea castus*)



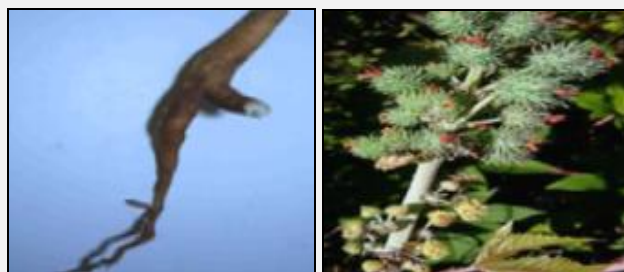
5 **Puskar mool**, (root), <sup>7, 21-22, 24, 26, 41, 83-84</sup>  
*Inula racemosa*



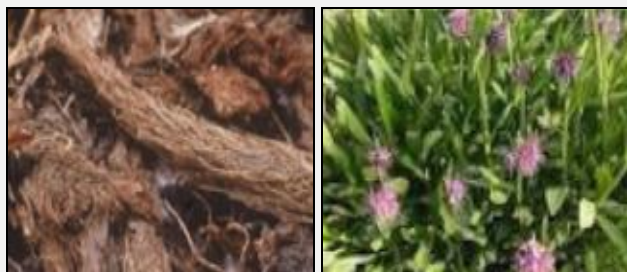
a- **Kustha**(root), (*Saussurealappa*)



b- **Eranda** (root), (*Ricinus communis*)



6 **Jatamansi** (root), <sup>7, 21-24, 26, 44-45, 83-84</sup>  
(*Nardostachys Jatamansi* D C)



a- **Bhootkeshi** (root), <sup>19,21,</sup>  
(*Selinum vaginatum*)



7 **Guggulu** (Exudate), <sup>7, 21-22, 26, 46-50, 83</sup>  
*Commiphora wightii* (Arn.) Bhand  
and *Commiphora mukul*

a- **Babul, Kikar** (Exudate),  
*Acacia nilatica* (L) willd

b- **Myrrha gond or myrrh gum**, (Exudate),  
*Commiphora myrrha*



8 **Hing or Hingu** (Exudate),<sup>7, 21-22, 24, 26, 51-54, 83-84</sup>  
(*Ferula foetida* regal) and  
(*Ferula narthex* boiss)



a- **Kikar or Babul Gond, Hashab** (Exudate),  
(*Gum Accasia* or *Acacia senegal*)  
c- **Shittim Gond, Talha, Karaya** (Exudate),  
(*Acacia seyal*)



9 **Rumi Mastagi**, (Exudate),<sup>7, 21-22, 24, 26, 55-58, 83</sup>  
(*Pistacia lentisecus* Linn)



a- **Salai guggul or Gum olibanum** (Exudate),  
(*Frankincense indica*)



10 **Riddhi**, (Tubers),<sup>7, 21-22, 26, 29, 59, 83-84</sup>  
(*Hobenaria intermedia* D. Don)



a- **Varahikand** (Tubers),  
(*Dioscorea bulbifera*)  
b- **Chiriya Musali** (Tubers),  
(*Asparagus filicinus* Buch. Ham. ex. D. Don)





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**Vriddhi**, (Tubers), <sup>7, 21-22, 26, 29, 59, 83-84</sup>  
 (*Habenaria edgeworthii* Hook. f. ex. Collett)

**a- Varahikand** (Tubers),  
 (*Dioscorea bulbifera*)

**b- Salam Panja** (Tubers),  
 (*Dactylorhiza hatagirea* (D. Don) Soo)

**c- Maha bala**, (*Sida acuta* Burm. f.)



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**Kakoli**, (Rhizomes and Bulbs), <sup>7, 21-22, 26, 29, 60, 83-84</sup>  
 (*Roseea purpurea* Smith)

**a- Ashwagandha, Asrol, Asgandh Nagori** (root), (*Withania somnifera* Dunal)

**b- Kali Musali** (root),  
 (*Corculigo orchioids* Gaerth)

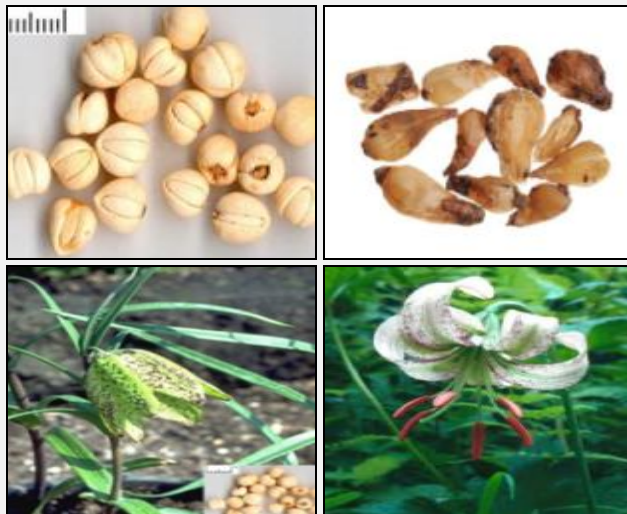


13

**Kshirakakoli**, (Pseudobulbs), 7, 21-22, 26, 29, 31, 61, 83-84  
(*Fritillaria roylei* Hook) and  
(*Lilium polyphyllum* D. Don)



**a- Ashwagandha, Asrol, Asgandh Nagori** (root), (*Withania somnifera* Dunal)  
**b- Safed Musali** (root),  
(*Chlorophytum arundinaceum* Boker)



14

**Jeevak**, (Pseudobulbs), 7, 21-22, 26, 29, 83-84  
(*Crepipium acuminatum* (D. Don.) Szlach.)

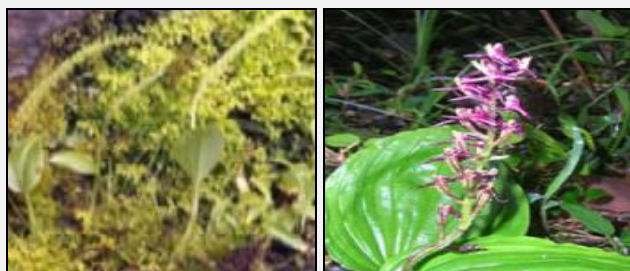


**a- Varahikand** (Tubers),  
(*Dioscorea bulbifera*)  
**b- Safed behman** (*Centaurea behen* Linn.)  
**c- Guruchi** (*Tinospora cordifolia* (willd))



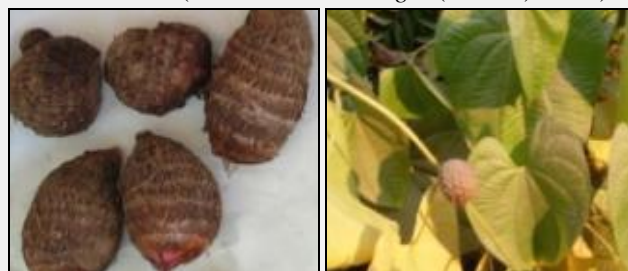
15

**Rishbhak**, (Pseudobulbs), <sup>7, 21-22, 26, 29, 83-84</sup>  
(*Malaxis muscifera* (Lindl.)Kuntze)



**a- Varahikand** (Tubers),  
(*Dioscorea bulbifera*)

**Lal behmen** (*Centaurium roxburghi* (D. Don) Drue.)



16

**Meda**, (Rhizomes and roots), <sup>7, 21-22, 26, 29, 83-84</sup>  
(*Polygonatum verticillatum* (Linn.) Allioni)



**a- Satavari** (root bulbs), (*Asparagus racemosus* willd) Royle)

**b- Salam mishri** (root), (*Eulophia campestris* wall.)



17

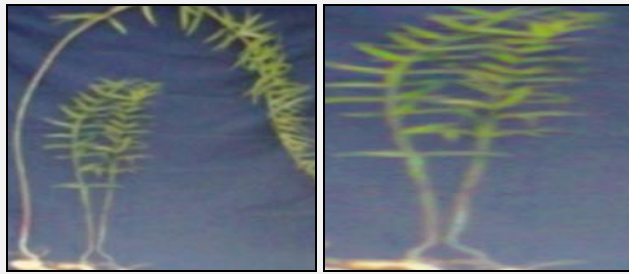
**Maha meda**,  
(Rhizomes and roots), <sup>7, 21-22, 26, 29, 62, 83-84</sup>  
(*Polygonatum cirrhifolium* (wall.) Royal) and  
(*Polygonatum Vertecillatum* Alloi)



**a- Satavari** (root bulbs),  
(*Asparagus racemosus* willd) Royle)

**b- Shakakul mishri** (root bulbs),  
(*Polygonatum multiflorum* (Linn.) All.)

**c- Prasarani**, (root bulbs),  
(*Paederia foetida* Linn.)



18 **Rakta Chandana or Sandal Surkh,**  
(Hard wood powder), <sup>7, 21-22, 24, 63-64, 66-72, 83</sup>  
(*Pterocarpus santalinus* Linn.)

a- **Red Capsicum, Lal shimla mirch,** (Fruit powder),  
(*Capsicum annum* Linn., *Capsicum baccatum* Linn. and  
*Capsicum frutescens* Linn.)



19 **Sveta Chandana or Sandal Safed,**  
(Hard wood powder), <sup>7, 21-22, 24, 65-72, 83</sup>  
(*Pterocarpus santalinus* Linn.)

a- **White Capsicum, Safed shimla mirch,**  
(Fruit powder),  
(*Capsicum annum* Linn.)



**20 Kesar, Keshar or KumKum, Zafran,** (Styles and Stigmas of Aerial part of the flower ), <sup>7, 21-22, 24, 26, 73-75, 83</sup>  
(*Crocus sativus* Linn.)



**a-Kusubh, Kusum,** (Style and Stigma of Aerial part of the flower ), (*Carthamus tinctorius*)



**TABLE 3: ACTIVE PHYTOCHEMICAL CONSTITUENTS OF ENDANGERED, COSTLY ASU. HERBAL DRUGS OF INDIA** <sup>7, 21-22, 24, 26, 32-33, 83-84</sup>

S. no.	Local name and Botanical name	Family and Part used	Investigated and reported Active phytochemical constituents
1	Vatsnabh , ( <i>Aconitum Chasmanthum</i> stapf ex. Haines)	Ranunculaceae, (Dried root)	Aconite alkaloid contained - 2.85% to 3.11%, <i>Aconitum Chasmanthum</i> stapf ex. Haines- Aconite alkaloid - 3.092 %
2	Ativisha, ( <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%
3	Kutki , ( <i>Picrorhiza kurroa</i> royle ex)	Serophulariaceae, (Dried rhizome)	Kuthoside, Glycoside - Picoside, Andrasis & Apocyne, Active Iridoid glycoside contained - Picrotin - 1.50% to 3.10% , Picrotoxin – 0.83 to 1.70%
4	Kuth or Kustha, ( <i>Saussurea lappa</i> )	Compositae, (Astenaceae), (Dried root)	Hexadectarinol-2.5%-5%, Dehydrocostus 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
5	Puskar mool, ( <i>Inula racemosa</i> )	Compositae, (Astenaceae), (Dried root)	Trinosesquiterpene, Lactones, Alanto- lactone , Isoalloalanto lactone essential oil
6	Chirata, ( <i>Swerita chirata</i> Buch. Ham.)	Gentianaceae, (Whole plants)	Seco-iridoid glycoside, Enico-flovine, Gontia -mine & Gentiocrucine triterpenoid alkaloid, Lupeol, Triterpene alcohol, Swertanone & Swertanol Triterpenoid,Swertaianin Xan-thone , $\beta$ -sitosterol-3- $\beta$ -D-glucoside sterol
7	Jatamansi, ( <i>Nardostachys Jatamansi</i> DC)	Valerianaceae, (Dried rhizomes)	Sesquiterpene acid,Nardin and Coumarins, Pyranocoumarin, Volatile oil % - 0.5% to 2.5%
8	Guggulu or Guggul <i>Commiphora wightii</i> (Arn.) Bhand and <i>Commiphora mukul</i> Engl.	Bureseaceae, (Exudate, natural resin)	Lignons,Lipids,Diterpens and Steroids,Z-Guggulsterone and E-Guggulsterone, Querce -tin palmitic and stearic acids, Compesterol, Cholesterol, $\beta$ -sitosterol, $\alpha$ -Spinosterol(seed oil),Comphorene, polymyrcene and caryaphy -llene (essential oil)etc.,Total % of Guggl -sterones - 0.75 to 2.35%, Volatile oil-1.0 to 5.0%
9	Hing or Hingu, ( <i>Ferula foetida</i> regal) and ( <i>Ferula narthex</i> boiss)	Umbelliferae, (Exudate, natural resin)	Resin- 40 to 65%,Gum - 20 to 25%, Volatile oil - 4 to 20%,Sesquiterpene, Assafoetidnol A & B, Umbellifeone, Fesclol, Azulene, $\alpha$ -pinene, $\alpha$ -terpineol, $\alpha$ -Zulene, Vanillin, Ferulic acid, Diallyldisulfide, Diallyl disulphfide , Luteolin Resin, Volatile oil, $\alpha$ -bicycliterpenoid, Triterpenic and Fatty acid compound- Oleanonic acid, Moronic acid, 242-masicadienolic acid, 242-iso- masticadienolic acid, Triucallol, Dammarodienone, 28-naroleon-12-en-3-one, Oleonic aldehyde
10	Rumi Mastagi or Mastagi (Resin), (Exudate), ( <i>Pistacia lentiscus</i> Linn)	Anacardiaceae, (Exudate, natural resin)	Dried Tuber contained Starch and Minerals with bitter Substances, Also reported Taxol compound
11	Riddhi, ( <i>Hobenaria intermedia</i> D. Don )	Orchidaceae, (Tuber)	Dried Tuber contained Starch and Minerals with bitter Substances, Also reported active Phenolic compounds
12	Vridhhi, ( <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	Kakoli, ( <i>Roseea purpurea</i> Smith)	Zingiberaceae, (Rhizome and Tuberous root)	Dried Rhizome and tuberous root contained Flavonoids, Alkaloids, Tannins, Saponin. Glycoside and also reported active Phenolic compounds
14	Kshirakakoli, ( <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-linoleiyl-3-linoleiate, Glyceryl-1-n-octadec-9-enoyl-2-n-decomoyl-3-n-decanoate and Glyceryl-1-octadec-9-enoyl-2-octadec-9, 12-dienoyl-3-tetra cosanote and alkaloids Kashmirine (imperialine), peimine, Peimisine,

15	Jeevak, ( <i>Crepipium acuminatum</i> (D. Don.) Szlach.)	Orchidaceae, (Pseudobulb)	Propeimine, Peimiphine and Peimitidine 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	Rishbhak, ( <i>Malaxis muscifera</i> (Lindl.) Kuntze)	Orchidaceae, (Pseudobulb)	Dried pseudobulb contained bitter substances alkaloid, glycoside, flavonoids with active derivate compounds
17	Meda, ( <i>Polygonatum verticillatum</i> (Linn.) Allioni )	Liliaceae, (Rhizome and root )	Dried Rhizome and root are contained Lysine, Serine, Aspartic acid, Threonine, Diosgenin, $\beta$ -sitosterol, Sucrose and Glucose
18	Maha meda, ( <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	Rakta Chandana or Sandal Surkh, ( <i>Pterocarpus santalinus</i> Linn.)	Papilionaceae, (Hardwood powder)	Dried hard wood contained Santalol, Essential oil - 1.0 to 3.5%, Glycosides, coloring matter. As well as Dried seeds contained 50% fixed oil
20	Sveta Chandana or Sandal Safed, , ( <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, coloring matter. As well as Dried seeds contained 50% fixed oil
21	Keshar or Kesar, KumKum, Zafran, ( <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 phytochemical constituents - Gums - 10%, Pentosans - 8.0% ,Polypeptieds-11-14%,Carotenoids-1%, Lipids -12 %,Starch-6%,Non volatile oils -6.0 %,Volatileoils- 12%,Water-10%,Fibers-(crude)-5.6%, $\alpha$ -Crocic- 2.0%,Crocetin, Crocin, Picrocrocine, Safranlol
22	Badam or Badam shireen, ( <i>Prunus amygdalus Batsch. var.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 flavanones, protein, fat, sugar, glycoside, daucostrin, sito- sterol, Vitamin-E, Essential oil - 36% -60%
23	Gulab or Gul-e-Surkh, ( <i>Rosadamascena</i> Mill.)	Rosaceae, (Dried flower)	Gulab flowers parts or Roses contained $\beta$ -phenethyl -B-D- glycopyranoside, Diglucoside, phenylethanol-2- hydroxyursolic 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:** In the challenging task of Drug controlling and Drug regularity affairs and pharmacovigilance aspects for used Misbrand, Adulterated or Substituted, Spurious drugs in ASU. herbal products that are a major offense which is Government or private industrialist or pharmacy manufacturer have used Misbrand blindly, Adulterated or Substituted, Spurious drugs as intestinally or unintentionally in our various type of ASU.

Herbal products hence finally effected and suffer our ignescent national peoples due to continue using and no medicinal values of its result of their adverse and side effect to humankind. It is found out focus point on the aspects of conclusive view or scientific observation that all adulterations are intentional malpractice as stated in many authenticated literature. 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 of their spurious as well as the collection of substitute, adulterations supply. Major reasons are named confusion, non-availability, and lack of knowledge about the authentic plant.

Even scientific community and traditional physicians (Hakeems and Vads from production ends) which has attached or debuted in production sites are unaware of it and consumed intestinally or unintentionally using as an organoleptic test (Panchiyainderiya parikshen) malpractice in large scale levels for manufacturing and formulation Herbal Pharmaceuticals and Pharmacies of Government and Private organization. Resulted effectually suffer ignescent national peoples due to their continues using and without having any medicinal values, Quality and Efficacy as well as decrease product shelf life. Now today's demand herbal drug industries follow, high-quality standards using modern techniques and instruments such as Auto-UPLC, HPTLC, GC-MS.,  $C^{13}$  and  $H^1$  NMR Chromatography and Spectroscopy techniques, etc. to maintained and monitored their

standard quality and determine sophisticated 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 and our expertise devotion to improving day to day products Quality and Efficacy, shelf life. The future research and development require of the Pharmacognostic and Phytochemical analysis, cross-check of active phytochemical constituents concentration as the aspects of evolution medicinal potency, purity, safety of the final finished goods products as well as pharmacovigilance aspects with complies evolution of it's medicinal values, potency, purity, product stability for the detect and investigate changes, decay of active phytochemical constituents by using their references standards. in the resulted follow-ups requirements provide or issue rule and act, time to time update and modify guideline should be follows 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 Drug Controlling and Regularity authority (DCRA.), World Health Organization (WHO) authorities for effectively redressal complaints and control of using adulteration, substitution, spurious drugs in ASU herbal products<sup>2, 6, 10, 14, 17</sup>.

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 (*e.g.*, stem in leaf drugs), even though they derived from the authentic plant. Based on these standards, adulteration, whether intentional or unintentional should be rejected<sup>2, 10, 84</sup>. 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.

**CONCLUSION:** As the scientific ethnobotanical and innovated demand of protecting critically endangered, rare and costly medicinal plant species. It should be a 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 farming, 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 oushadhee therapy developed, served as well as provide traditional and alternative original medicinal plant-based standard quality ASU. Products to our stream nation<sup>29, 83, 84</sup>.

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### CONFLICT OF INTEREST: Nil

### REFERENCES:

- Kokate CK, Purohit AP and Gokhele SB: Pharmacognosy. Chapter-6, Nirali Prakashan, 2007; 39<sup>th</sup> Ed: 97-98.
- Anonymous, The Drugs and Cosmetics Act and Rule, (The Drugs and Cosmetics Act 1940. The Drugs and Cosmetics Rule 1945), Government of India, Ministry of Health and Family Welfare, chapter 2, 2003: 5.
- Dubey NK, Kumar R and Tripathi P: Global promotion of herbal medicine: India's opportunity, Current Science 2004; 86(1): 37-41.
- Tewari NN: Some crude drugs: source, substitute and adulterant with special reference to KTM crude drug market. Sachitra Ayurved 1991; 44(4): 284-90.
- Vasudevan NK, Yoganarasimhan KR, Kehava M and Shantha TR: Studies on some south Indian market samples of Ayurvedic drugs II. Ancient Science of Life 1983; 3(2): 60-66.
- Bisset WG: Herbal drugs & phytopharmaceuticals, CRC Press, London 1984.
- Sunita G: Substitute and adulterant plants, Periodical Experts Book Agency, New Delhi. 19 92.
- Uniyal MR and Joshi GC: Historical view of the basic principles of the identification of controversial drugs, problems and suggestions. Sachitra Ayurved 1993; 45(7): 531-36.
- Saraswathy A: Adulterants and substitutes in Ayurveda. Sachitra Ayurved 2001; 54(1): 63-66.
- Gupta AK. Quality standards of Indian medicinal plants Vol. I. ICMR, New Delhi 2003.
- De Smet PAGM, Keller K, Hansel R and Chandler RF: Adverse effects of herbal drugs. Vol.1. Springer-Verlag, Heidelberg 1992.
- Afaq SH: A comparative introduction of the Unani and Tibetan medical traditions, Ayur Vijnana 1999; 6. Accessed on 25 January 2013.
- Mitra SK. and Kannan R: A Note on Unintentional Adulterations in Ayurvedic Herbs. Ethno botanical Leaflets 2007; 11: 11- 15.
- Sarin YK: Illustrated Manual of Herbal drugs used in Ayurveda and Unani, Joint Publication of C.S.I.R and I.C.M.R, New Delhi 1996.
- Mishra B, Shankar and Vaishya R: "Bhava Mishra's Bhavaprakasha Choukamba Sanskrit sansthan, Varanasi, UP, 10<sup>th</sup> ed: 2002.
- Shastri Ambikadatta "Baishajya Ratnavali" Chaukamba Sanskrit Sansthan, Varanasi, U.P. 18<sup>th</sup> Ed: 2005.
- Mukherjee PK: Quality Control of Herbal drugs, Business Horizons, New Delhi. 2002; 1<sup>st</sup> ed: 113-17.
- Pandeya G: Caraka Samhita of Agnivesa with Cakrapanidatta Tika. Chaukhamba Sanskrit Sansthan, Varanasi 1997.
- Chunekar KC: Bhavaprakasa Nighantu of Bhavamisra. Chaukhamba Bharati Academy, Varanasi 2004.
- Sastry R: Bhaishajya Ratnavali of Govind Das Sen. Varanasi: Chaukhamba Sanskrit Bhavan 2002.
- Poornima B: Adulteration and substitution in herbal drugs a critical analysis, IJRAP 2010; 1(1): 8-12.
- Mallick RA and Amrinder AK: Adulteration and substitution in Indian medicinal plants. IJPRBS 2013; 2(1): 208-18.
- Chouhan NS: Medicinal and Aromatic plants of H.P.; 1999: 373-74.
- Shah B and Seth AK: Test book of pharmacognosy & phytochemistry. Drug Adulteration Chapter 10; 2010: 107-09.
- Uniyal Mayaram. Astavarga Sandigdha Vanaushadhi, Dhanwantri Patrika, Shri Jwala Ayurvedic Bhavan Aligharh 1975.
- Uniyal Mayaram. Medicinal plants and minerals of Uttarakhand Himalaya, Baidyanath, Ayurved Shodh Sansthan, Patna 1987: 168-33.
- Uniyal Mayaram. Medicinal Flora of Garhwal Himalya shree Baidyanath Ayurvedic Bhavan, Nagpur 1989.
- Uniyal Mayaram. Medicinal plants and minerals of Uttarakhand Himalaya, Baidyanath, Ayurved Shodh Sansthan, Patna 1997.
- Balkrishna A, Vashistha RK, Srivastva A and Mishra RK: Astavarga plants-threatened medicinal herbs of the North-West Himalaya, International Journal of Medicine and Aromatic Plants 2012; 2(4): 661-76.
- Chauhan RS, Noutiyal MC and Prasad P: *Habenaria intermedia* D. Don. An endangered medicinal orchid. The MeAllen International orchid Society Journal 2007; 8(10): 15-20.
- Naqurikamran J, Husain AS, Ali M and Nazish I: Phytoconstituents from the bulb of *Lilium polyphyllum* D. Don. International Research Journal of Pharmacy 2012; 3(2): 146-48.
- Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-II, First edition 1999: 180-82.
- Sarkar PK, Prajapati PK, Pillai APG, Chauhan MG and Chuhhan: Pharmacognosy of aconite sold under the name Vatsanabha in Indian market. Indian Journal of Traditional Knowledge 2012; 11(4): 685-96.
- Anonymous, The Unani pharmacopeia of India, part-I, Volume-I, First edition 2007; 11-12.
- Bahuguna R, Prakash V and Bisht H: Quantitative enhancement of active content and Biomass of two aconitum species through suitable cultivation technology; International Journal of Conservation Science 2013; 4(1): 101-06.
- Anonymous, The Unani pharmacopeia of India, part-I, Volume-IV, First edition 2007; 85-86.
- Singh AP: Kuthins -A Review of Chemistry and Pharmacology, Ethnobotanical leaf lets. An international Journal of Ethnobotanical Research 2004; 1(9): 1-5.
- Bahuguna R, Bisht H and Prakash V: Active content enhancement through different agrotechnological and post harvesting approaches in *Picrorhiza Kurroa* Royel ex benth, An endangered medicinal plant; International Journal of Biological Chemistry 2012; 6: 97-102.
- Andola HC, Gwari G, Bhandari U, Lohani H and Chouhan N: Volatile constituents of *Saussurea costus* roots cultivated in Uttarakhand Himalayas. Indian Journal of Pharmacognosy Research 2013; 5(3): 179-82.
- Robinson A, Kumar V, Rao JM, Srinivas PV and Babu KS: A new sesquiterpene lactone from the roots of *Saussurea lappa*: Structure - anticancer activity study. Bio Organic and Medicinal Chemistry Letters 2008; 18: 4015-17.
- Jamma, Jabbar, Balakrish R, Ramakrishnan P, Sarala, Samuel and Jally C I: Comparative pharmacognostic study of *Inula racemosa* Hook. f. and its adulterant *coffea travanocorensis* wight & Arn. Indian Journal of Natural Products and Resources 2012; 3(3): 386-94.
- Anonymous, The Unani pharmacopeia of India, part-I, Volume-I, First edition 2007; 23-24.
- Joshi P and Dhawan V: *Swertia chirayita*-An overview. Current Science 2005; 89(4): 635-40.



44. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-I, First edition 1986; 67-68.
45. Chatterjee A, Basak B, Dalla U, Baner J, Neuman A and Prange T: Studies on the chemical constituents of *Nardostachys jatamansi* DC. (Valerianaceae). Indian Journal of Chemistry 2005; 44B: 430-433.
46. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-I, First edition 1989; 43-44.
47. Mohan JSS, Kalpesh B, Ishnava and Mahida YN: *In-vitro* assessments of antibacterial potential of *Commiphora wightii* (Arn.) Bhendari gum extract. Journal of Pharmacognosy and Phytotherapy 2010; 2(7): 91-96.
48. Kant T, Prajapati S and Parmar AK: *Commiphora wightii* (Guggul) An endangered Ayurvedic Divyaushidhi; 2005:1-11. Internet address [http://www.afri.res.in/download/thematic\\_2\\_load.pdf](http://www.afri.res.in/download/thematic_2_load.pdf).
49. Sabinsa Corp. *Commiphora mukul*: The plant source of Guggulipid. 2000. Internet address <http://www.gugulip.com/commip.htm>
50. Sharma ML: Comparative chemical analysis of oleogum resin of *Commiphora wightii* Arnott. Bhandari. Current Science 1994; 66(1): 9-10.
51. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-I, First edition 1989; 43-44.
52. Kareparamban JA, Nikam PH, Jadhav AP and Kadam VJ: *Ferula foetida* "Hing": a review. Research Journal of Pharmaceutical, Biological and Chemical Sciences 2012; 3(2): 775786.
53. Shah NC and Zare A: Asafoetide (Heeng); The well know medicinal condiment of India & Iraq. Herbal Tech Industry Journal 2013; 10(41): 1-8
54. Sharadini A and Dahanukar: Immunostimulants in Ayurvedic medicines, Immuno- modulatory agents from plants, edited by Wagner H, Switzerland 1999: 316.
55. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-V, First edition 2006; 190-91.
56. Anonymous, The Unani pharmacopeia of India, part-I, Volume-V, First edition 2008; 50-51.
57. Zalkaw CH, Hydson CC and Pouris G: Medicinal and Aromatic plant Abstract 1984; 17-19.
58. Paraschas S, Magiatis P and Mitakou S: *In-vitro* and *in-vivo* activities of chios mastic gum extracts and constituents against *Helicobacter pylori*. Antimicrobial Agents Chemother Journal 1990; 51(2): 551-59.
59. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-V, First edition 2006; 184-85.
60. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-III, First edition 2001: 79-80.
61. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-V, First edition 2006: 103-04.
62. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-V, First edition 2006; 119-21.
63. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-III, First edition 2001: 156-57.
64. Anonymous, The Unani pharmacopeia of India, part-I, Volume-V, First edition 2008; 80-81.
65. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-III, First edition 2001: 208-09
66. Nulu JR and Singh CU: Sandalwood oil and Santalols for treating cold sores and herpes; 2010. United State patent publication NO.US7858126B2. <http://www.google.com/patents/US7858126>
67. Okugawa H, Ueda R and Matsumoto K: Effect of alpha-Santalol and beta-Santalol from sandalwood on the central nervous system in mice. Journal of Phytomedicines 1995; 2: 119-26.
68. Divivedi C and Ghazaleh A: Chemopreventive effects of Sandalwood oil on skin papillomas in mice. European Journal of Cancer Prevent 1997; 6(4); 399-01.
69. Burdock GA and Carabin IG: Safety assessment of Sandalwood oil (*Santalum album* L.) Journal of food Chemistry Toxicology 2008; 46: 421-32.
70. Warnke PH: The battle against multi-resistant strains: the renaissance of antimicrobial essential oils as a promising force to fight hospital-acquired infection. Journal of Carnio. Maxillofacial Surgery 2009; 37: 392-97.
71. Paulpandi M, Kannan S, Thangam R, Kaveri K, Gunasekaran P and Rejeeth C: *In-vitro* anti-viral effect of  $\beta$ -santalol against influenza viral replication, Journal of Phytomedicine 2012; 19: 231-35.
72. Wang Z and Hang X: Comparative GC analysis of essential oil in imported sandalwood. Zhagguo Zhong Yao Za Zhi 1991; 16(64): 40-43.
73. Anonymous, The Ayurvedic pharmacopeia of India, part-I, Volume-IV, First edition 2007: 59-60.
74. Anonymous. The Unani pharmacopeia of India, part-I, Volume-VI, First edition 2009; 101-02.
75. Srivastava R, Ahmed H, Dixit RK, Dharamveer and Saraf SA: *Crocus sativus* L.: A Comprehensive review. Journal of Pharmacognosy Review 2010; 4(8): 200-208.
76. Anonymous, The Unani pharmacopeia of India, part-I, Volume-II, First edition 2007; 17-18.
77. Mandalari G, Tanaine A, Arcoraci T and Martorana M: Characterization of polyphenol, lipids and dietary fibre from almond skins (*Amygdolus Communis* L.). Journal of Food Composition and Analysis 2010; 23(2): 166-74.
78. Labavitch J: Almond, United sates Dept. of Agricu 2001: 1-4.
79. Venkatachalam M and Sathe SK: Chemical composition of selected edible nut seeds. Journal of Agriculture Food Chemistry 2006; 54(13): 4705-14.
80. Soler: Oil content and fatty acid composition of developing almond seeds. Journal of Agriculture Food Chemistry 1988; 36(4): 695-97.
81. Anonymous, The Unani pharmacopeia of India, part-I, Volume-III, First edition 2007; 31-32.
82. Sharma KR, Sood SK and Singh VB: Effect of diurnal variability and storage conditions on essential oil content and quality of damask rose. (*Rosa damascene* Mill.) flowers in north western Himalayas, Scientia Horticulture 2013; 154: 102-08.
83. Anonymous, Quality control methods for medicinal plant materials, World Health Organization, Geneva 2000.
84. Ved DK, Kinhal GA, Kumar KR, Prabhakaran V, Ghate U, Sankar RV and Indresha JH: CAMP Report: Conservation assessment and management prioritization for the medicinal plants of Jammu & Kashmir, Himachal Pradesh & Uttarakhand, workshop, Shimla, Himachal Pradesh, FRLHT., Bangalore, India 2003: 206.

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