Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating 2017: 3.53
JMPS 2017; 5(4): 01-06

Received: 01-05-2017
Accepted: 02-06-2017

Dr. Sreelekshmi M
PG Scholar, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Dr. Vimala KS
Professor, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Dr. Raiby P Paul
Assistant Professor, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Dr. Nidhin Chandran
PG Scholar, Department of Swasthavritha, School of Ayurveda, Amrita University, Kollam, Kerala, India

Dr. Priyanka A Shine
PG Scholar, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Dr. Nazneen A Salam
PG Scholar, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Correspondence
Dr. Sreelekshmi M
PG Scholar, Department of Dravyaguna, School of Ayurveda, Amrita University, Kollam, Kerala, India

Drug adulteration: A threat to efficacy of ayurveda medicine

Dr. Sreelekshmi M, Dr. Vimala KS, Dr. Raiby P Paul, Dr. Nidhin Chandran, Dr. Priyanka A Shine and Dr. Nazneen A Salam

Abstract
Even though Ayurveda has gained popularity among the medicinal systems there is a hindrance to its further development. One of the burning problems is the practice of adulteration which creates doubts and disbelief in the curative capability of traditional systems.In the present work methods & reasons for adulteration are described. The efficacies of Ayurvedic Products are critically dependent on an uninterrupted availability of herbs. The unethical practice of adulteration by the drug manufacturers would not only reduce the efficacy of the drugs but also affect the trust of the people in the traditional healthcare systems. Adulteration may be evaluated by different methods like morphological or organoleptic tests, microscopic evaluation, chemical evaluation, physical evaluation, chromatography, spectrophotometry etc. The solution lies in ensuring the availability of crude drugs. Studies on adulteration practices will have to be taken up along with identification of the scares drugs. Conservation measures of their natural habitat & ex-situ medicinal plant cultivation may have to be taken up in large scale.

Keywords: Adulteration, chromatography, spectrophotometry

Introduction
Ayurveda is a system of Indian traditional form of alternative medicine. Too often we hear the expression as herbal products are natural, they are safe, unfortunately this is not always true because of many reasons & one among them is Drug Adulteration. In olden days, Vaidyas used to treat patients on individual basis & prepare drug according to the requirement of the patients but now the scene has changed, herbal medicines are being manufactured on large scale. Currently, there is very high demand for all forms & preparations of medicinal plants worldwide. There is a great demand for raw materials even as medicinal plants worldwide are facing the threat of becoming extinct or endangered.

During the recent years people are becoming aware of side effects & adverse reactions of synthetic drugs, so there is an increasing interest in traditional system of Medicines. Even though Ayurveda has gained popularity among the medicinal systems there is a hindrance to its further development. One of the burning problems is the practice of Adulteration which creates doubts and disbelief in the curative capability of traditional systems.The mushrooming Ayurvedic industry and removal of natural forest habitats of these plants had adverse impact on the herb supply. The deforestation and extinction of many species & incorrect identifications intentionally or unintentionally of many rare, endangered plants has resulted in a quality assurance and quality control of herbal drugs.

Definition [1-2]
Adulteration is a practice of substituting original crude drug partially or whole with other similar looking substances but the latter is either free from or inferior in chemical and therapeutic properties. Adulterants are usually sub-standard varieties of a crude drug or inferior drug or artificially prepared commodities.

Types of Adulteration [3]
Adulteration can be broadly classified into two types
Deliberate (Intentional) Adulteration: Intentional adulteration is mainly encouraged by traders who are reluctant to pay premium prices for herbs of superior quality & hence are inclined to purchase only the cheaper products.

This encourages producers & traders to sell herbs of inferior quality.

In-deliberate/Unintentional (Accidental) Adulteration: Occurs without bad intention of the manufacturers or suppliers. Some times in the absence of proper means of evaluation, an authentic drug partially or fully devoid of the active ingredients may enter the market.

Methods of Adulteration

- Inferiority
- Spoilage
- Deterioration
- Admixture
- Sophistication
- Superficially similar Inferior drugs
- Artificially Manufactured substance
- Using of Synthetic Drugs
- Harmful Adulterants

From the stand point of present day commerce, inferior, spoiled or deteriorated drug represent the greatest percentage of cases of drug adulteration.

Inferiority: Replacement with substandard drug. Natural sub-standard condition, where a crop is taken whose natural constituents is below the minimum standard for that particular drug. Adulterants resembles the original crude drug morphologically, chemically, therapeutically but are sub-standard in nature and cheaper in cost.

Examples: *Strychnos nux-vomica* adulterated with *Strychnos potatorum, Indian senna* adulterated with *Arabian-senna*, *Zingiber officinalis* adulterated with *Japanese ginger*, *Solanum xanthocarpum* adulterated with *Solanum mammosum.* It can be avoided by more careful selection of plant material, (Figure 1)

Fig 1: (Inferiority)

Spoilage (Attack of Microbes): Sub-standard condition produced by microbial or other pest infestation which makes a drug unfit for medicinal preparation. Examples: Ativisha, Vatsanabha and Vacha. It can be avoided by giving more careful attention to the drying & storage conditions. (Figure 2)

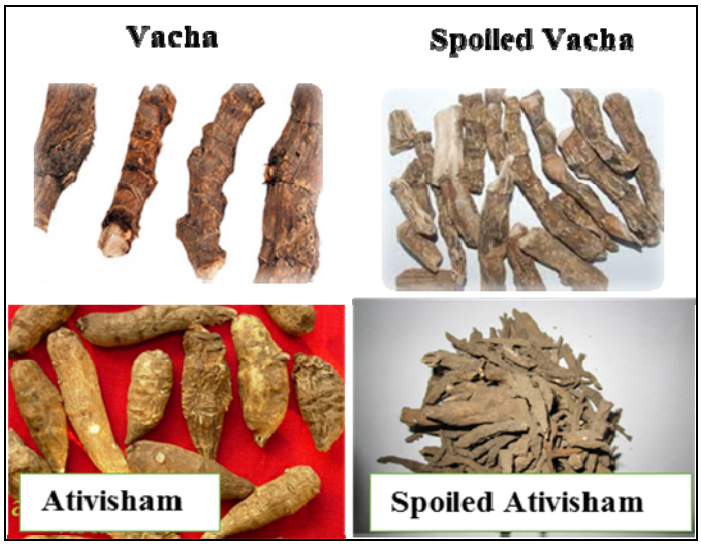

Fig 2: (Spoilage)

Deterioration: Deliberate extraction of the constituents & the sale of the residue as the original drugs. Refer to any impairment of the quality or value of a drug due to destruction or abstraction of valuable constituents by some physical processes. Same drug is admixed but that drug is devoid of medicinally active substance as it has been already extracted. Mainly volatile oil containing drugs like Fennel, Clove, and Coriander are adulterated by this method. (Figure 3)

Fig 3: (Deterioration)

In case of using exhausted drugs, as it is devoid of colour & taste due to extraction, natural colour & taste is manipulated with additives.

Admixture: Refers to addition of one article to another through accident, ignorance or carelessness. A part of same plant which is devoid of therapeutic action is mixed. Eg: Stem portions are mixed along with leaf in drugs like –*Bala; Dhattura*; Inclusion of soil and stone pieces in *Hingu; Sariba* root with adhering soil and other plants; Clove is mixed along with leaves and petioles.

Sophistication: Means addition of spurious or inferior material to an article with an intent to defraud. The drugs which are in the form of powders are frequently adulterated by this method. Example: Addition of wheat flour to powdered ginger, with enough capsicum to restore the pungency &curcuma to maintain the colour; Rose wood in capsicum powder; powdered bark adulterated with brick powder. (Figure 4)

Fig 4: (Sophistication)

Superficially Similar but Inferior Drugs: Inferior drugs may or may not have any chemical or therapeutic value. Eg:*Piper nigrum* adulterated with *Carica papaya;Crocus sativus* adulterated with *Carthamus tinctorius*; *Bee wax* adulterated with *Japan wax; Belladona leaves* adulterated with *Ailanthus leaves.* (Figure 5)

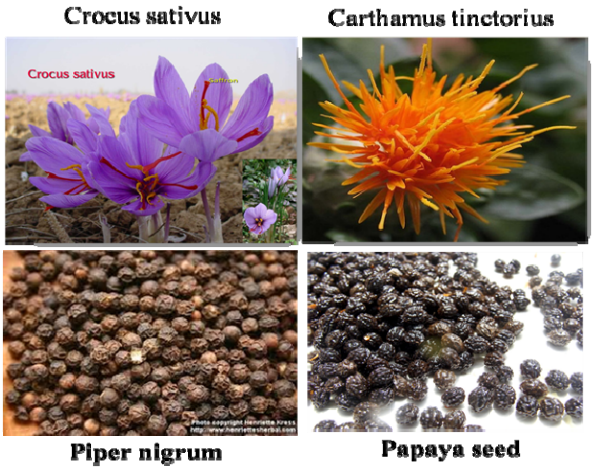

Fig 5: (Superficially Similar but Inferior Drugs)

Artificially Manufactured Substances: The drug is adulterated with substance which has been prepared artificially. Examples: Properly cut, shaved Basswood – For nutmeg; Yellow coloured paraffin wax for Bees wax.

Using of Synthetic Drugs: Synthetic chemicals are used to enhance natural character. Eg: Citral is added to citrus oils (like oil of lemon and oil of orange).

Harmful Adulterants: Sometimes waste from the market are collected and admixed with the authentic drug. Eg: Limestone in Asafoetida, Mentanil Yellow in Turmeric powder, Lead shot in Opium, Addition of rodent faecal matter in Cardamom seed, Argemone seed in Mustard seed, White oil in coconut oil. (Figure 6)

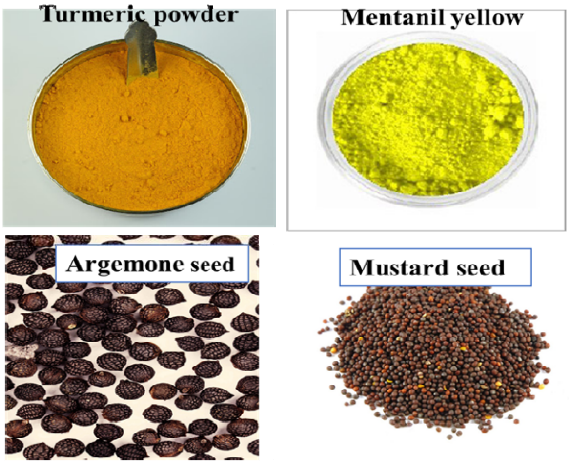

Fig 6: (Harmful Adulterants)

Detection of Mentanil Yellow: Dissolve half spoon of Turmeric powder in Luke warm water. Add drops of HCl, and then if the aqueous solution turned pink, violet or purple, it indicates the presence of mentanil yellow. Mentanil yellow is carcinogenic.

Reasons for Adulteration [4]

- Confusion in vernacular names.
- Lack of knowledge about authentic sources.
- Similarity in Morphology.
- Lack of authentic plants.
- Unscientific collection.
- High price of the drug in the market.
- With the intention of enhancing profits.

Confusion in vernacular names: Because of the confusion in vernacular names, there occurs adulteration with other drugs. For example, *Lantana camera* an ornamental plant & *Pergularia daemia* (Yugmaphala), both have same name as Veliparuthy in malayalam. (Figure 7)

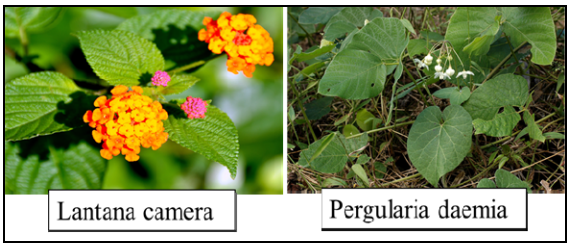

Fig 7: (Confusion in vernacular names)

Lack of knowledge about authentic source: Though authentic plant is available in plenty in Western Ghats & Himalayas, suppliers are unaware of it. Nagakesara (*Mesua ferrea*), market samples are adulterated with flowers of *Calophyllum inophyllum* (Punnaga) Figure 8

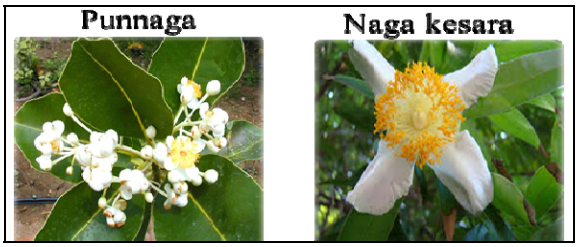

Fig 8: (Lack of knowledge about authentic source)

Adulterated flowers are identified by presence of two celled ovary, but the original flowers are with single celled ovary.

Similarity in morphology: *Mucuna pruriens* adultered with,other similar papilonaceae seeds like *Mucuna utilis* (White variety) & *Mucuna deeringiana* (Bigger variety).Apart from this, *Canavalia virosa* & *Canavalia ensiformis* are sold in Indian market for *Mucuna pruriens.(Figure 9)*

Fig 9: (Similarity in morphology)

Authentic seeds are up to one cm in length with shinning mosaic pattern of black or brown colour on their surface.

Lack of authentic plant: Ancient Vedic literature reveals the description of Soma plant.ie, Somalatha (*Sarcostemma acidum),* but identification of the plant and its morphology, habitat and distribution are still not clearly established. So different botanical sources like *Ephedra gerardiana, Ceropegia species* are used. (Figure 10)

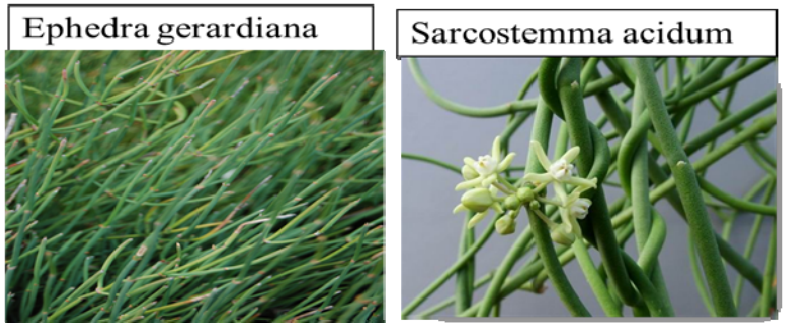

Fig 10: (Lack of authentic plant)

Unscientific collection: Careless collection of herbs by suppliers. For eg: Saileyam or Shilapushpam [5] *(Parmelia perlata), a* lichen usually admixed with *Parmelia perforata & Parmelia cirrhata*. (Figure 11)

Fig 11: (Unscientific collection)

Effect of adulteration on GMP

The efficacies of Ayurvedic Products are critically dependent on an uninterrupted availability of Herbs. It means that Ayurvedic plants of the right quality should be available in the right quantity. The Government of India considers more than100 Ayurvedic plants to be scarce. This scarcity has unfortunately resulted in most Ayurvedic manufacturers either skipping the scarce herbs in the preparations or accepting knowingly or unknowingly adulterated herbs from forest gatherers. It is not that all adulterations are intentional malpractice as stated in many literatures. But it is noted that the herbal drugs are adulterated unintentionally also. Suppliers are illiterate and not aware about their spurious supply. Major reasons are name confusion, non-availability and lack of knowledge about authentic plant. This unethical practice of the drug manufacturers would not only reduce the efficacy of the drugs but also affect the trust of the people in the traditional healthcare systems.

Adulterants of some medicinal plants (Figure 12) [6]

S.N	Drug Name	Genuine Source [7]	Adulterant
1	Asoka	*Saraca asoca*	*Polyalthia longifolia*
2	Vasha	*Adhatoda vasica*	*Ailanthus excels*
3	Yashtimadhu	*Glycyrrhiza glabra*	*Abrus precatorius*
4	Sarpagandha	*Rauwolfia serpentina*	*Rauwolfia densiflora*
5	Parpata	*Fumaria parviflora*	*Justicia procumbens*
6	Langali	*Gloriosa superba*	*Costus speciosus*
7	Maricha	*Piper nigrum*	*Schinus molle*
8	Markandika	*Cassia angustifolia*	*Cassia obtuse*

Fig 12: (Adulterants of some medicinal plants)

Detection of Adulteration [8]

Adulteration may be evaluated by following methods:

- Morphological or Organoleptic tests
- Microscopic Evaluation
- Chemical Evaluation
- Physical Evaluation
- Chromatography
- Spectrophotometry
- Radio Immuno Assay
- Biological Evaluation

Test for Genuinity of Drugs [9]

a) Kumkuma (*Crocus sativus*): Adulterants are Stamens of Safflower, Stamens of Marigold. Test for Genuinity: When sprinkled with concentrated H_2SO_4, the stigmas turn blue immediately, gradually changing to purplish red.

b) Haridra (*Curcuma longa)*: On addition of Concentrated H_2SO_4 or a mixture of concentrated H_2SO_4 and alcohol to the powdered drug: A deep crimson colour is produced, if the sample is genuine.

c) Hingu (*Ferula asafoetida*): Freshly broken surface when touched with concentrated H_2SO_4: A bright red or reddish brown colour is produced, changing to violet when acid washed off with water, if the sample is genuine.

d) Karpoora (*Cinnamomum camphora*): Adulterants used are Gum, Resin, Alum, Starch etc. Original camphor floats & burns quickly. Original camphor dilutes very quickly, when put in Chloroform or solvent ether, but adulterated may dilute slowly.

e) Guggulu (*Commiphora mukul)*: Adulterants used are sand, wood pieces, pieces of bark and shallaki exudates.When small particles put on water, the particles become round. When put on fire, first liquefies then gives white fumes.

f) Sarja (*Vateria indica*): Slightly soluble in Alcohol in which it forms a jelly like mass, insoluble in petroleum ether forming white precipitation.

g) Kunduru (*Boswellia serrata*): Trituration with water forms an emulsion. When immersed in alcohol (90%),a tear of Kunduru is not altered much in form, but becomes almost opaque and white.When a drop of concentrated H_2SO_4 is added on a freshly fractured surface, it becomes cherry red which when washed with water changes to white emulsion, then turn to a buff color.

Conclusion

So, it is high time to have a control over both intentional & unintentional Adulteration. Nowadays, herbal drug industries follow, high quality standards using modern techniques and instruments to maintain their quality. World Health Organization (WHO), 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 [10]. The collectors and traders have to be educated about the danger and unethical nature of adulteration. Legal sanctions based on proven studies on the ill effects of adulteration have to enforce to check the practice. Standardization of drug formulations to the maximum possible extent has to be jointly developed by Ayurvedic, Botanical, Photochemical and Pharmacological experts. Monographs as compiled in the standard books like Indian Pharmacopeia, Ayurvedic Pharmacopeia of India, Wealth of India & Ayurvedic Formulary, provide all the details for the various tests to be performed in order to determine the conformity of the crude or formulated herbal drug with the standard lay. Crude drug adulteration has to be developed as a major area of study for both Biology & Ayurveda students.

Moreover, our Acharyas in the concept of Abhava Pratinidhi dravyas has given detailed description about the Pratinidhi dravyas which can be used in the absence of original drugs. This concept prevailed ages back & in Ayurveda we can find this in the treatise of Bhavaprakasha & Yogaratnakara. In the absence of Kakoli & Kshirakakoli, we can use Aswagandha & in the absence of Meda, Mahameda, we can use Satavari. The solution lies in ensuring the availability of crude drugs. Studies on adulteration practices will have to be taken up along with identification of the scares drugs. Conservation measures of their natural habitat & ex-situ medicinal plant cultivation may have to be taken up in large scale.

References

1. Dr. Poornima B. Adulteration & Substitution in Herbal Drugs A Critical Analysis, International Journal of Research in Ayurveda & Pharmacy. 2010; 1(1):8-12
2. Kokate CK, Purohit AP, Gokhele SB. Pharmacognosy. Chapter-6, Edn 39, Nirali Prakashan, Pune, 2007, 97-98.
3. Poornima B. Adulteration and substitution in herbal drugs a critical analysis, IJRAP. 2010; 1(1):8-12.
4. Sarin YK. Illustrated Manual of Herbal drugs used in Ayurveda, Joint Publication of C.S.I.R and I.C.M.R, New Delhi. 1996.
5. Bapalal Vaidya G, Nighantu Adarsh. Varanasi, Chaukhambha Bharati Academy, 3rd edition-2002; 2:785.
6. Prakash Hegde L. A Text book of Dravyaguna Vijnana, Chaukambha Publications, Edition. 2014; 1:598.
7. Ayurvedic Pharmacopia of India, Ministry of health and welfare; Department of AYUSH, New Delhi, Cirrus Graphics Pvt. Ltd; First edition.
8. Prakash Hegde L. A Text book of Dravyaguna Vijnana, Chaukambha Publications, 2014; 1:599.
9. Prakash Hegde L. A Text book of Dravyaguna Vijnana, Chaukambha Publications, 2014; 1:599.
10. Om Prakash. Adulteration and Substitution in Indian Medicinal Plants: An Overview Journal of Medicinal Plants Studies. Journal of Medicinal Plants Studies. 2013; 1(4):127-132. First page: (127)