Market Study of *Keshar* (*Crocus Sativus* Linn.) an Expensive Ayurvedic Herb

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Abstract:

The biological source of Keshar is Crocus sativus Linn. Belonging to family Iridaceae. Worldwide known as Saffron. It is used in diseases like Chardi, Kasa, Vyanga, Drshti Roga, Kantha Roga, Sidhma, Suryavartta, Shiroroga. It is highly priced drug also known as red gold in market, as it is cultivated in limited pockets of J&K due to which production is very less as compared to its substantial demand. This decrease in production gives chance to the raw drug traders to adopt unscrupulous trade.

Materials and Methods: *The genuine samples of Keshar i.e. stigmas of Crocus sativus Linn was collected from Dist. Doda State- Jammu and Kashmir along with its mentioned adulterants were collected from their native habitat. Market samples of Keshar from seven major markets from all over India were collected and compared with the genuine samples by organoleptic and chemical tests like treatment with chloroform, sulphuric acid etc.*

Results: *Samples from four markets of India matches with Keshar i.e. stigmas of Crocus sativus Linn. Samples from three markets were not matches with the genuine sample. Quality of the market samples along with the price of the drug varies from market to market.*

Discussion: *This exclusive dependence on traders has created serious malpractice of adulteration and selling of substandard medicinal plant raw materials in the market. All these chemical tests are reliable, rapid and sensitive method to find originality of the keshar in quick time.*

Keywords*: Keshar, Crocus sativus, Market Study, Adulteration.*

Introduction

The biological source of *Keshar* is *Crocus sativus* Linn. Belonging to family Iridaceae. Worldwide known as Saffron. Acharaya Charaka has classified it under *shonit sthapana* mahakashaya[1], whereas acharaya Sushrut[2] and Bhagbhat[3] had mentioned it under *eladi* gana It has *katu tikta* taste, *Ushna virya, Katu vipaka* and *snigdha guna* and having properties like *Vatahara, Varnya, Vishaghna, Sleshmahara, Rasayana, Jantuhara*. It is used in diseases like *Chardi, Kasa, Vyanga, Drshti Roga, Kantha Roga, Sidhma, Suryavartta, Shiroroga*[4]. It is herbaceous, perennial plant with height 6 to 10 inch. Leaves are radicle, linear, tunnel shaped surrounded by sheath. Flowers are violet, autumnal appearing with the leaves. Styles of stigma extorted outside, orange in colour, apex divided into many. Style 1 cm. in length and elongated. Stigma generally 3 in numbers 2.5-3 cm. long, thread like and red in colour. Stigmas are actually known as saffron which are practically thread like. It is native of South Europe, it is cultivated on commercial level in Spain, Italy, Germany, France, Sicily, Austria, China and Russia. Its cultivation so far is limited to Jammu & Kashmir. Saffron is a valuable drug used in several Ayurvedic preparations. It is imported mostly from Spain to meet the requirement, as the production obtained from Kashmir is inadequate. In order to explore the possibility of growing this highly priced plant in U.K. hills, the Central Council for Research in Ayurveda & Siddha started experimental trials related to its propagation, multiplication, acclimatization and cultivation at the garden of Indian Institute of Ayurveda for Drug Research, Ranikhet in 1971.

Saffron has two active ingredients as crocin and safranal. Medicinally, Saffron has a long history as a part of traditional healing. Modern medicine has also discovered Saffron as anti-carcinogenic, anti-mutagenic, immuno-modulating and antioxidant like properties. Saffron has been shown to have antidepressant effect. As per the study, it is found that Saffron is helpful in macular degeneration and retinitis pigmentosa. It is also a sophisticated food colouring agent. It is highly priced drug also known as red gold in market, as it is cultivated in limited pockets of J&K due to which production is very less as compared to its substantial demand. This decrease in production gives chance to the raw drug traders to adopt unscrupulous trade. Adulteration of the Saffron in the present era is serious crime as it has a direct effect on the economy of the country and has serious ill health effects[5]. So it is mandatory to study the market samples to check the adulteration.

Geographical Distribution:

It is native of south Europe and grows wild in Greece, Asia minor and Persia. It is cultivated in Iran, Spain, France, Italy Greece, China and Turky. In India it is largely cultivated in Kashmir (Pampore, Srinagar) and Jammu (Kishtawar). It has been successfully cultivated in non-habitat area like Ranikhet in Uttaranchal.

Adulterants

Biological source of *Keshar* is (*Crocus sativus* Linn.) which consists of dried stigmas and upper part of styles. It was found to be adulterated with various substances of vegetable and inorganic origin like fibers of horse meat, saffron sized sliced onion pieces. The common adulterants of saffron are ligulate florets or carpels of *Calendula officinalis* dyed with methyl orange or a red dye. Ligulate corollas of Marigold flowers and tubular florets of *Carthamus tinctorius,* Corolla-tube of flower of *Nyctanthes arbor-tristis* which is orange-red in colour are sold as substitute for pure saffron. Other adulterants includes, stigmas of maize (corn silk), florets of *Onopordon acanthium* dyed with Ponceau 3R and tartrazine and mixed with ammonium and potassium nitrate, borax, and glycerine to increase weight.

Apart from this aerial roots of Salix and also Cuscuta are used after being dyed with sandal wood extract or crimson coloured salt. Other admixtures includes petals of Papaver, the outer skin of red onions cut to suitable saffron size and dyed with eosin, certain grasses treated with honey fats and oils, florets of *Arnica montana* and species of Pulicaria or the strips of petals. The admixture of fiber of shredded beef after curing and processing is a common adulterant in Italy.

Methodology

Collection of genuine sample and their adulterants and substitute from the field:

The genuine stigma and style of *Crocus sativus* was collected from the fields of Dist. Doda during flowering time in October, where Saffron is cultivated by formers. Style and Stigma of flower of *Carthamus tinctorius* was collected from the fields of Harangula (Khurda) Dist- Latur, Maharashtra where Safflower is cultivated by formers under the name of '*Kardayi'*. Petals of *Calendula officinalis* and *Nyctanthes arbor-tristis* was collected from herbal garden of NIA, Jaipur, Rajasthan. The other drugs that are mentioned above as a substitute / adulterants of *Keshar* could not be collect due to lack of time and inconvenience.

Table No. 1 Summarized macroscopic features of *Keshar* and its adulterants

Sl. No.	**Appearance**	***Crocus sativus*. (Stigma & Style)**	***Carthamus tinctorius*. (Style & Stigma)**	***Calendula officinalis*. (Petals)**	***Nyctanthes arbor-tristis*. (Corolla-tube)**
1.	Size	50-53 mm. long (Stigma) and style about 10-13 mm.	40-46 mm. long Stigma & Style 9-11 mm.	1.5-2 cm. long in length.	1.5-2 cm. long & 1-2 mm. in thickness.
2.	Shape	Stigma is flattish-tubular, almost thread like having dentate rim. It is	The style is short, round terminated into bifid stigma. Stigma is flat at the basal part.	Petals are yellow to deep orange in colour. The inflorescences are yellow, comprising a thick	Corolla with a cylindric, orange tube and 5-8

		hollow tube narrowed at the base where it joints the style, broadening towards the upper end; Texture- quite soft and brittle.	Carpel consisting a long, slender style, broad flattened, hairy, bifid stigma, inferior ovary measuring 6-8 x 0.50-0.75 mm. in long in length. It looks like stigma of Keshar.	capitulum or flower head 4-7 cm. diameter surrounded by two row of hairy bract; the disc florets are tubular and hermaphrodite, and generally of a more intense orange-yellow colour than the female, tridentate, peripheral ray florets.	spreading imbricate and more or less contorted, white lobes 5-15 mm. long.
3.	Colour	Reddish –brown.	Reddish in colour while terminal part is bright yellowish in colour.	Yellow to deep orange in colour.	Orange colour.
4.	Odour	Strong, peculiar and aromatic.	Odour less.	Aromatic, pleasant.	Aromatic
5.	Taste	Aromatic and bitter.	Sweet (Saccharine)	Sweet (Saccharine)	Bitter.

Collection of Samples

Exclusive dependence on traders has created serious malpractice of adulteration and selling of substandard medicinal plant raw materials in the market. So it is mandatory to study the market samples to check the adulteration. Seven markets from all over India were selected these seven markets are Mumbai, Kolkatta, Chennai, Amritsar, Bangalore, Jaipur and Delhi. Fallowing points were kept in mind while collection of market samples. Markets samples were collected as such and not verified on spot. All the available grades were collected with the simple order method. Sample purchased or received from contacts were properly labelled, stored and subjected to investigation.

Table no 2 Showing local name and price of Keshar.

S. No	Market	Local name	Price Rs /gm
1	Mumbai	*Keshar*	320
2	Kolkatta	*Jafran*	275
3	Chennai	*Kesharapu*	200
4	Amritsar	*Keshar*	300
5	Bangalore	*Keshar*	400
6	Jaipur	*Keshar*	240
7	Delhi	*Keshar*	300

Chemical tests

Genuine samples and market samples were tested with chemicals like potassium dichromate solution, sulphuric acid, chloroform and Absolute alcohol.

1. Method of chemical Test with potassium dichromate solution: Yellow colour of 0.1 % potassium dichromate solution is taken as standard. For conducting this test, 0.02 gms. of *Keshar* was dissolved into 100 ml of water in a test tube. The colour of the solution should matches with the standard potassium dichromate solution i.e. yellow in colour. If this doesn't match, then it can be inferred that the test sample is not genuine.

2. Method of testing Keshar with sulphuric acid: 0.02 gms. of *Keshar* stigma should be taken in a test tube and to it 05 ml of sulphuric acid added. After 05 seconds colour of the test solution changed in to blue colour and after sometimes the colour of solution changes to reddish blue and finally the solution turns into violet colour with a reddish tint.

3. Method of testing samples of keshar with chloroform: 20 mg. of *Keshar* was taken in a sterile test tube along with 10 ml of chloroform. The resultant solution should remain colour less in genuine sample.

4. Method of testing samples with Absolute alcohol: 20 mg of *Keshar* was taken in a sterile test tube mix with 10 ml of absolute alcohol. In case of authenticate sample, there is no colour change in stigma of *Keshar* and there is associated colour change in the solvent i.e. absolute alcohol.

Results

All the results are presented in the tabular form.

Table no 3 showing organoleptic features of genuine and market samples of *Keshar*.

Sl. No.	Name of the source	Appearance	Size	Colour	Odour	Taste
1.	Mumbai	Thread like, cylindrical in shape and brittle in nature.	5-20 cm. long in length and 1-1.5 mm. in thickness.	Reddish- brown in colour.	Strong and aromatic.	Bitter.
2.	Kolkata	Thread like, funnel shaped, red in colour, apex is divided into many, brittle in nature	10-20 mm. in length & 0.5-1 mm. in thickness.	Red in colour.	Strong and aromatic.	Bitter.
3.	Chennai	Cylindrical, straight, thread-like, slender-funnel shaped.	7-20 mm. long in length & 0.25-1 mm. in thickness.	Dull-reddish in colour.	Odourless.	Not specific.
4.	Amritsar	Straight, cylindrical, thread like in shape.	6-12 mm. long in length & 0.25-0.75 mm. in thickness.	Brownish in colour.	Odourless.	Not specific.
5.	Bangalore	Flattish-tubular, almost thread like having dentate rim, basal part is flat while terminal part is round in shape.	8-20 mm. long in length & 0.25-0.75 mm. in thickness.	Reddish-brown in colour.	Characteristic and aromatic.	Bitter.
6.	Doda	Flattish-tubular, almost thread	8-27 mm. long in length	Reddish–brown in	Strong,	Bitter.

	(Genuine)	like having dentate rim. It is hollow tube narrowed at the base where it joints the style, broadening towards the upper end.	& 0.75-1 mm. in thickness.	colour while style is yellow in colour.	peculiar and aromatic.	
7.	Jaipur	Straight, cylindrical in shape, narrow at the basal end and broader at upper end.	7-22 mm. long in length & 0.75-1 mm. in thickness.	Faint red in colour.	Slightly aromatic.	Slightly bitter.
8.	Delhi	Thread like, cylindrical, funnel-shaped, basal part is flat while terminal part is round in shape.	8-22 mm. long in length & 0.25-0.75 mm. in thickness.	Bright red in colour.	Characteristic and slightly aromatic.	Bitter.

Table no 4 showing the colour changes when samples treated with 0.1% Potassium dichromate

Market sample	Reference colour of solution with 0.1% Potassium dichromate	Colour of the solution of sample tested
Doda (Genuine)	Yellow colour	Yellow colour
Bangalore	Yellow colour	Yellow colour
Jaipur	Yellow colour	Colourless
Delhi	Yellow colour	Yellow colour
Mumbai	Yellow colour	Yellow colour
Kolkatta	Yellow colour	Yellow colour
Chennai	Yellow colour	Light Yellow colour
Amritsar	Yellow colour	Colourless

Table no 5 showing the colour changes when samples treated with sulphuric acid

Market sample	After 05 seconds	After Sometimes	Finally
Doda (Genuine)	Blue colour	Bluish Red colour	Violet colour
Bangalore	Blue colour	Bluish Red colour	Violet colour
Jaipur	No change	No change	No Change
Delhi	Blue colour	Orange Blue colour	Violet colour
Mumbai	Blue colour	Bluish Red colour	Violet colour
Kolkatta	Blue colour	Bluish Red colour	Violet colour
Chennai	Blue colour	Orange colour	Orange colour
Amritsar	No change	Light violet colour	Light violet colour

Table no 6 showing the colour changes when treated with Chloroform

Market sample	Colour Changes on adding organic solvent (Chloroform)
Doda (Genuine)	Colourless
Bangalore	Colourless
Jaipur	Slightly yellow colour
Delhi	Colourless
Mumbai	Colourless
Kolkatta	Colourless
Chennai	Slightly yellow colour
Amritsar	Colourless

Table no 7 showing the colour changes when treated with Absolute Alcohol

Market sample	Colour of Keshar	Colour of solvent
Doda (Genuine)	Brick red colour	Yellow colour
Bangalore	Brick red colour	Yellow colour
Jaipur	Light red colour	Reddish colour
Delhi	Brick red colour	Yellow colour
Mumbai	Brick red colour	Yellow colour
Kolkatta	Brick red colour	Yellow colour
Chennai	Light red colour	Reddish colour
Amritsar	Violet colour	Violet colour

Discussion

After study all the samples, it had been observed that, the samples collected from the markets of Mumbai, Delhi, Kolkata, & Bangalore market were having all diagnostic characters & same appearance with the characters of stigmas of authenticated genuine sample of *Crocus sativus* collected from Doda. So, the sample taken from above mentioned markets may be *Crocus sativus* which is an authentic source of *Keshar*. The sample taken from Amritsar, Jaipur & Chennai market is not coincide with any characters of *Crocus sativus*. The sample may be materials of other source. Similar results found when these samples were tested with chemicals like 0.1% potassium dichromate, sulphuric acid, chloroform and absolute alcohol.

Conclusion:

In ancient days Ayurvedic physicians himself goes to forest to collect herb and prepare the medicines by themselves. However due to extensive industrialization and urbanization it has become almost impractical for Ayurvedic physician to personally procure the authentic drugs and therefore totally dependent on raw drug sellers and the middle men for procurement of medicinal plant raw materials. This exclusive dependence on traders has created serious malpractice of adulteration and selling of substandard medicinal plant raw materials in the

market. In the present research market study was done to differentiate genuine sample of *keshar* from its adulterant by organoleptic method and by performing various chemical tests. All these chemical tests are reliable, rapid and sensitive method to find originality of the *keshar* in quick time. These chemical tests can be used by physicians, researchers or common man as per the resources available to check the adulteration in *keshar*.

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