Saffron Frauds in Jammu and Kashmir: Preliminary Organoleptic and Microscopic Investigation

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Abstract: **Kashmir (J&K), India is famous for production of the high quality mogra saffron (Kong).It attracts interest to both scientists and consumers due to its immense value in spices and medicine. The adulteration and frauds are frequent in market of saffron to mislead the consumers. Organoleptic and microscopic investigation are performed on thirteen varieties of the saffron of Kashmir (J&K) to decide authenticity.**

Keywords: Saffron, Kashmir, adulteration, microscopy, organoleptic

I. INTRODUCTION

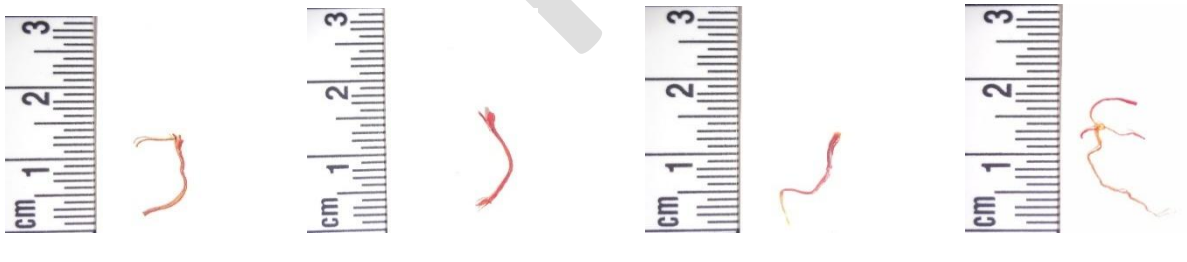
Saffron, a dried sterile stigma of triploid plant Crocus sativus Linnaeus [1].Saffron is also known as the king of all spices due to its flavor, aroma and colour [2, 3]. It is largely used in culinary, drugs and textile dyes [4]. The countries like Iran, Spain, Italy, Switzerland and India produce quality saffron [5]. In India, Kashmir (J&K) is the major producer of the high-quality mogra saffron known as Kong [6]. In 1990, Kashmir (10t) is the second producer of saffron after Iran (80t) [7]. The Saffron (Kong) of Kashmir is exported to countries like USA, UAE, Japan, Israel, etc., however, the export increases due to declining domestic costs of saffron in European countries [8].

The increasing market value of the saffron leads to adulteration and fraud [9]. Modern adulteration practices involves: (i) Falsification or misbranding; (ii) Addition of saffron style material; (iii) soaking of the saffron to viscous material like honey, syrup, glycerin, etc. (iv) Extraneous plant material with or without synthetic colours [10]. Saffron adulteration is a heinous white collar crime largely practiced in Kashmir [11].The frauds in the saffron market of Kashmir (J&K) constitute 52% genuine, 30% poor grade and 17% adulterated saffron [12].

II. MATERIAL AND METHODS

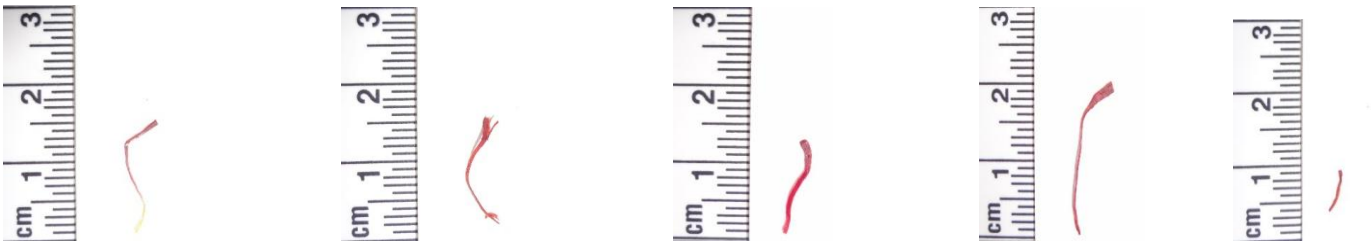
A. Sampling

Thirteen varieties of saffron samples each 1-5 gram were collected from Srinagar, Baramulla and Pulwama districts of Kashmir division, Jammu and Kashmir, India (Fig. 1). Preliminary organoleptic and microscopical investigation are conducted according to ISO-3636(2) 2010 (E) [13].



S1 **S2** **S3** **S4**

S 5 **S 6** **S7** **S8**



S9 S10 S11 S12 S13

Fig.1 Saffron samples of Kashmir division, Jammu & Kashmir, India

B. Organoleptic Studies

Organoleptic investigation of the saffron samples involves the sense organs to test the characters such as colour, odour, size and shape to set up the preliminary identity of saffron[14].The sulphuric acid chemical test provides originality of the saffron to highest degree. On reaction of sulphuric acid, the genuine saffron produces blue colour immediately, while as fake saffron yields yellow colour [15].

C. Microscopic Investigation

Microscopic features of entire saffron (stigma) are studied using compound light microscope of Olympus BX41. Photomicrographs were taken by Sony DSLR-α58 at lower (4X) and higher magnifications (10X).

D. Sample Preparation for Microscopy

Depigmentation of the entire saffron samples in methanol for 4 hours, followed by three washing with solution of methanol & water (1:1) and final washing of saffron by methanol only. The exposed saffron samples were observed directly under the compound light microscope at different magnifications.

III. RESUTLS

The results of organoleptic studies along with chemical tests were obtained by examination of thirteen varieties of saffron samples (Table-1).

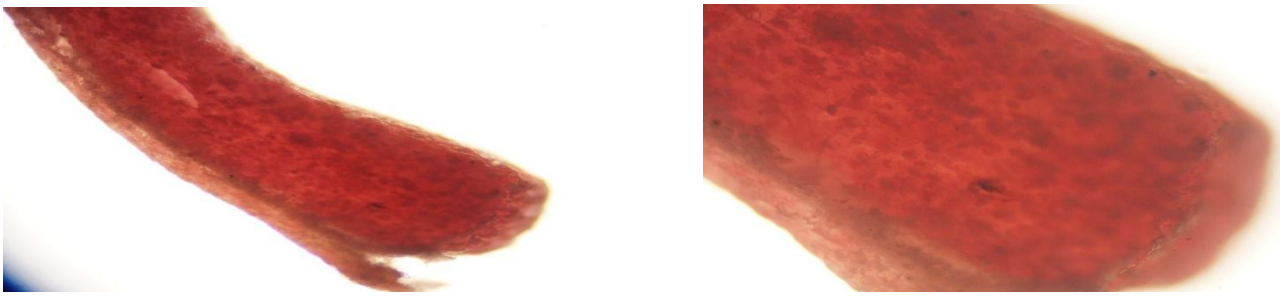
Table-1Organoleptic and Chemical characteristics

Saffron	Condition	Colour	Smell	Taste	Texture	Chemical test	Result
S1	dried	Crimson red	No smell	sour	smooth	yellow colour	-
S2	dried	Crimson red	No smell	sweet	smooth	yellow colour	-
S3	dried	Crimson red	characteristic	bitter	smooth	blue colour	+
S4	dried	Crimson red	characteristic	bitter	smooth	blue colour	+
S5	dried	Crimson red	No smell	sour	smooth	yellow colour	-
S6	dried	Crimson red	No smell	sour	smooth	yellow colour	-
S7	dried	Crimson red	characteristic	bitter	smooth	blue colour	+
S8	dried	Crimson red	characteristic	bitter	smooth	blue colour	+
S9	dried	Crimson red	characteristic	bitter	smooth	blue colour	+
S10	dried	Crimson red	Pungent	sweet	smooth	yellow colour	-
S11	dried	Crimson red	No smell	sweet	smooth	yellow colour	-
S12	dried	Crimson red	Pungent	salty	smooth	yellow colour	-
S13	dried	Crimson red	characteristic	bitter	smooth	blue colour	+

+ Genuine, - Fake

The photomicrographs of saffron samples using microscopy at lower (4X) and higher (10X) magnifications (Fig. 2).

4X 10X



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4X 10X

S 2

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S 3

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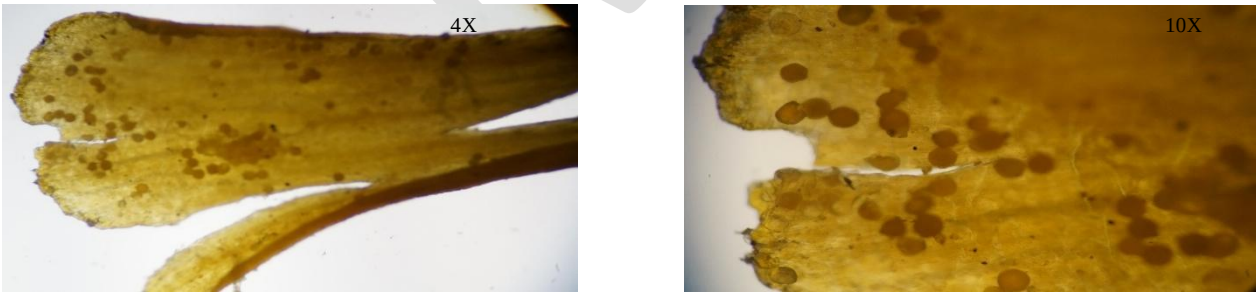

S 4

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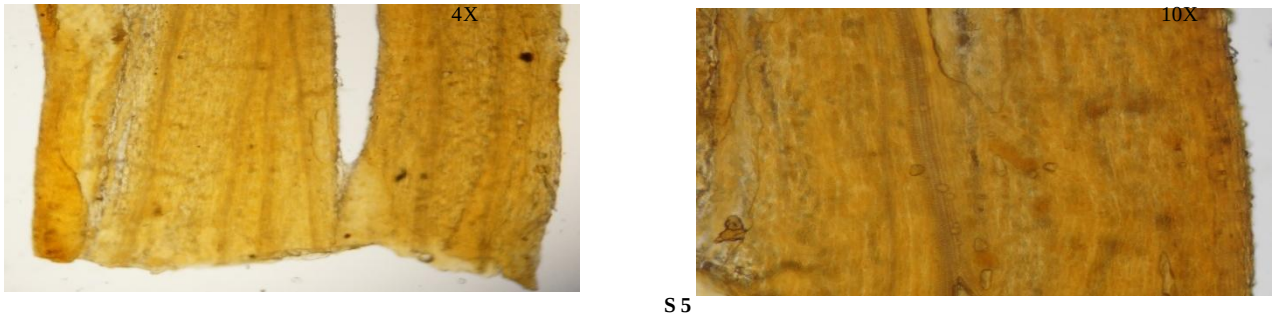

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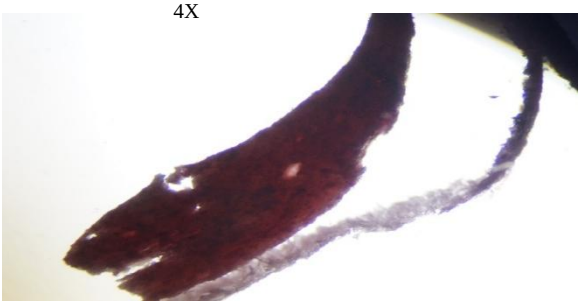

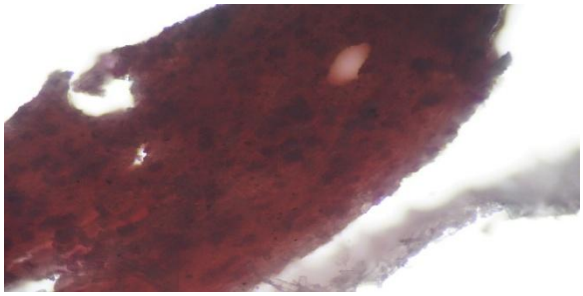

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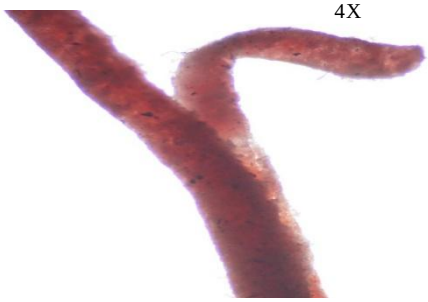
4X



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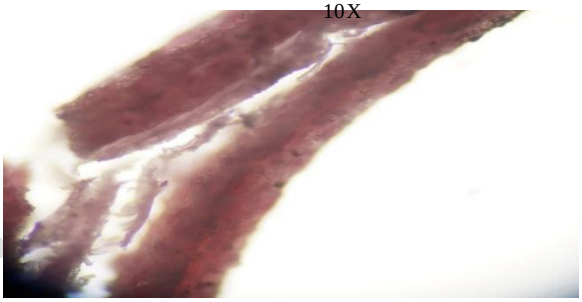

S 7

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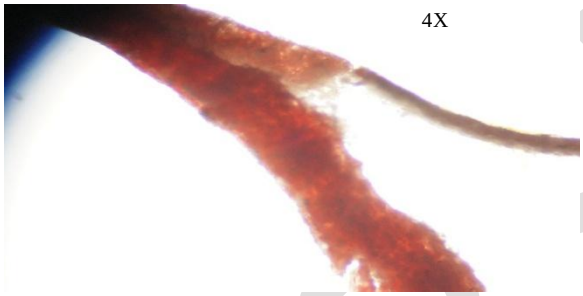

10X

S 8

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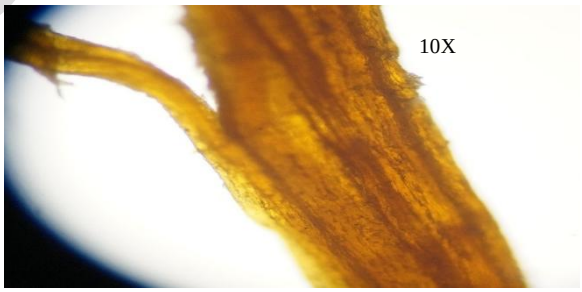

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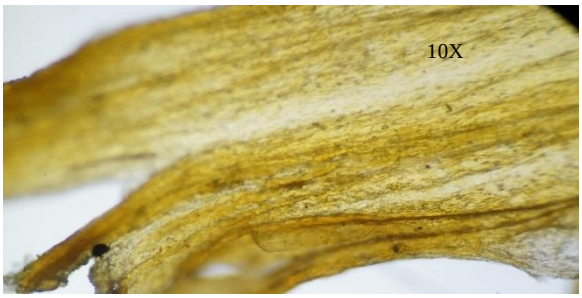

S10

4X 10X

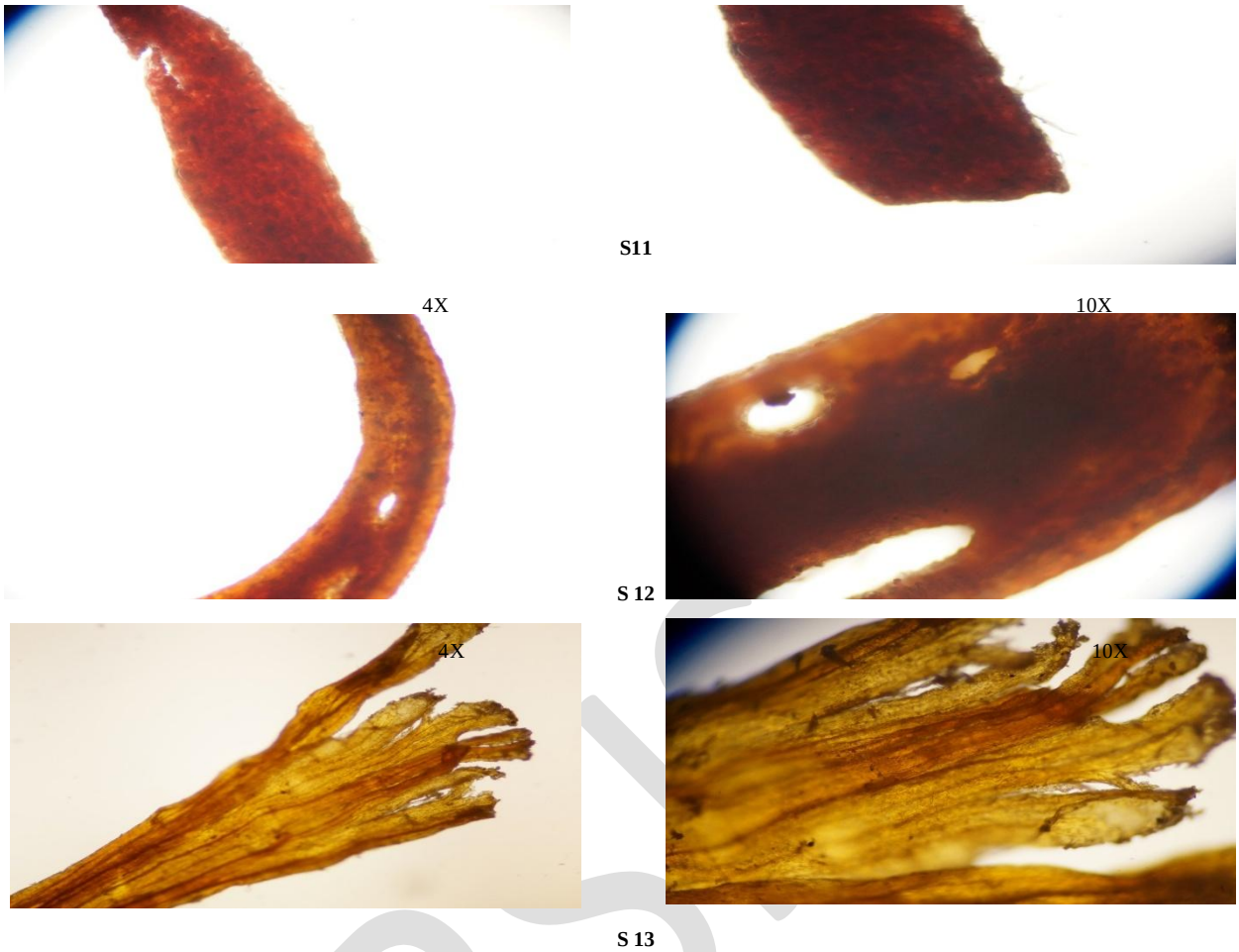

Fig. 2 Photomicrographs of saffron samples

IV. DISCUSSION

Organoleptic studies revealed the preliminary idea of originality of the saffron which includes characteristic aroma and peculiar bitter taste (table-1). Observation of the anatomical elements which includes fingerlike projections on the top extremity, small adaxial dermal papillae, Pollens etc. constitute peculiar feature of the original saffron (Fig. 2 S3, S4, S9) [16].

The fake saffron lacks such anatomical elements and exhibits varieties of structures like irregular pigment distribution, presence of lacunae, absence of abaxial and adaxial epidermis etc. (Fig. 2S5, S11, S12).

V. CONCLUSION

In a present research, preliminary organoleptic and microscopical examination were conducted on saffron of Kashmir (J&K), India for determination of frauds and adulteration. Out of thirteen varieties of saffron samples, seven saffron varieties were found fake and sold in the market as genuine saffron to mislead the consumers of Jammu and Kashmir.

ACKNOWLEDGMENT

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ETHICAL STANDARDS

The research is based on forensic examination of the marketed sample of the saffron and does not involve any human subject.

CONFLICT OF INTEREST

It is declaring the research is having no conflict of interest.

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