Plant Archives Vol. 22, Special Issue (VSOG), 2022 pp.204-207 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2022.v22.splecialissue.039

DEVELOPMENT OF A TEST METHOD FOR IDENTIFICATION OF DIFFERENT TYPES OF VANYA SILKS

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ABSTRACT

India is the only country in the world that produces four commercial varieties of silk : Mulberry, Tasar, Muga and Eri. All these varieties existed in India since time immemorial, but Mulberry and Tasar silk became better known to the consumers much earlier than Muga and Eri silks, perhaps due to their relatively higher volume of production and geographical spread. Thus, the Indian standard IS 667:1981 R: 2017, published by the Bureau of Indian Standards (BIS) for identification of textile fibres includes only methods to identify Mulberry and Tasar silks but does not mention Muga and Eri silks. The production of Muga silk in the country has increased three times and Eri silk has increased seven times in the last 20 years. It is the need of the hour to include these two fibres in the above IS standard for the correct identification of all the commercial varieties of silk and facilitate fair trade and consumer satisfaction. While the distinguishing features of the mulberry and vanya silks are quite evident, it is a challenge to identify between the vanya varieties, especially Tasar and Muga silks. This paper proposes the methods for identifying the types of vanya silks based on Light microscopy, SEM analysis and chemical methods. The method has been proposed to BIS for inclusion in the above standard, after its validation through inter-laboratory comparison or any other validation method. Further, it is proposed to study the identification of the four varieties of silk through DNA -polymerase chain reaction (PCR) method.

Keywords **:** Test methods, Vanya Silk, Eri, Muga, Tassar

Introduction

India is the only country in the world that produces four commercial varieties of silk : Mulberry, Tasar, Muga and Eri. All these varieties existed in India since time immemorial, but Mulberry and Tasar silk became better known to the consumers much earlier than Muga and Eri silks, perhaps due to their relatively higher volume of production and geographical spread. While the production of mulberry silk has only doubled over the past two decades the vanya silk have witnessed a five times growth collectively. Muga silk production has increased three times, that of Tasar and Eri silk have increased 6 to 7 times in the same period (See Table 1). This clearly shows the emphasis on the productivity improvement in the vanya sector.

Table 1 : Raw silk production in MT

Year	Mulberry	Tasar	Muga	Eri
1980-81	4593	265	48	135
2000-01	14,432	237	99	1,089
2021-22	25818	1466	255	7364

The original Indian Standard, IS 667: Methods for Identification of Textile Fibres was published by Bureau of Indian Standards (BIS) in the year 1955. It included mainly natural fibres such as wool, silk, cotton and bast fibres which were until then being identified based on the longitudinal view. In the year 1981, the standard was revised to include the synthetic fibres which had gained popularity in India and microscopic analysis of their cross sections was also included. The production of the Muga and Eri silks during 1980-81 was 48MT and 135 MT only. The standard IS 667:1981 Methods for identification of Textile Fibres, reaffirmed in 2017 includes methods to identify Mulberry and Tasar silks but does not mention Muga and Eri silks. These two varieties of silk are not mentioned in any of the foreign / international standards also such as AATCC, ISO, BS, etc. Therefore, till date there are no standard test methods to identify either Muga silk or Eri silk. Therefore most of the testing laboratories do not identify the type of silk or do so based on their own method, which usually allows the customer the benefit of doubt. Such methods/ test results are not accepted by all concerned parties, leading to conflict of interest. Of late, there is much unrest amongst the Muga reelers as they fear that some tassar yarn is being sold as Muga (at a considerable lower cost) and there is no method to identify the variety of silk yarn. In order to safeguard the interest of all stakeholders in the vanya sector, a standard method of identifying all the varieties of vanya silk is of utmost importance.

Therefore, efforts have been made at CSTRI, CSB to identify the silks by chemical dissolution method. Various chemicals, solvents, means and methods were tried out. Separation of mulberry silk from the non-mulberry silks was achieved but Tasar and Muga silks could not be identified as both fibres were found to react in a similar manner. Further, efforts are on at CSTRI, CSB to identify these fibres by other methods including FTIR and FTNIR spectroscopy so that it can be used even at the shop floor by the consumers who can be assured about the type of silk they are purchasing.

Method of Identification

(1) Light Microscopy

Representative samples of all four varieties of silk fibres viz., Mulberry, Tasar, Muga and Eri were examined for lateral and cross sectional views under light microscope to an appropriate scale/size under an optical microscope (Figures 1 to 4)*.

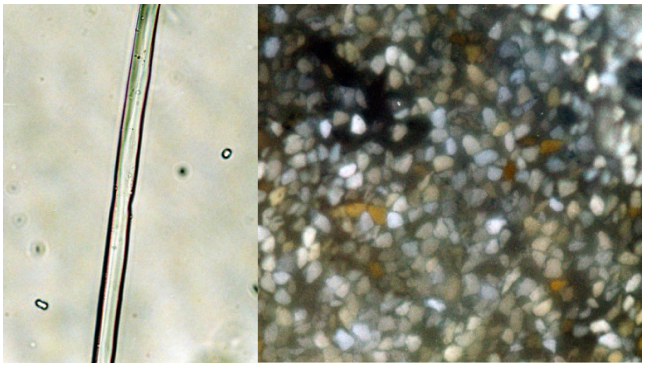

Fig. 1 : Mulberry Silk

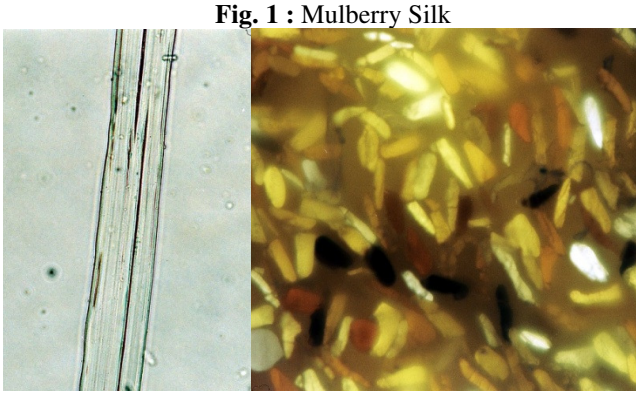

Fig. 2 : Tasar Silk

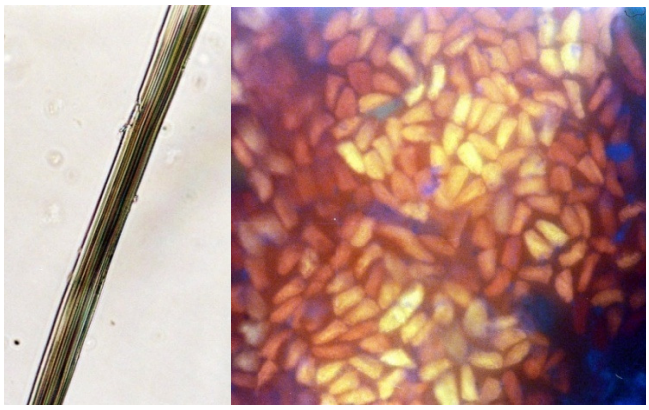

Fig. 3 : Muga Silk

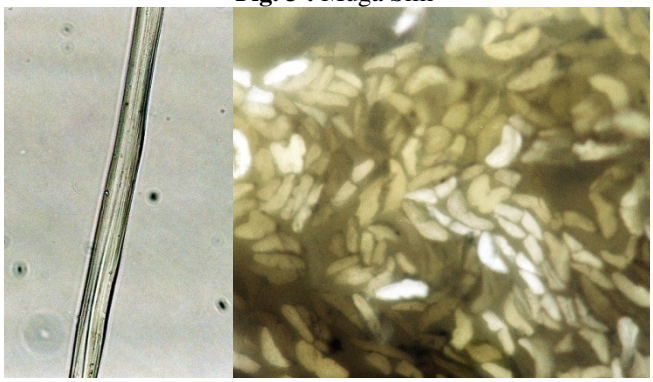

Fig. 4 : Eri Silk

(2) Scanning Electron Microscopy

All four silk samples were imaged under Scanning electron microscope (SEM-EDS, Hitachi SU 3500) with gold coating (Figures 5 to 8). Further, the longest distance from tip to end along the length and the width of each type of fibre was determined under SEM and their ratio was calculated for guidance. The ratio of length to width is least for mulberry (1.4 : 1) followed by Eri (2:1), Tasar (4:1) and Muga (5:1), as shown in Figures 9 to 12.

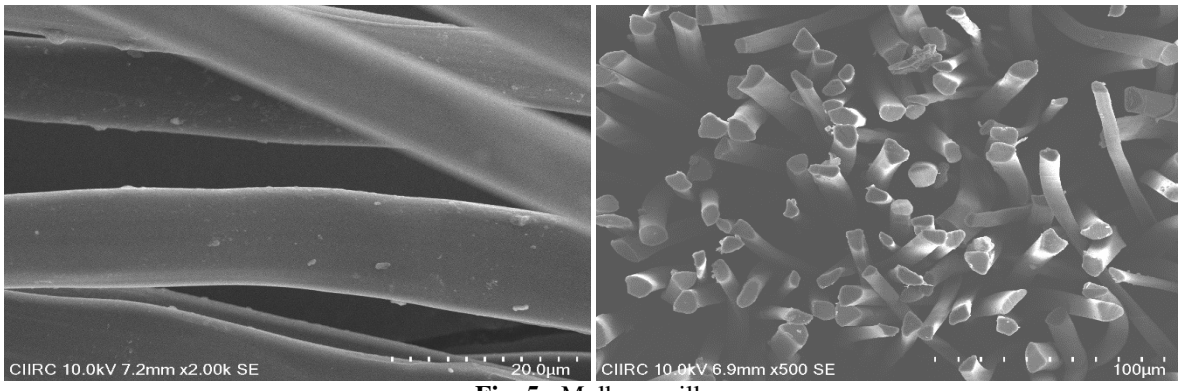

Fig. 5 : Mulberry silk

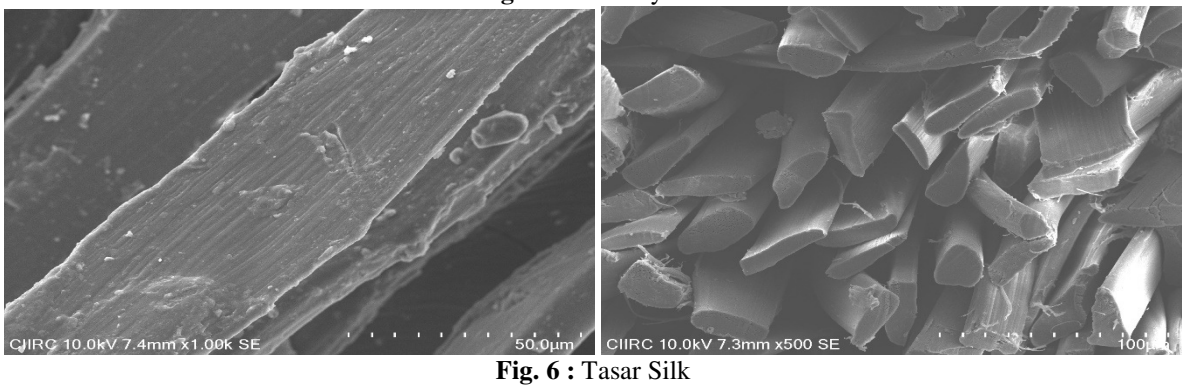

Fig. 6 : Tasar Silk

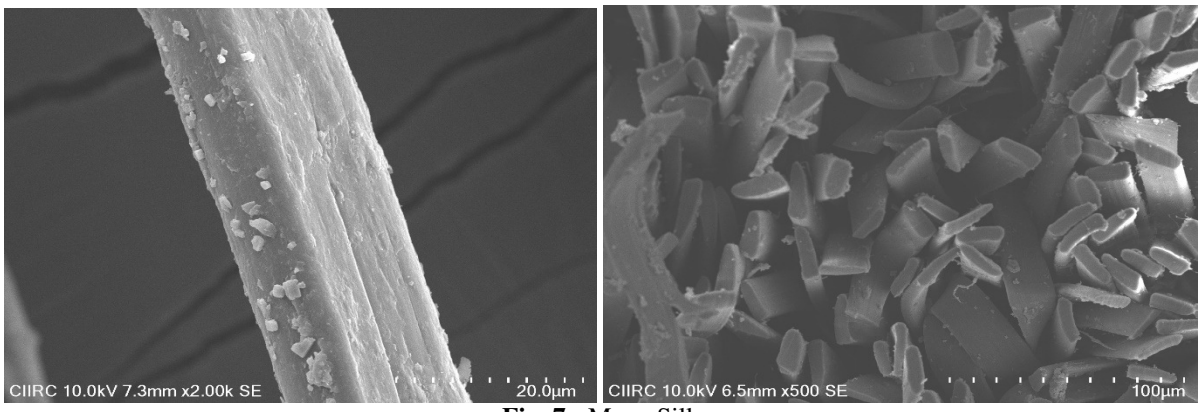

Fig. 7 : Muga Silk

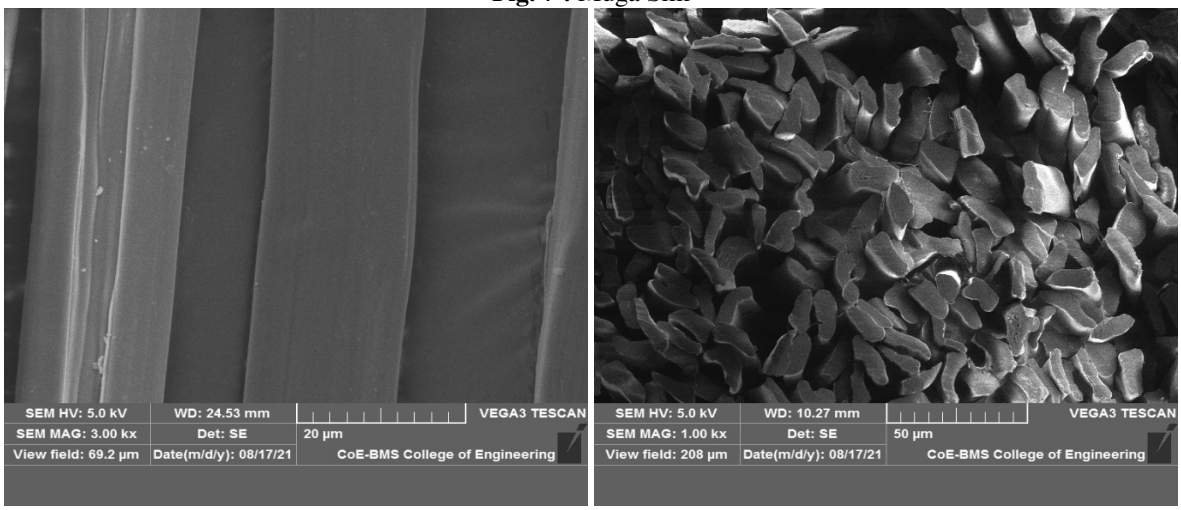

Fig. 8 : Eri Silk

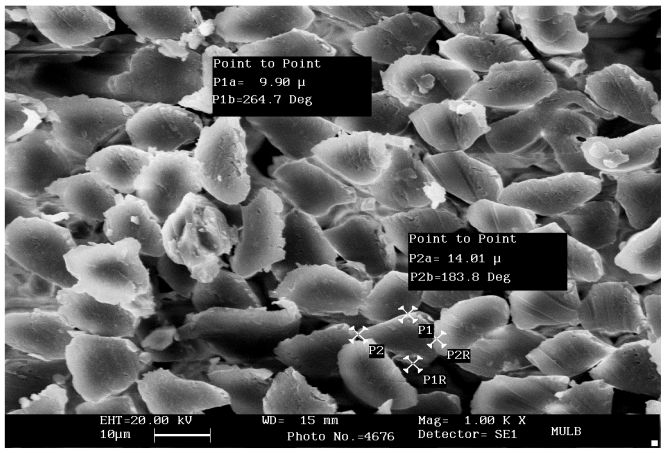

Fig. 9 : Mulberry Silk

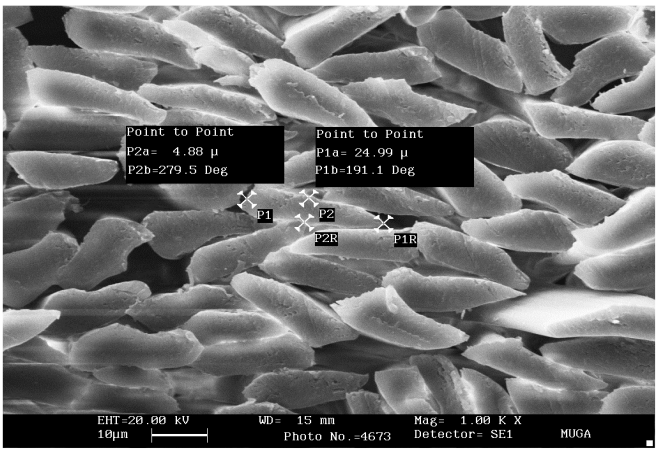

Fig. 11 : Muga Silk

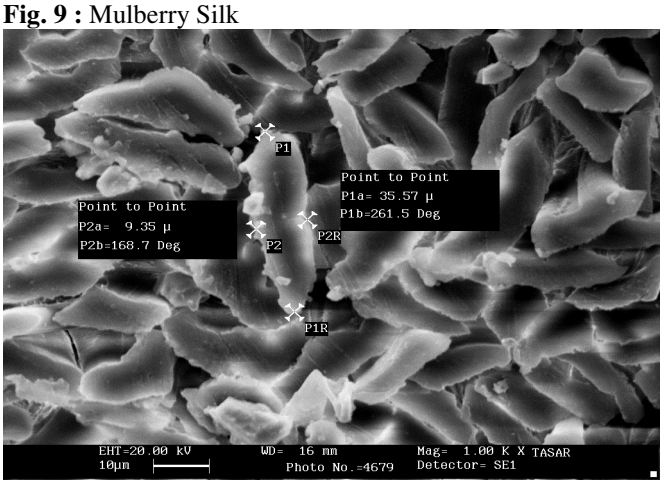

Fig. 10 : Tasar Silk

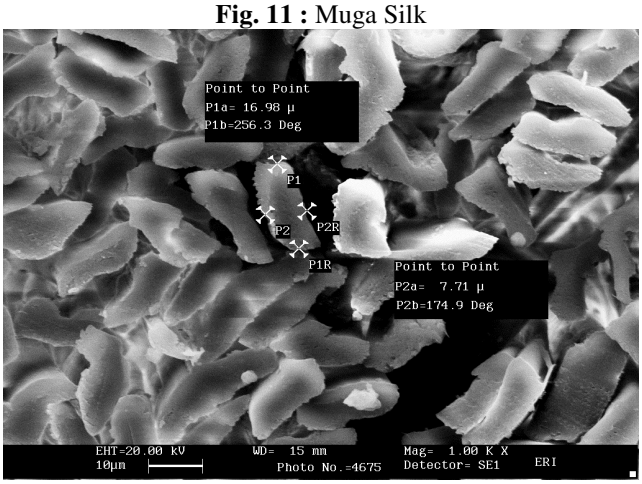

Fig. 12 : Eri Silk

(3) Solubility Tests

Sample Preparation:

Very small quantity of degummed silk sample i.e. in the range of 0.1 to 0.2 grams were taken for the test. The material was in opened form. In case of fabric, the threads were unravelled, the yarn was untwisted to open out the material completely into fiber form. The quantity of chemical solution taken was 200 times the weight of the material, i.e., material to solution ratio kept at 1:200. The required quantity of solution was taken in a beaker and the opened silk material was placed into it in very loose form (all fibres in open form). Different dissolution time in the following chemical formulation were obtained:

(a) 1% Calcium chloride solution in 100% Conc. Formic acid: Mulberry silk dissolves instantaneously in this solution, where as Tasar, Muga and Eri silks do not dissolve. After putting the material in the solvent, observe for two mins, if the fibres structure is intact then the fibres are of Tasar, Muga or Eri silk.

(b) 5% NaOH solution: All four varieties of silk fibres, dissolve in 5% NaOH solution at boil, but the time of dissolution differs, time requires for dissolution provides an idea of the silk type.

Variety of silk	Time Taken (min) for dissolution in 5% NaOH sol. at boil.
Mulberry	2-3
Tasar	8-10
Eri	13-15
Muga	8-10

(c) 60% H_2SO_4: All 4 varieties of silk fibres, dissolve in 60% H_2SO_4 at room temperature, but the time of dissolution differs, time requires for dissolution provides an idea of the silk type.

Variety of silk	Time Taken (min) for dissolution
Mulberry	1-2
Tasar	8-10
Eri	13-15
Muga	>20

Conclusion

All four natural silk fibres show a fairly wide variation in typical cross section. No specimen will look exactly as the pictures provided. A sufficient number of fibres should be examined to cover the range of appearance in any specimen. Further it is to be noted that there are different species in each variety, which also need to be studied. Secondly, successful identification of fibres depends upon experience and familiarity with the fibres. The identification is best made by comparison with properly identified fibres used as reference standards. Finally, it is recommended that all the tests listed above need to be performed and results should not be based on any one or two tests only.

Future Proposal

Recently, a method to identify Pashmina fibres based by DNA- polymerase chain reaction (PCR) was published by BIS (IS 17269:2021 Identification, Labelling and marketing of Pashmina products) Here, mitochondrial DNA is extracted from animal fibre samples by using a chemical and enzyme reaction. The extracted DNA is purified by using a precipitation method and centrifuge. The purified DNA is applied for the amplification reaction of PCR method. In the PCR method, primers for Pashmina, Angora rabbit, yak and wool are respectively tested. If the sample is Pashmina, only Pashmina primer can amplify the constant length of DNA fragments. Then, the constant length of DNA fragments is detected by the electrophoretic migration method. The sample fibres are identified by knowing whether amplification was observed or not for the tests using all primers respectively. It would be interesting to study if this method can be used to identify the different types of silks as well.

Acknowledgement: Authors are thankful to Dr. Kariyappa, Scientist D, CSTRI, Bengaluru for providing the figures 1 to 4.

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