# Weaving techniques and pathology of the historical textiles at the Moghadam Museum from Iran

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**ABSTRACT – REZUMAT**

**Weaving techniques and pathology of the historical textiles at the Moghadam Museum from Iran**

*Textiles at the Moghadam Museum (Tehran, Iran) are considered a valuable heritage collection that has a historical legacy of more than 2,200 years. They comprise a variety of weaving and stitching techniques, textures, materials, patterns and designs, and they are from a wide range of national and ethnic people who lived in the Persian plateau during the above-mentioned two millennia. The valuable collection was gathered by its founders, Dr. Mohsen Moghadam and his wife, Mrs. Selma Kiyoomjian. They utilised different sustainable preservation techniques and restoration methods, based on the historical value, size, and material of the textiles. After their demise, facilities limitations and poor maintenance gave way to the occurrence of irreparable damage to the collection. High fluctuations of the environmental conditions, in humidity and temperature, accompanied by low ventilation, resulted in the growth of fungi and the attack of insects on some of the textiles. Exposure to light also paled the colours in some of the textiles. In terms of weaving technique, three textile types are discussed in the present research study, including mixed-weaving technique (the Parthian Empire, 247 BC till 224 AD), Ghalamkaar textiles and textiles with metal-threads (both during the Safavid dynasty, 1501 AD till 1722 AD).*

***Keywords:*** *cultural heritage, historical textiles, environmental conditions, insects, Moghadam Museum*

**Tehnici de țesere și patologia textilelor istorice din Muzeul Moghadam din Iran**

*Textilele din Muzeul Moghadam (Teheran, Iran) sunt considerate o colecție de patrimoniu de mare valoare, având o moștenire istorică de peste 2.200 de ani. Acestea includ o varietate de tehnici de țesere și cusături, diferite texturi, materiale și modele, provenind dintr-o mare diversitate de comunități și culturi care au locuit pe platoul Persan de-a lungul ultimelor două milenii. Valoroasa colecție a fost adunată de fondatorii muzeului, dr. Mohsen Moghadam și soția sa, doamna Selma Kiyoomjian. Aceștia au aplicat diverse metode de conservare și restaurare sustenabilă, alese în funcție de valoarea istorică, dimensiunea și materialul fiecărui obiect textil. După dispariția lor, limitările infrastructurale și întreținerea deficitară au dus la apariția unor deteriorări ireparabile ale colecției. Fluctuațiile mari ale condițiilor de mediu interne: umiditate, temperatură, ventilație insuficientă etc. au favorizat dezvoltarea fungilor și deteriorarea unor materiale ca urmare a prezenței insectelor. Expunerea la lumină a determinat, de asemenea, decolorarea unor țesături. În ceea ce privește tehnicile de țesere, prezenta lucrare analizează trei tipuri de textile: țesături realizate prin tehnica mixtă de țesere (datând din perioada Imperiului Part, 247 î.Hr. – 224 d.Hr.), textile Ghalamkaar și țesături cu fire metalice (ambele aparținând perioadei dinastiei Safavide, 1501–1722 d.Hr.).*

***Cuvinte-cheie:*** *patrimoniu cultural, textile istorice, condiții de mediu interne, insecte, Muzeul Moghadam*

## INTRODUCTION

Textiles and fabrics are considered a valuable and reliable source of information about the past communities, on their activities that were common among them, the materials they used, their cultural and religious beliefs, and even the superstitions that the people permanently or temporarily believed [1]. Moreover, the gradual development of different weaving and stitching techniques over the history of civilisation is considered a good example of human learning capabilities and their innovative approaches. The emergence of some weaving techniques and patterns is even rooted in cultural, social, and religious aspects. Some weaving techniques and patterns are indicative of how cultures were mixed so that eventually a new pattern has emerged. For instance, a case study on a peasant's traditional garment (about two thousand years old) indicated how Trajan's Column in Rome (113 AD) influenced certain elements in Romanian garments [2, 3]. Careful elaboration on the emergence and process of production for different textiles and fabrics in the past can reveal many other hidden aspects of the society in which they were produced and mixed. In this connection, it is believed that principles of weaving techniques originated in an ancient civilisation located in Western Asia, which over time were passed on to other cultures and nations [4, 5].

Iran is located in a strategic geopolitical region that has received a variety of different techniques, arts, and skills in textiles and fabrics. Iranian artists and

craftsmen mixed domestic techniques and innovative skills with those introduced from other nations to eventually develop outstanding patterns of high quality, lasting for generations. Over the first four millennia of the textile industry, there were only two main weaving techniques known in the Persian plateau, namely the plain weaving technique (occurring in the fourth and fifth millennium) and the tablet weaving technique on terra-cotta (occurring in the late third or early second millennium BC). Both these techniques were found in the Susa region. After these two main techniques, the tapestry weaving style was introduced in the Western regions of Iran, followed by shuttle weaving techniques first in the Eastern and then in the Western regions of Iran, which enabled the making of different patterns. Tapestry was first initiated in Egypt about 1500 BC. It was considered the basis of weaving technique in the East until as late as the 14th Century AD [4]. The real history of the textile industry in Iran actually started when all the above-mentioned had already been introduced in the Plateau. The Golden Age of textile art in the Persian plateau happened during the sixteenth and seventeenth centuries (AD) [6]. A combination of different factors resulted in the blooming of the textile industry in this era, including the utilisation of complex and mixed stitching techniques, the usage of different long-lasting and newly developed colours and designs, and the use of metal threads (mostly silver and gold threads) in textiles [6, 7].

The textile collection at the Moghadam Museum includes artistic heritage that provides historical information on a period of more than two millennia. All the items were gathered by the founders of the Museum, Dr Mohsen Moghadam (Persian: محسن مقدم) and her wife, Mrs Selma Kiyoomjian (Persian: سلما کیومجیان). Many nations and ethnic groups lived at one time or another in the Persian plateau. The Different preservation techniques and restoration methods were used by the founders, according to each textile specimen, age, type of material, size, colour, etc. After their demise, irreparable damage was suffered by the textiles collection because of facility limitations and poor maintenance. The internal microclimate conditions (temperature and humidity), low ventilation, and other possible factors contributed over time to the development of microorganisms and insect attacks, as also reported in previous studies [8–11]. Because historical places and objects are of great value from social, cultural, ethnic, religious, and even touristic purposes, and they are considered a historical identity of the people living there [12, 13], the present paper intends to categorise some of the most important textiles based on their weaving techniques, and to estimate which dynasty they belong to. Moreover, fungal damages to the textiles were observed to determine the main fungal species that attacked and deteriorated these historical textiles.

## GENERAL INFORMATION

### Description of the textile collection and apparatuses

Textiles and fabrics at the Moghadam Museum in Tehran (Iran) cover a wide time span of more than 2,200 years, contemporary to many dynasties that ruled in Iran. The Empires and dynasties from which the weaving techniques and textiles were gathered by the founders of the Moghadam Museum are as follows:

- Parthian Empire (247 BC – 224 AD)
- Sassanid Empire (224 AD – 651 AD)
- Safavid dynasty (1501 AD – 1722 AD)
- Afsharid dynasty (1736 AD – 1751 AD)
- Zand dynasty (1751 AD – 1794 AD)
- Qajar dynasty (1789 AD – 1925 AD).

In the present study, two weaving techniques belonging to the Parthian Empire and the Safavid dynasty are evaluated. The founders collected the specimens from different cities and regions of Iran, and probably from other neighbouring countries that previously belonged to the Persian plateau. They used different preservation techniques and restoration methods, based on the historical value, size, and material of the textiles. Their reports indicate that no damage was done to the collection during their living periods. However, after their demise and because of the 1979 Iranian Revolution, poor maintenance caused irreparable damage to some of the unique textile specimens in the collection.

In the present research study, SEM image and elemental analysis were done by SEM-EDX electronic microscope: VEGA/TESCAN-XMU, VEGA/TESCAN-LMU apparatus. The light microscopy images with magnification were carried out by an Olympus light microscope DSX1000.

### Categorisation of the textiles

There are many types of textiles and fabrics at the Moghadam Museum based on the microscopic observation, weaving techniques, patterns, and fibres of the textiles, relating to different historical dynasties and ethnic groups who lived in the Persian plateau in Iran over the last two millennia. In the present research study, three of the textile types and specimens are discussed based on their weaving techniques.

*Mixed-weaving textiles*

The specimen under the mixed-weaving technique (complex stitching technique) is the inventory code No. 2333, as one of the oldest specimens at the Moghadam Museum (figure 1). The founders of the Moghadam Museum categorised this specimen under the Sassanid Empire (the 3rd to 7th centuries AD). However, a recent study has categorised it under the Parthian Empire (the 3rd century BC till the early 3rd century AD) [14]. Therefore, in the present study, the term “Parthian-Sassanid Empires” is used for this specimen.

The Parthian-Sassanid specimen is comprised of three parts, sewn together (figure 1, bottom). The two

Fig. 1. Front (top, left) and back (top, right) sides of the textile under the inventory code No. 2333, belonging to the Parthian-Sassanid Empires (more than 2,000 years old); delicate embroidery showing the outline of a woman (bottom, right), using the slit-tapestry weaving technique (bottom, right, magnification ×40)

main parts have a slit-tapestry weaving technique (figure 1, bottom, right), having a small part on the left with a simple taffeta weaving technique. On the textile, the outline of two people is decorated using embroidery (figure 1, top left). Visual observation and microscopic images revealed that the brown fibres in this historical textile specimen were wool, and the light colour fibres were made of linen, which confirms a previous study on this specimen [14].

*Ghalamkaar textiles*. The term Ghalamkaar or Ghalamkar was derived from the way this type of textile is produced (figure 2). Ghalamkaar or Kalamkaari (Persian: قلمکار) is a type of textile (usually cotton textile) on which block-printing is delicately done. The origin of this type of textile printing is Isfahan (located in the central parts of Iran). Over centuries, this artistic textile painting was also introduced to the Indian state of Andhra Pradesh. Traditionally, only natural dyes are used in Ghalamkaari. The dying process usually involves twenty-three steps.

Originally, patterns and designs were painted with delicate brushes on cotton and silk fabrics. However, this process was really time-consuming. Moreover, the patterns were not identical. Therefore, artists produced wooden stamps to replace brushes. As the production process was simplified and this type of textile became more popular, different types of textile materials were also used, like cotton, linen, calico, and duck [15]. Researchers estimate that it goes back to the 10th and 11th centuries AD, as three stone stamps were found in Nishapur (Persian: نیشابور) historical excavation. In the Safavid dynasty (the 16th century till early 18th century) and during King Abbas realm, people showed a special eagerness for this type of textile, giving way to the


Fig. 2. Ghalamkaar textile specimen on taffeta cotton fabrics using gold-Ghalamkaar technique or gold-printing Ghalamkaar (top) (inventory code numbers 4448-72); close-up images (magnification ×40)

initiation of different ways and methods to produce Ghalamkaar textiles.

Ghalamkaar textile collection at the Moghadam Museum includes Iranian and Indian Ghalamkaar specimens. Different printing techniques were used on the Ghalamkaar textiles, including brush printing, different wooden or metal stamps, and gold printing. Elemental analysis of the gold-printing Ghalamkaar (inventory code numbers 4448-72, figure 2) revealed that more than 88% of the printing was comprised of gold (figure 3). SEM images of the fabric beneath the gold-printing in the specimen 4448-72 Ghalamkaar fabric are shown in figure 4. Elemental analysis of the fabric revealed it is comprised of 46% carbon and 52% oxygen.

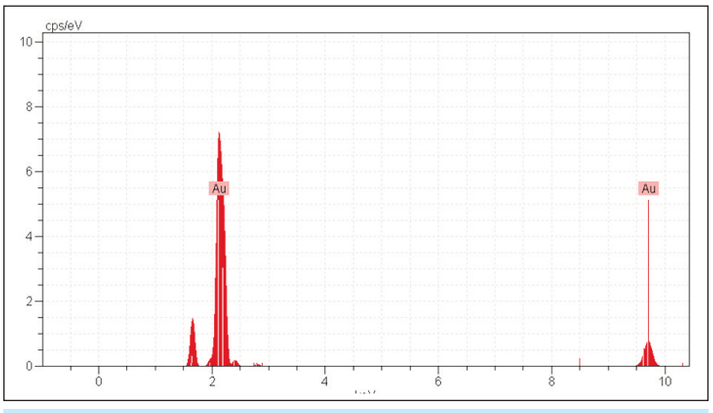


Fig. 3. Elemental analysis of the gold-printing on the Ghalamkaar textile specimen on taffeta cotton fabrics using the gold-Ghalamkaar technique or gold-printing Ghalamkaar (inventory code numbers 4448-72)

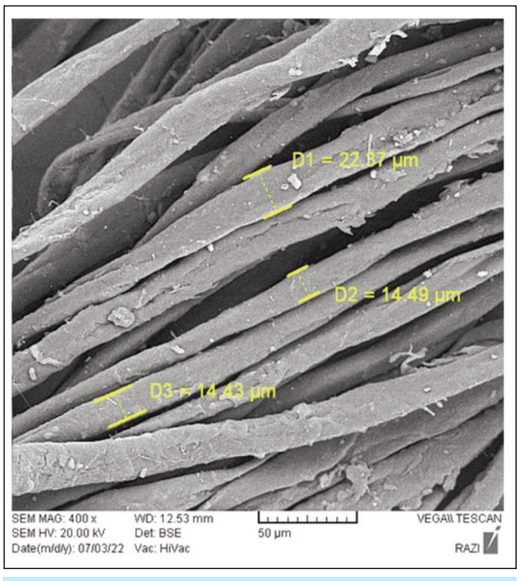


Fig. 4. SEM images of the cotton threads (taffeta cotton fabric beneath the gold-printing) in the gold-printing Ghalamkaar (inventory code numbers 4448-72)

*Textiles with metal-threads*

The textiles with metal threads at the Moghadam Museum are mostly made with gold and silver threads [16]. Gold and silver threads are produced with a core thread made in silk, with two delicate threads in gold or silver winded and drawn around the core thread. In order to produce the metal threads, metals (either gold or silver) are first melted to be passed through a number of small holes in sequence, the diameter of which becomes smaller gradually. Eventually, delicate metal threads are formed that are as this as hair. These round threads are then delicately hammered and flattened so that they can be more easily wound around the silk core thread. The thickness of the metal threads significantly influences the softness or coarseness of the produced metal-thread textile. There are several different metal-thread textiles and fabrics, depending on the extent of metal threads that are used in the whole textile structure [17, 18].

The Safavid textile specimen with inventory code No. 3674 is a specimen with metal threads, related to the Safavid dynasty (the 16th century till the early 18th century). This specimen has two decorative sides, with two series of warps (figure 5). The warps are in navy blue and orange colours that make up the background colour of the textile on each side. Wefts are in different colours, including yellow, green, cream, orange, white, and light blue (figure 6).

Fig. 5. Safavid textile with metal thread (inventory code No. 3674, the 16th century till early 18th century) with two decorative sides in different background colours of navy blue (right) and orange (left)

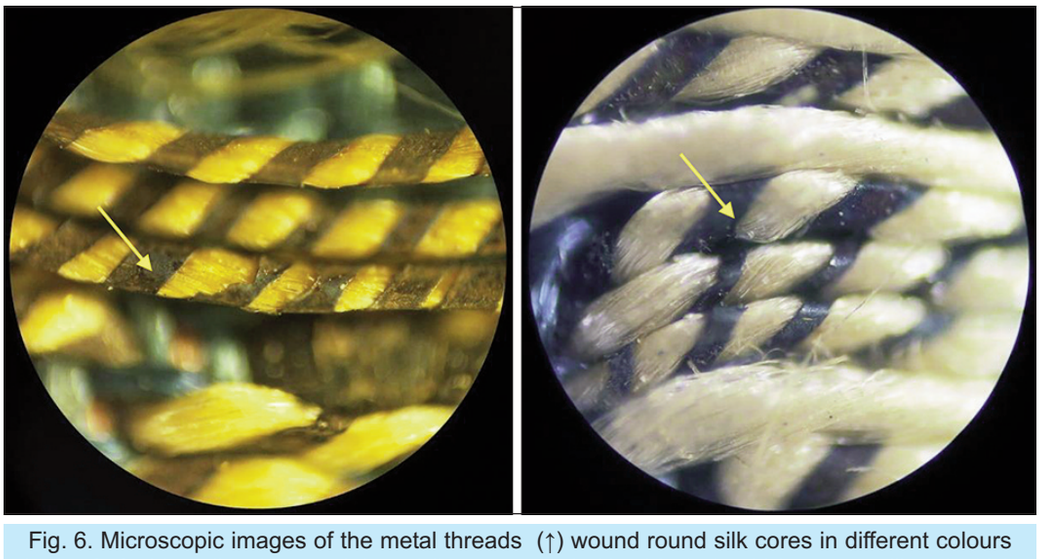

Fig. 6. Microscopic images of the metal threads (↑) wound round silk cores in different colours in the Safavid textile with metal thread (inventory code No. 3674, the 16th century till early 18th century) (magnification ×100)

Microscopic analysis revealed that all threads used in this textile are of silk. The weaving technique in this specimen is Z-type for the warps and wefts. The diameter of the warps is bigger than that of the wefts. Density is about 36–37 warps and 46–47 wefts in each centimetre. The background weaving technique is taffeta [19].

## CONCLUSIONS

Upon personal endeavour and private expense account, the founders of the Moghadam Museum (Dr. Mohsen Moghadam and her wife, Mrs. Selma Kiyoomjian) got together a priceless collection of different textiles and fabrics woven by artists from the Persian plateau, and from European artists as well. The collection covers a long history, as old as 2,200 years, and over different Empires and dynasties that ruled in the above-mentioned vast region. The present study categorised three textile specimens in this collection, based on their weaving techniques. The strategic location of the Persian plateau made it a crossroad of different civilisations, where remarkable works by outstanding artists were mixed to form new patterns and weaving techniques. The Persian artists kept this legacy that went back many years in time and conserved the history of many nations and civilisations, from the Nile in Egypt to China and Japan, and from the European countries to South East Asia. Though many scattered studies have been carried out on several specimens in this valuable collection of textiles and fabrics at the Moghadam Museum, there is still a great need to do research from different aspects, like the development procedure of weaving techniques over the history of the Persian plateau for about 2,500 years. A joint scientific and historical cooperation between Iran and different European and Asian countries, with a focus on this collection, can reveal many facts about the history of weaving techniques, patterns in textiles and fabrics, and indoor air quality, which have an impact on the artefacts.

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