THE MAKING OF TEXTILES
1. COTTON PROCESSING AND WEAVING

The Prehistory of Cotton

There is a great deal of debate about the origin of cotton/old World cotton. A.de. Candolle, a botanist had claimed that *Gossypium herbaceum* was developed from certain wild cottons, notably *G. stocksic*, found in present day Pakistan.¹ His second observation was that the ancestors of the domesticated *G. arboreum* could be traced in wild cotton found in upper Guinea and along the valley of upper Nile.² After him many theories have been put forward. Some consider India to be the home of cotton,³ others consider Arabia, the Sudan or other parts of the Sahara and the savanna lands around this desert.⁴ More recently, Hutchinson and others have claimed that it originated first in South-West Africa and Angola.⁵ He, however, has recently modified his opinion and now is of the opinion that many apparently strains of wild cotton are in fact ‘escapes’ descended from cultivars, or wild “associates” of the cultivated plants that have developed through intercrossing.⁶ Since intercrossing is easy

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² Ibid.

³ Ibid.

⁴ Ibid.

⁵ Ibid., p.32.

⁶ Ibid.
in cotton, the wild ancestor of cultivated plant may have disappeared because it developed in association with cultivars. Thus this hypothesis explains the trouble in finding truly wild ancestors of either *G. arboreum* or *G. herbaceum*.

Besides botanical efforts, we have the archaeological and literary evidence which need careful analysis. The earliest archaeological evidence of cotton seeds come from Period II of Mehrgarh on the Bolan river in Central Baluchistan dating back to the fifth millennium B.C. K.D. Sethna argues that it was a wild cotton. He doubts cultivation at Mehrgarh. The earliest archaeological comes from 5000 B.C. and after 5000 B.C., the next archaeological evidence comes from Mohenjodaro. A microscopic examination of it suggests that it was a close relative of *G. arboreum*. Mixed cotton stuffs have been reported from 1500 to 1000

7. Ibid.


10. Ibid.


B.C. at Nevasa (cotton with silk) and at Chandoli (cotton with flax threads). Watson is of the opinion that cotton cultivation spread from India to the west and east both in different times.

Watson, the latest in the line of historians concerned with cotton, is of the opinion that the north Western part of the Indian subcontinent was possibly the cradle of cotton cultivation from which an “ennobled” plant was diffused to other parts of Asia, the Middle East, Africa and Europe. Ctesias (5th Century B.C.) stated that Indians traded cotton garments with people of North of the Himalayas (mountains to the north). By the 1st Century A.D., Scotra, Eritrea and the Horn of Africa received cotton from India. Egypt was importing cotton from India in the early third century A.D. Indian cotton reached Mongolia in the first

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the period, see Watson, pp.32, 163 (note 10) considers them to be of 1500-1000 B.C. But the other date assigned is 3000-1500 B.C., see A.M. Dani and J.P. Mohen, eds., *History of Humanity*, pp.246-263.

13. Watson, p.32.
14. Ibid.
16. Watson, p.32.
17. Ibid., pp.33-34.
18. Ibid., p.34.
century A.D., and Xinjiang, Turkestan; and Palmyra received it in second-third century A.D. By the early 6th century it reached China.¹⁹

Dieter Kuhn, on the basis of Hutchinson, Silow and Stephens works, thinks that there were two regions in India which produced two different species of cotton.²⁰ Firstly *G. herbaceum*, a short seasonal annual plant producing short staple fibres of inferior quality, originating in the Indus valley civilization reached China by the 'silk road', around the first century A.D.²¹ But it remained confined to basin of Turfan and Khotan.²² Here the seeds of *G. herbaceum* and cotton fabrics have been archaeologically attested.²³ A second specie of cotton was of *G. arboreum* reached the Yunnan province via Assam and Burma from East Bengal.²⁴ It became a speciality of Szechwan province.²⁵

**Cotton Processing: Seed-extraction and Fibre-separation**

Cotton created for itself its own technology from the very beginning. The preparation of cotton for weaving cloth is preceded by three processes

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19. Ibid., p.35.
21. Ibid.
22. Ibid.
23. Ibid.
24. Ibid.
25. Ibid.
- (a) extraction of the seeds (b) separation of the fibres, and (c) spinning of the yarn. Each of these three processes involves specialized skills and tools.

Cotton was one of the major cash crops of India. Its cultivation during the sixteenth and seventeenth centuries was noticed in the so called Bombay Cotton Tract especially in Khandesh.\textsuperscript{26} It was cultivated in the northern India\textsuperscript{27} and extensively grown in Bengal.\textsuperscript{28} It was in comparison to the 19th century grown on a smaller acreage which was possibly the reason why it was assigned high value in comparison to other crops listed in the \textit{Ain-i Akbari}\.\textsuperscript{29} The peasants used to carry out initial manufacturing processes before it was carted out of the village.\textsuperscript{30} It was, therefore, the peasants who generally picked and ginned cotton.\textsuperscript{31}

After being removed from the field, the harvested cotton has to be left in the sun for a few days, so that the seed’s adherence to the floss weakens.

The seed has now to be extracted out of cotton. In India, this has been done traditionally by two means, viz., the roller-and-board, and the

\begin{itemize}
\item \textsuperscript{26} Cf. Irfan Habib, \textit{The Agrarian System of Mughal India 1556-1707}, 1st pub. 1963, 2nd rev. ed., Delhi, 1999, pp.43-44.
\item \textsuperscript{27} Ibid.
\item \textsuperscript{28} Ibid.
\item \textsuperscript{29} Ibid.
\item \textsuperscript{30} Ibid., p.63.
\item \textsuperscript{31} Ibid.
\end{itemize}
worm-press (*charkhi* in Hindi). Both the forms appear to be of ancient origin. The roller-and-board was present in nearly all ancient civilizations for various purposes. The roller used to be cylindrical and was worked with hands on a flat board. D. Schlinglofif has pointed out reference to its use in ancient Indian texts and in the Ajanta frescoes (Pl.I). Its apparent solidness suggests the use of stone for roller and board. This mode of threshing was presumably done to loosen the cotton wool's tenacious adherence to the seeds, in order to facilitate its further ginning in the worm-press. That it continued to be used in medieval India is confirmed by the description and accompanying illustration of a wooden instrument called the *chobkin*, used for separating cotton from the seeds (Pl.II).

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33. Its usage continued till the late nineteenth century except that rollers were made of iron later. The cotton ginned in this manner was called 'stone-cotton'. See George Watt, *The Dictionary of the Economic Products of India*, (Henceforth *D.E.P.I.*), IV, London, 1890, pp.105-06.

34. Ibid. IV, pp.105-06. This practice was quite common for ginning cotton in the nineteenth century. This laborious and ineffectual process of stone-cleaning was advised to be replaced 'at least by the *churka* (*chakhri*)' (Ibid., p.106).


This method was also practised in medieval China. This was probably the wooden roller, though whether it was moved by hand or feet is not made clear. The foot-manipulated roller was widely used in the nineteenth century in South India. Perhaps, both practices have been simultaneously in use. Indeed, the continuity of its usage till recent times indicates a popular receptivity to its usefulness.

The worm-press or worm-roller (Hindi-Charkhi) is mechanically a much more advanced device. It consists of two cylindrical rollers joined by a pair of helical gears so as to move in opposite directions when one of them is turned by hand or crank-handle. Both rollers are horizontally placed and are supported by two uprights. After the addition of the crank-

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38. Watt and Murray in D.E.P.I. ,IV, pp.152-3, describes a similar process except that it worked with the worker’s feet manipulating the roller. Owing to this, they call it a foot-roller. Sometimes the rod is shorter and slightly conical, in which case the motion is circular. This had an advantage over the hand roller in that the pressure of the feet was joined by the rolling motion which certainly increased the rapidity of the extraction. On worker can, in this way, turn out from four to six pounds of cleaned cotton in a day. The feet also do not tire as much as the hands. This can, in turn, keep the work going for a longer time.
handle, the lower roller is turned by it on the one end,\textsuperscript{39} which communicates motion to the rollers.\textsuperscript{40} Once the cotton is fed into the revolving rollers, the fibre is drawn through. The seeds being too large are unable to pass through the closely wedged rollers and are expelled and dropped to one side.

The prevalence of this device in ancient India is being proved by its widespread presence in India,\textsuperscript{41} Cambodia and Xinjiang (Sinkiang).\textsuperscript{42} India exercised a very powerful influence on Cambodia's culture during the first millenium of the Christian era. Since the Indo-Cambodian cultural relationship belongs to the period fifth to tenth century AD,\textsuperscript{43} it is likely that transmission of the device took place at that time. China received cotton-gin with cotton itself from India between sixth to thirteenth century probably through two routes: 'through Burma (sixth century); and Indo-


\textsuperscript{40} By the mid-19\textsuperscript{th} century, the \textit{charkhi} had even started having a wheel at one or both ends, \textit{D.E.P.I.}, IV, pp.152-53.

\textsuperscript{41} For its widespread use in India in various provinces, see \textit{D.E.P.I.}, IV, pp.105-06, 115, 123, 147-48, 152-53.


\textsuperscript{43} For Indo-Cambodian contacts, see R.C. Majumdar, \textit{Inscriptions of Kambuja}, Calcutta, 1953; See also, Himanshu P. Ray. \textit{The Winds of Change, Buddhism and the Maritime Links of Early South Asia}, Delhi, 1994, pp.87-120.
China through Sinkiang (thirteenth century). But the more conclusive evidence for its presence in ancient India would be the Ajanta fresco where what Schlingloff recognizes to be a bow-string device to separate cotton fibres seems really to be a charkhi (Pls. I and III). It is depicted with its characteristic rectangular frame, which has nothing in common with the bow-string device. Both the upper rollers are visible, though they are slender (perhaps of iron). Quite reasonably a crank-handle is not shown (since the crank is a late comer in this technology). A woman is shown moving the upper roller with the left hand and inserting the cotton by the right-hand. This evidence makes it almost certain that the device was known to Indians by the middle of the sixth century AD.

This can easily be reconciled with the view that the charkhi reached China (sixth to thirteenth century) and Cambodia sometime during this period from India. As far as history of this device in Islamic World is

44. Needham, IV(2), pp. 122-24, 204.


46. This fresco is in Cave No.1, which dates back to the middle of the sixth century A.D., see M.K. Dhavalikar, Ajanta – A Cultural Study, Poona, 1973, p.2.
concerned, Irfan Habib could not find evidence to attest to its presence there. It seems that a variant form of Indian cotton-gin was received by the Islamic World which had double rollers while the worm-gearing was lost in the transition.\textsuperscript{47} Similar was the experience of China.\textsuperscript{48}

The Indian origin of this device has no other documentary evidence, but the use of the same mechanical principle of the Indian sugarcane rollers is significant. It cannot escape notice that while there is no early evidence of the worm-rollers in any other civilization, both cotton and sugarcane were indigenous to India. The main difference between the two kinds of rollers is that the cotton-gin is always mounted so as to rotate vertically whereas the sugarcane rollers move horizontally owing to the employment of cattle-power.

As for the worm-gear in the Indian cotton-gin, some doubt has been raised. Indeed, it is conjectured that this could have consisted of two rollers moved by a handle only, since worm-gearing was alien to Indian technology.\textsuperscript{49} Such a suggestion, however, is not tenable in the absence of evidence in its support. For the mechanism of worm-gearing

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  \item \textsuperscript{48} Ibid.
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in the cotton-gin, the significance of the Ajanta fresco is that the cotton-gin without a gearing mechanism would be held alien to Indian technology only if it was established that it was invented outside India, and if it was an importation it could have come only during or after that period. China received cotton-gin with cotton itself. But it was devoid of worm-gearing owing to its knowledge of double-powered rollers since the Han period. Therefore, it adapted the Indian cotton-gin to its indigenous practices and instead of worm-gearing, the earliest Chinese depiction of a cotton-gin of the fourteenth century had a crank-handle for each roller. The earliest available depiction of the charkhi in a miniature Kangra painting of the mid-eighteenth century, shows parallel worms. However the artist has erroneously transferred the worm to the handle (Pl.IX). The worm was known to Europe since classical times, but this particular form of worm-gearing is only traced to the early nineteenth century. There is no evidence for Islamic world's familiarity with it. The hardness of Indian cotton also makes it, technically speaking, difficult to gin on a cotton-


52. M.S. Randhawa, *Kangra Paintings of the Bhagvata Purana*, New Delhi, 1960, p.50, Pl.V. The cotton-gin is prominently shown in Pl.V. which deals with 'Migration from Gokula to Vrindavana'.


gin without a crank-handle or worm-gearing. For ginning, the rollers were supposed to be closely wedged. This could only be achieved with a crank handle or worm-gearing or both. Therefore, the chances of worm-gearing in the Indian cotton-gin are greater in the absence of a crank-handle. In view of this it may be concluded that the Indian cotton-gin presumably had worm-gearing since its inception and it remained in use till the late nineteenth century.

The dating of another important part of the charkhi, i.e. the crank-handle is not certain. Documentary references such as in the Bahar-i Ajam (1740) are not helpful. But the depiction of a cotton-gin in a miniature Kangra-painting of the mid-eighteenth century shows the crank handle (Pl.IX). It is possible that the cotton-gin received the crank-


58. Tek Chand ‘Bahar’, Bahar-i Ajam, AD 1739-40, lithographed, Lucknow, 1916 s.v. charkh. The Bahar-i Ajam seems to give the earliest textual evidence for charkhi when it refers to the cotton dresser’s wheel, i.e. cotton-gin (charkh-i naddafi).

59. M.S. Randhawa, p. 50, Pl.V.
handle along with the spinning-wheel in the thirteenth-fourteenth century. The cotton-gin depicted in the Kangra painting shows parallel grooves in both the rollers which presumably enhanced the grip of the rollers. The cotton-gin with worm-gearing and crank-handle had increased its efficiency to gin cotton more rapidly and finely. No further mechanical change can be traced, but at some stage water-power was used to drive the charkhi in Pakhli in the Hazara district between the Indus and the Jhelum. The use of the charkhi would possibly have been of great economic significance. It has been estimated that its average capacity to clean cotton varied from six to eight pounds per day, per man/woman. Thus cotton-gin had an advantage over the roller-and-

60. Irfan Habib, “The Technology and Economy of Mughal Empire”, *The Indian Economic and Social History Review* (henceforth *I.E.S.H.R.*), XVII(I), Delhi, 1980, p.7 has traced the addition of the crank-handle to the spinning wheel during the seventeenth century; see also, Irfan Habib, “Joseph Needham and the History of Indian Technology”, pp.261-262.

61. M.S. Randhawa, p.50, Pl.V.

62. Unlike in India, charkhi witnessed many improvements in China in the form of the addition of a treadle motion to the upper roller besides the crank-handle. This motion was assisted by a radial bob-flywheel. In Japan, the flywheel tended to take the form of a single club-shaped weight attached to the shaft by the early seventeenth century (Cf. Needham, IV(2), p.123). The Persian gin also had three rollers pressed against each other by a manipulation of wedges between their bearings. A rear roller was there to keep off the fibre from the main roller, but its first date of use is not certain (See Hans E. Wulff, *Traditional Crafts of Persia*, Cambridge, 1966, pp.179-80).


64. Ibid., pp.153.
board device and increased the production of cotton fibre considerably.

After the cotton has thus been ginned, its fibres need to be separated. Scutching not only loosens the texture of the cotton, it also removes the dirt and dust. One of the most primitive methods for achieving this was beating the cotton with a stick. An illustration of the late sixteenth century, 'Idris giving instruction to mankind in the art of weaving' shows the use of a stick for beating cotton (Pl.XI). Even by the seventeenth century, this mode of scutching cotton was found existing side by side with the carding bow. But beating cotton with a stick had its own hazards. Instead of loosening, it might break the fibres. Therefore, the bow-string device was much better. The vibrations of the string open the knots of the cotton, loosen and separate fibres of the plant material, instead of scutching where the fibres get broken.

There is some dispute about the origin of the bow-string device. Schlingloff has traced the first textual reference to it in one of the Jatakas


66. W. Foster, ed., *English Factories in India 1665-67*, Oxford, 1925, p.174, the cotton was said to be ‘bowed or beaten’.

where one reads *ithinam kappasapothanadhanukam* (i.e. a woman's bow for carding cotton).\(^{68}\) Vijaya Ramaswamy has also discovered reference to 'bowing' from the second century to sixth century A.D.\(^{69}\) *Trikandasesa*, a work of ninth century A.D. refers to its use.\(^{70}\)

D. Schilonglof identified a rectangular frame in the Ajanta fresco of the sixth century with the bow-string device. But a rectangular frame cannot perform the function of a bow, since it cannot produce the required vibration. This is only possible when the frame could have been bow shaped for it would then have the elementary aspect of a spring in the

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\(^{68}\) *The Jataka*, ed. V. Fausboll, VI, London, 1964, p.41; *The Jataka or Stories of the Buddha's former Births*, tr. H.T. Francis, ed., E.B. Cowell, V, London, 1957, p.26. The accurate dating of the *Jataka* is not possible due the nature of their compilation. Nevertheless, they are presumably not later than 2nd century A.D. Secondly, Schlingloff's identification of the words *pinjanikaya*, *pinjitam*, etc. meaning carding bow from the dictionaries of eleventh-twelfth centuries does not appear very convincing (pp.86-89). They could probably mean beating cotton with stick also (as discussed earlier).


\(^{70}\) Purushottamadeva, *Trikandasesa*, Bombay, 1937, p.78. The sloka reads, 'Kapallasika tarkustarkushanastu Jhamaka Varantani tarkupithi syatpinjanam tulakarmukam'. I owe this information to Professor S.R. Sarma, Department of Sanskrit, A.M.U., Aligarh; K.N. Mahaputra "Purushotam Deva, The Lexicographer" *The Orissa Historical Research Journal*, II, Bhubaneswar, 1953, p.71, has traced the *Trikandasesa* to be a work of the ninth century AD.
vibrating wire, for loosening and separating the fibres instead of scutching. In fact, as already shown above the instrument depicted in the Ajanta fresco was really the *charkhi* which has to have a rectangular frame.

India, thus, had a bow-string device well within the first millennium of the Christian era. Moti Chandra cites two dictionaries. *Vijayanti* (eleventh century) and *Abhidhanacintamani* (twelfth century) for reference to the bow-string device. The *Miftahu'l Fuzala* (fifteenth century) provides the earliest description and depictions of it along with the mallet in two illustrations (Pls.IV & V). Both the bows are identical in shape. Each bow consists of a round wooden bow shaft. The shape of the top of the bow is like the neck of the harp, and the bottom is made by a board which is possibly inserted into the slot of a round board carrier and the whole is attached to the shaft. A strong bow-string runs from top to the bottom of the foot-board of the bow. But both the illustrations do not show any toggle-peg which is usually placed between the strings to achieve rough tightening by twisting it. Apart from it, the leathern block between string and foot-board for final adjustment is also absent. A sling


of some material (perhaps of cotton yarn) is shown fastened to the bow-shaft near its centre of gravity. The bower passes one hand through this sling while working; it also protected his hand. The *Miftahu'l Fuzala* gives *duruna, shafshahang, lorak* and *kaman naddaf* as synonym for the bow-string device.\(^7^4\)

An important part of the bow-string device is the mallet. The *Miftahu'l Fuzala* gives the synonym of *mushta*(mallet) as *shafshahang*.\(^7^5\) The mallet is also depicted in both the illustrations of the bow-string device.\(^7^6\) The mallet has double tapering heads. In operation, the bower is depicted as holding it by the middle in his right hand (Pl.V). The ridge of the upper head grip the bow-string when the bower strikes the string with the mallet. When so struck, the bow-string becomes very tense and slips off the ridge. This results in strong vibrations, which help to loosen the cotton fibres.

India, thus, had a bow-string device in ancient times at least by 2nd century A.D.

Therefore, it could be safely assumed that the bow-string device radiated outwards from India to other cultures. Irfan Habib finds the earliest evidence for the Islamic World's familiarity with it only in the

\(^7^4\) *Miftahu'l Fuzala*, s.v. *duruna, shafshahang, lorak*.

\(^7^5\) Ibid., s.v. *shafshahang*.

\(^7^6\) Ibid., f.126b and 259a.
eleventh century AD. China received it in the thirteenth century with cotton itself. Europe knew it only in the fifteenth century. In 1409, the wool workers of Constance had protested against its use for cleaning cotton.

The bow string device still survives in India practically as it was in medieval times. It is called *dhanuki* in Hindi from Sanskrit/Pali; *dhanukam* or *dhunna* from a different Sanskrit root *dhu*, which means to beat, 'pummel' — probably vigorous bearing like one with bow-string device, and the cotton-carder obviously being called *dhunya* in Hindi.

The carder (*dhunya, naddaf*) was an itinerant artisan who moved from 'village to village' with his family in search of work. Thevenot (1666)


80. Cf. Maulavi Zafrur Rehman Dehlavi, *Farhang Istitilahat-i Peshawaran*, II, Delhi, 1940, pp.5-6. It is called *dhunki* apparently a variant of Sanskrit *dhanukam*.


82. Ibid.
writes, "We went next to Gitbag (near Sarkhej), five leagues from Mader, we met a great many Colies, which are a people of a Caste or tribe of Gentiles, who have no fixed Habitation, but wander from Village to Village, and carry all they have about with them. Their chief business is to pick and clean Cotten, and when they have no more to do in one village they go to another." 83

It is therefore very likely that India was able to produce some of the finest cotton-cloth in the ancient and medieval period owing to its invention of the two basic tools of pre-modern textile industry, namely (1) the cotton-gin for cleaning cotton more efficiently, and (2) the bow-string, a device for carding cotton for disentangling fibres without damaging it much. These, in turn, might undoubtedly have caused a major increase in the production of fine cotton ready for smooth spinning.

Spinning

It is difficult to explain the origin of spinning technology. Spinning may be said to have its predecessor in cord making, from straw and plant fibres. Cords presumably had a spiral put into them by some kind of "twisting". 84 These spirals added strength and elasticity to the material.

83. Surendranth Sen, tr./ed., Indian Travels of Thevenot and Careri, New Delhi, 1949, p.10.

84. Such twists could be achieved by rolling the raw material between the fingers, between the palm of the hands, or between the fingers and the thigh or the cheek. It is not easy to ascertain definitely as to which of the two methods of impressing the sherd (through the application of pressure directly on to the surface of the pot or the beater technique) was used, Dieter Kuhn, pp.63-64.
Similarly it is difficult to know as to who discovered that the plant and animal fibres were separable, though some tentative attempts have been made to explain it. Unlike Europe, Egypt, Mesopotamia and China, we do not find evidence of onos or epinetron (flat or semicylindrical) for hand spinning.

After simple twisting by hand, a crucial invention has been the spindle. Stone spindle-whorls were found in Telaitat Ghassul, Palestine, about 3000 BC. Small and convex limestone spindle whorls were discovered in Naqada, Egypt from about the same time, and from the first settlement of Troy, also dated about 3000 BC and the second settlement some 500 years later. The earliest European spindle whorls, made of stone, have been reported from Bielersee, Switzerland, from the middle of the third millennium BC. Bone, limestone, alabaster and basalt spindle whorls excavated at Meggido, Palestine, date from before 3500 BC to 1050 or 1100 BC. So far as India is concerned, it seems that the Indus civilization people were familiar with the suspended spindle spinning method in which the fibres could be gathered on the distaff or placed in a basket and then drawn out, fastened to the spindle and caught

85. Ibid.
86. Ibid.
87. Ibid.
88. Ibid., p.73.
under a hook. The feeding could be done regularly while the spindle rotated. Rotation was done by hand, then the spindle was dropped and thereafter allowed to swing. This free-flying spindle spinning method used to increase the momentum of the revolving mass of the whorl and in this way a fine, even yarn of some strength was obtained.* Its antiquity is borne out by the numerous finds of spindle whorls in the Indus civilization.90 Spindle whorls were of varying types and materials.91 Small holes in the whorls were made for the use of metal.92 These spindle whorls were made of pottery, shell and faience. The pottery whorls were of three types:

(a) With a single hole in the middle

(b) With two holes in the middle

(c) With three holes in the middle.

Mostly, according to J. Marshall, wooden stick was used for the spindle.93 But E. Mackay suggested that spindles were chiefly metallic on the basis of the size of holes in most of the whorls.94 The two-holed type was found

89. E.J.H. Mackay, *Early Indus Civilization*, Delhi, 1976, p.82.


in Mesopotamia, early Elam and Turkistan,\(^95\) while the three-hole type is peculiar to the Indus valley civilization.\(^96\) Spindles varied considerably in size, varying from 1.25 inches to 2.1 inches in diameter.\(^97\)

Some of the two and three-holed whorls have a deep grooved edges which were perhaps used for drawing the thread along it to consolidate the fibres.\(^98\)

Spindle-whorls made of shell, were especially numerous in the Indus Civilization.\(^99\) Their size varied from 1.5 inches to 1.85 inches in diameter and their hole in the centre averaged 0.18 inch in diameter which was presumably because of the use of metal spindle.\(^100\) Spindle whorls of faience were very rare and also possibly had a metal spindle. The lighter nature of the whorls suggests that only fine yarns were spun with them. Wool could not be spun upon such whorls due to its great elasticiity. Wool was possibly spun with large wooden whorls.\(^101\) Sometimes the

\(^{95}\) John Marshall, p.468.
\(^{96}\) Ibid.
\(^{97}\) Ibid.
\(^{98}\) Ibid.
\(^{100}\) John Marshall, p.469.
spindle whorls were ornamented: pottery whorls with paint, faience with simple moulded designs, and shell whorls with incised lines.¹⁰²

In the Rigveda (IX, 86.32) there is a reference to a triply twisted thread.¹⁰³ Such triply twisted yarns could have been obtained with the help of three holed whorls. By the 4ᵗʰ-3ʳᵈ century bone, ivory, stone and terracotta whorls came into use.¹⁰⁴ Grinding stone was used for sharpening the spindle.¹⁰⁵ Hemachandra (12ᵗʰ century), speaks of the spindle as Tarku and Kattansadhanam.¹⁰⁶ Spindles continued to remain in use in medieval period.¹⁰⁷ In the 18ᵗʰ century Bahar-i-Ajam refers to their use.¹⁰⁸ The role of spindle in finest spinning is well illustrated by the popularity enjoyed by muslin manufacture in the Dacca district.¹⁰⁹ Very fine threads were

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¹⁰². Ibid.


¹⁰⁵. Trikandasesa, p.78. Grinding stone was known as ‘Tarkushana’.


¹⁰⁷. Miftahu'l Fuzala, s.v. shokak wa sangok, f. 188 a-b.

¹⁰⁸. Bahar-i-Ajam, s.v. duk.

used in the preparation of ancient India's legendary muslin. Such fine thread was possible with the employment of lightest spindle, it could not in later times be spun on the spinning wheel.

The fineness and strength of the fibre to be converted into yarn depended on the sizes, shapes and weights of spindle whorls and the length of the spindle rods. The tensile strength of the yarns depends entirely on the number of rotations of the whorls.

The Miftahu'l Fuzala describes shokak or sangok as the whorl holder in which the spindle (duk) is rotated, the whorl-holder called phirki in Hindi. The Bahar-i Ajam explains duk or spindle as a long (mustatil) piece of wood under which another piece of wood is attached and that iron or wood is rotated by both hands, so that short (khurd) silk or wool is twisted (tafta bashad). The two bits of wood or one bit of wood and one of iron in this definition refer to the whorl of the spindle containing

110. Moti Chandra, p.130. The Arab merchant Sulayman (851AD) refers to the fine muslin of Bengal. In praise of the stuff he writes, "In that country are made cloths which are not made anywhere else. One of these garments could pass through a ring because the stuff is extremely fine. The stuff is cotton...."

111. Encyclopaedia Britannica, 1911 edn, XXV pp.685-6, s.v. spinning.


113. Miftahu'l-Fuzala, s.v. shokak wa sangok, f.188 a-b.

114. Bahar-i-Ajam, s.v. duk.
the spindle, the *phirki*, of the *Miftahu’l Fuzala*. The whorl greatly increases the speed of the spindle, leading to the more rapid spinning of yarn.

So far presence of spindle wheel in India is concerned, we have not come across any evidence for the existence of the spinning-wheel in ancient India. J. Marshall took the presence of an iron-axle for the existence of the spinning wheel.\textsuperscript{115} Lynn White was the first to insist on the absence of the spinning wheel in ancient India.\textsuperscript{116} The spinning-wheel with its belt-transmission of power, the flywheel and differential speeds of rotation originated in China during the Western Han Dynasty (206 BC-AD 24).\textsuperscript{117} Needham has discovered an illustration in China as early as AD 1035.\textsuperscript{118} The Islamic world received it in the twelfth century.\textsuperscript{119} Ahmad J. al-Hasan and Donald R. Hill have suggested that


\textsuperscript{116} Lynn White, “Tibet, India and Malaya as Sources of Western Medieval Technology”, *American History Review*, LXV(3), 1960, p.517.

\textsuperscript{117} Gao Hanyu and Shi Bokui in *Ancient China’s Technology and Science*, Beijing, 1983, pp.504-08, and thus antedates Needham’s suggestion of its origin in China after the second century AD (see Needham, IV(2), p.105).


the Arabs introduced the spinning wheel in Europe during the tenth century AD.\textsuperscript{120} At the same time they are not fully convinced of their identification because they also suggest that it could also well have been a silk-thread, multi-spindle throwing or twisting machine.\textsuperscript{121} However, there are clear references to a spinning wheel (\textit{charkha}, lit. wheel) in the works of Persian poets like Anwari (fl.1138-9), Nizami (d.1199-1200) and Sa’de (1257).\textsuperscript{122} Irfan Habib, therefore, has suggested the spinning wheel reached the Islamic world by the twelfth century,\textsuperscript{123} and thus the Islamic civilization seems to have been the first outside China to accept her superb invention.\textsuperscript{124} Subsequently, it travelled to Europe in the thirteenth century. Lynn White found the evidence for its first appearance in 1280 at Spyer on the basis of which he had assumed it to be an invention of Europe.\textsuperscript{125} Now in the light of above discussion it seems that Europe probably received it through the Islamic world.\textsuperscript{126} India too

\textsuperscript{120} Ahmad J. al-Hassan and Donald R. Hill, \textit{Islamic Technology, An Illustrated History}, Cambridge, 1986, pp.185-86.

\textsuperscript{121} Ibid.

\textsuperscript{122} Irfan Habib, “Medieval Technology: Exchanges between India and the Islamic World”, pp.203-04.

\textsuperscript{123} Ibid.

\textsuperscript{124} Ibid.


\textsuperscript{126} Irfan Habib, “Medieval Technology: Exchanges between India and the Islamic World”, p.204.
received it from the Islamic source. I27 Irfan Habib has traced the earliest
reference to it in India in the Futuh-us Salatin (1350) of Isami. I28 The
Miftahul Fuzala (1468-69) refers to spinning by wheel. I29 and, there is
an illustration in it of spinning wheel, which is perhaps the first illustration
of it in India (Pl.VI). I30 The use of the spinning wheel is continuously
attested to in later times by its depictions and descriptions. I31

127. Ibid.

128. Irfan Habib, “Technological Changes and Society 13th and 14th
Centuries”, P.I.H.C., p.142. Isami, Futuh-us Salatin, ed. A.S. Usha,
Madras, 1948, p.134, reflecting the resentment of the officers of
Sultan Razia (1236-40) against her, writes:
“That woman alone is good, who works all the time with the
charkha (spinning-wheel); for a seat of honour would deprive her
of her reason.
Let cotton (pamba) be the woman’s companion, grief her wine-
cup, and the twang of the spindle will serve well for her minstrel.”

129. Miftahul Fuzala, f. 94b, s.v. charkh.

130. Ibid., f.151a.

131. Cf. S.C. Welch, India Art and Culture, 1300-1900, New York,
1985, p.176, Pl.109; S.C. Welch, The Art of Mughal India,
Painting and Precious Objects, (Exhibition Catalogue), New York,
1963, Pl.13, p.164; E. Kuhnel and H. Goetz, India Book Painting
from Jahangir’s Album in State Library in Berlin, London, 1926,
Pl. I, text on pp.53-54; Ivan Stchoukine, La Peinture a’Lepoque
des Grands Moghols, Paris, 1928, P. XLIV (c.1620-25); Georges
Roques, cited by Indrani Ray, “Of Trade and Traders in
Seventeenth Century India: An Unpublished French Memoir by
George Roques”, describes its use in 1676, I.H.R., IX, (1-2), p.86
(pp.10-11, Roques’ Text),“There is an infinite number of this type
of traders as well as spinners because all female slaves of Muslims
make their masters subsist by the wheel”; F.R. Martin, The
Miniature Painting and Painters of Persia, India and Turkey from
the Eight to the Eighteenth Century, London, 1912, p.207a;
The spinning-wheel incorporated power-transmission by 'wrapping-connection'. It embodied one of the earliest uses of fly wheel principle and differential speeds of rotation. The belt drive was essential to the main motion in this apparatus.

Medieval paintings (16\textsuperscript{th} century and later) reveal that rimless spinning wheels were used. In them the outwardly diverging spokes were connected by thin cords to form a 'cat's cradle' which carried the driving belt.

The introduction of crank arm or eccentric lug into spinning-wheel added greatly to the convenience of working the spinning wheel.\textsuperscript{132} Needham has traced the antiquity of crank-handle in a rotary winnowing fan of prior to 2\textsuperscript{nd} century A.D. in China.\textsuperscript{133} It reached Europe in 9\textsuperscript{th} century A.D.\textsuperscript{134}

In China, crank-handle was attached to the reeling-wheel (the ancestor of the spinning-wheel) and naturally enough to the spinning wheel in the 13\textsuperscript{th} century, when the device was used to spin cotton.\textsuperscript{135} It is

\textsuperscript{132} Cf. Needham, IV(2), pp.111-119, Pl. CLVI.
\textsuperscript{133} Ibid.
\textsuperscript{134} Lynn White, p.110.
\textsuperscript{135} Needham, IV(2). p.104.
not clear if the spinning-wheel originally travelled from China with crank-handle or the Chinese reeling-wheel gave birth to spinning-wheel in other cultures, and the crank was applied there at a later stage. Shadiabadi’s depiction does not show any handle on the wheel, either on its rim or its face (Pl. VI).\textsuperscript{136} In one of the two spinning-wheels shown in \textit{Harivamsa} (1590-95), the crank-handle is not visible and may well be absent (Pl.VII).\textsuperscript{137} The depiction of spinning-wheels, in an unsigned miniature of Jahangir’s atelier, can not be taken as the representative of their counterpart in Mughal India; the miniature being drawn after the Persian example (original not known); but the wheels yet lack handles (Pl.VIII).\textsuperscript{138} In another spinning-wheel depicted by Bichitr during Jahangir’s reign, a half-handle with a hole for a small wooden peg handle can be seen.\textsuperscript{139} A miniature of Aurangzeb’s reign (1658-1707) display a spinning-wheel where a piece of wood mounted on the axle at an angle is visible.\textsuperscript{140} This

\textsuperscript{136} Miftahu’l Fuzala, f. 151a.


\textsuperscript{139} Ivan Stchoukine, \textit{La Peinture Indienne à L’ Époque des Grands Moghols}, Paris, 1928, Pl. XLV (c. 1620-25).

\textsuperscript{140} F.R. Martin, \textit{The Miniature Painting and Painters of Persia, India and Turkey from the Eighth to the Eighteenth Century}, London, 1912, Pl. 207a.
could have been capable of performing the office of crank. Another mid-
18th century (1760) painting shows the crank-handle clearly (Pl.IX). A further improvement was achieved by fitting a connecting-rod to the crank-handle by the mid-18th century. In Europe, however, the connecting-rod was developed as early as in the 15th century. Moreover, India never received the multi-spindle-wheels illustrated in China from 1313 onwards or the U-shaped flyer rotating around the spindle attached to it in Europe by 1480.

Thus, in all likelihood, the gap between the fast production of cotton-fibre after being ginned by the cotton-gin and carded by the bow-string device and the not so rapid spinning by the spindle was filled by the addition of the spinning wheel to pre-modern Indian cotton technology. In one sense the impact of this conglomeration of cotton gin, bow-string device and spinning wheel should have been considerable on the cloth production, and consequently on the economy and society of medieval India.


143. Lynn White, p.113.

Preparation of Yarn /Fibre for Weaving:

Some evidence is also available for the intermediary processes prior to weaving. Once the yarn was spun, it was transferred to the spool. In India, the earliest evidence of spool/ bobbin have been reported from Mohenjodaro (4000 B.C.)\textsuperscript{145} Three bobbins were found; two of which were of steatite.\textsuperscript{146} They are of varying sizes and types.\textsuperscript{147} Miftahu’l Fuzala gives the illustration and explains it as ‘a wooden instrument on which cotton and silk yarn are wound, it is called \textit{pareti} in Hindi’.\textsuperscript{148} This description is followed by an illustration of the same instrument (Pl.X).\textsuperscript{149}

From the cage spool or the winding stick the yarn was taken off as a skein. Shadiabadi again helps in understanding this when he describes the \textit{kalawa} (a skein) thus, “As yarn is put on yarn, that is coiled (pechand) and that is called \textit{ate} in Hindi.”\textsuperscript{150} This is the earliest and perhaps solitary

\textsuperscript{145} Mackay, \textit{Further Excavations at Mohenjodaro}, p.420.

\textsuperscript{146} Ibid.

\textsuperscript{147} Ibid.

\textsuperscript{148} Miftahu’l Fuzala, s.v. \textit{kalaba}. The Hindi equivalent \textit{pareti} is still in use. It is called \textit{parenti} or \textit{phirenti} (Istilahat-i-Peshawaran), II, p.10, s.v. \textit{parenti, phirenti}).

\textsuperscript{149} Ibid, f. 240a. The \textit{Bahar-i-Ajam}'s description of the \textit{kalafa} is similar: ‘a piece of wood on which yarn in wound and collected’ (s.v. \textit{kalafa}).

\textsuperscript{150} Miftahu’l Fuzala, s.v. \textit{kalawa}, f. 239b. Here again the continuance of the same equivalent upto modern times is very important in understanding the practice of the craft (Istilahat-i-Peshawaran), II, p.9, s.v. \textit{atti} or \textit{anti}).
evidence so far traced of the skeining.

Yarn was also collected in the form of coils from the cage-spool for dyeing prior to weaving. This is depicted in a later 16th century Mughal miniature. ‘Idris giving instruction to the mankind in the art of weaving’ (Pl.XI).\textsuperscript{151} A man is shown transferring the collected yarn from the cage-spool on to wooden pegs driven into the ground in a circular manner. The coiled yarn could be then collected and dyed.

Collection of yarn on the weft spool to be used in the shuttle was also a very important process prior to weaving. For weaving, the yarn is wound from the skein on a reed. The reed was pushed over the spindle head and the yarn was wound from skein on to the reed which served as the bobbin. The \textit{Miftahu’l Fuzala} provides the earliest reference to it. \textit{Zaghuna} was the obsolete word for it, and \textit{mashora} was the word in use. Shadiabadi describes the bobbin (\textit{mashora}) as “yarn (\textit{risman}) which women arrange (\textit{sazand}) in the shape of an egg on a spindle.”\textsuperscript{152} He also describes the bobbin (\textit{mashora}) elsewhere, where he says: “yarn is straightened (\textit{rast kunand}) and yarn is put together (\textit{baham karda})”.\textsuperscript{153} The \textit{Bahar-i Ajam} gives more accurate definition and also relates it to the further process in weaving. It says, “Reed (\textit{mashora}) is that on which

\textsuperscript{151} T. Falk and M. Archer, Pl. 3, Cat. 4, p.47.

\textsuperscript{152} \textit{Miftahu’l Fuzala}, s.v. \textit{zaghuna}, f.151a.

\textsuperscript{153} Ibid., s.v. \textit{mashora}. 
weavers wind yarn, pass (guzarand) it into the shuttle (maku)". The same dictionary also refers to a reel that ‘weavers put (andakhta) yarn on, and put on the shuttle (maku), the braiders (ilaqaband) wind silk on it (kalafa charkhi)".

Warp winding was the next most important process prior to weaving. Warp winding in its simplest form is shown in the Mughal miniature in the manuscript of Ziauddin Nakshabi’s *Tuti Nama* (1580-85) where Zarir, the weaver of silk garments has been shown at his loom in Nishapur (Pl. XIII). A man is shown transferring the collected yarn from warp winding stick on to a number of warp pegs driven into the ground in a circular manner. Two pegs could be seen placed near each other possibly to achieve a warp cross. First, the warp winder attaches the end of the thread to the first warp peg and then carries on the business of passing the thread to the right and left of the cross pegs alternately, until the warp has the requisite number of threads.

In order to facilitate weaving, warps were sized to reduce friction and avoid damage to the threads during weaving. Shadiabadi describes the size (ahar) thus “It was bat or pat (size) that was put on the cobweb

154. *Bahar-i-Ajam*, s.v._mashora._

155. Ibid., s.v. *kalafa charkhi._

156. See, *Indian Heritage, Court Life and Arts Under Mughal Rule*, Balding/Mansell, 1982, Pl.23, text on p.32. See the text (pp.195-6) and fig.(272) in Hans E. Wulff.
(танста) of yarn". The description is accompanied by an illustration. The yarn is put horizontally and is supported at both ends by stout sticks driven into the ground. A man is depicted applying the size on the yarn with a brush (mala). Shadiabadi describes the brush (mala) as “a weaver’s brush (simā), by which a weaver puts size upon yarn of the cloth, this is called kunchi in Hindi (Pl.XIV).” This is also clearly depicted in a late 16th century Mughal miniature (Pl.XI). Thus we find Hindi equivalents for these intermediary processes. This is perhaps owing to their knowledge in India prior to the advent of the Muslims. We do not find any evidence of warping with the help of cops. An Italian Manuscript of 1421 shows the familiarity of Italian weavers with warping a loom from as many as twelve cops.

WEAVING

The process of weaving consists of interlacing at right angles the two series of threads, the warp and the weft; the instrument by which this was done was the loom. The Indian weavers normally used the horizontal

157. Miftahu’l Fuzala, s.v. ahar, f.12b.
158. Ibid. f.12b.
159. Ibid. s.v. mala, ff.271b, 272a. The Hindi equivalent is still in use in common parlance, with slight modification (Istilahat-i-Peshawaran), II, p.83, s.v. kunch, It is also called full or iharii.
160. T.Falk and M. Archer, Pl.3, Cat.4, p.47.
throw-shuttle-type loom for the simple or tabby weave.

At what period in time weavers achieved methods of weaving patterns into the material, it is difficult to say, that the cotton of the Indus civilization is too thickly woven to have been produced by anything except the loom.¹⁶² Textual reference to the loom occur in Panini (fourth century BC) who uses the word tantra for the loom and pravani for shuttle. He tells us in the Bhashya of stretching the warp and then putting threads across it with a shuttle (astirnam tantram, protam tantram).¹⁶³ However, this does not help in understanding the nature of the loom. The earliest loom was perhaps horizontal. Wilhelm Rau has tried to trace this in a description in the Atharva veda.¹⁶⁴ Simple horizontal looms were widely spread in ancient civilizations.¹⁶⁵ By the end of twelfth century, the simple vertical loom was used in South India, for in 1184 there is an

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¹⁶³. V.S. Agrawala, India as known to Panini, Allahabad, 1953, pp.231-32.


¹⁶⁵. Forbes, IV, pp.198-199.
inscriptional reference to "loom that are tied to the roof with a rope."\textsuperscript{166}

Thus, the Indian weavers were familiar with both the simple horizontal and vertical loom in ancient India. One important aspect of the loom, the treadles — wherewith the shed, controlling sets of warp threads, are lifted or depressed — are a later addition. We do not find any evidence of it in the early Indian literature.\textsuperscript{167} Ancient India was not in possession of this device. There is a passage in \textit{Divyavadana} (first century AD), which Moti Chandra has translated, "The weaver (kuvinda), while engaged in weaving cloth, picked and gathered the cloth and yarn (avicira-vicirakam) and with raised head (abivinirmay dudhasiraskha) and with the clapping movements of hands and feet (sphatitam pani pado) began the weaving operation".\textsuperscript{168} The ‘clapping movements of hands and feet’ could easily lead one to assume the use of looms fitted with treadles. However, Moti Chandra’s rendering of the passage is doubtful. The term \textit{sphatitam} means ‘torn’, ‘lacerated’, ‘cracked’.\textsuperscript{169} Therefore, there is not even oblique reference to treadles. The loom treadles were in use in China in the second

\begin{itemize}
  \item \textsuperscript{166} Cited by Vijaya Ramaswamy, "Notes on Textile Technology in Medieval India with special Reference to the South", \textit{I.E.S.H.R.}, XVII(2), p.230.
  \item \textsuperscript{167} Parashuram Sharma Vaidya, ed., \textit{Divyavadana} (1st c. A.D.), 1959, pp.21-25.
  \item \textsuperscript{168} Moti Chandra, p.29.
  \item \textsuperscript{169} Franklin Edgerton, \textit{Buddhist Hybrid Sanskrit Grammar and Dictionary}, New Haven, 1953, II, p.61, s.v. sphatita. He cites other references also from \textit{Divyavadana}, pp.83-122, 304-7, 463-8.
\end{itemize}
century AD.\textsuperscript{170} These were unknown in ancient Egypt and classical antiquity.\textsuperscript{171} Europe probably received the treadles along with the horizontal loom in the early twelfth century AD,\textsuperscript{172} as the period when treadles were used in Europe coincided with its knowledge of the horizontal loom.\textsuperscript{173} The period of the Islamic World’s acquaintance with treadles is not certain.\textsuperscript{174} In India the earliest evidence possibly comes from Maulana Daud’s reference to weaver’s skill. He writes, ‘Look at the profession (capability) of the weaver, [when] his hands lift up, [his] feet do not touch the ground’.\textsuperscript{175} It was possibly because his feet were on the treadles under them. Thus it is quite possible that it came into use in

\textsuperscript{170.} Lynn White Jr., pp.117, 173.

\textsuperscript{171.} Forbes, IV, pp.218-219.


\textsuperscript{173.} Lynn White, p.117.

\textsuperscript{174.} Ahmad J. al-Hassan and Donald R. Hill, p.187.

\textsuperscript{175.} Maulana Daud, Chandayan, ed., Mataprasad Gupta, Agra, 1967, p.169. I am grateful to Prof. S. Jafar Raza Zaidi, Department of Hindi, AMU, Aligarh for drawing my attention towards this source.
India during the thirteenth-fourteenth centuries. Later on, Shadiabadi (1468-69) defined it as *lauh-pay* (lit. foot-board) as “wooden strip which the weaver keeps under his feet while weaving cloth (s.v. *lauh pay*: Babay *parsi takhta kah julah zir-pay wa jama bafad)*. The treadles are also depicted in an illustration on this folio (Pl.XII). Thus, this change improved the ordinary horizontal loom. The treadles obviously made weaving easier. Now the weaver could sit on ground and put his feet on a pair of treadles with ease. Therefore from the sixteenth century onwards we find the weavers working on pitlooms. The pitloom is first depicted in a Mughal miniature in the manuscript of Ziauddin Nakhhabi’s *Tuti-Nama* (1580-85) (Pl.XIII). The treadles are also depicted in a late sixteenth century miniature, ‘Idris giving instructions to the mankind in the art of weaving’ (Pl.XI). They are further attested to by the seventeenth century depiction of the weaver saint Kabir in a Mughal miniature (Pl.XV). In view of the time it must have taken Indian weavers


177. Ibid., f.262a; see also Norah M. Titley, p.18.

178. Manuscript is in Chester Beatty Library, Dublin, MS 21, f.79r, for reproduction see, *The Indian Heritage Court Life and Arts under Mughal Rule*, Balding/Mansell, 1982, pp.23, 32.

179. T. Falk and M. Archer, pl.3. Cat. 4, p.47.

in general to accept this technique, it would seem that foot treadles were introduced into India well before the fifteenth century. It is possible that the treadles of the loom reached India from China through the Islamic world. Given the treadles, the Indian loom the was basically similar to the ordinary loom in use in Europe from thirteenth century onwards. A contemporary description of the loom is given by Wouter Schouten (1676) as in use on the Coromandel coast: “that at some places weel four or five thousand weavers reside, I had been to some of their small and dark houses, which are very modest cottages, (more like) pigsties than look little houses of the artists. Their loom was small, and of bamboos and reed, so light as an ingenuity can make; I saw the same mostly in low rooms, which are three or four feet below the earth. The trenchers were dug out there. The dark weavers of Coromandel, day and night take delivery of goods through the small holes. In this twilight was displayed what kind of artists they were. Yet not only the men but also the women in these countries know how to operate the weavingloom and earn (still in a better way than) their usual livelihood.” Until the advent of Kay’s fly-shuttle in the first half of the eighteenth century, this loom did not


183. Wouter Schouten, Oost Indische Voyagie, Amsterdam, 1676, pp.293-94.
witness any basic development, even in England.

It is possible that the arrival of the footpedal in India coincided with the spinning wheel, also datable to the thirteenth-fourteenth centuries. But in the absence of clear evidence, this remains matter for speculation. Whenever this improvement might have occurred, it added greatly to the three motions of loom-shedding, shuttle manipulation and beating up, which would in turn have increased productivity considerably and also improved the quality of cloth production.

Fancy or complex weaves naturally required much greater manipulation in order to obtain the insertion of threads of various colours in the weft. One way to achieve colour patterns with simple looms was by the ‘patola’ technique.

The pre-dyeing of yarn to produce woven patterns seems to go back to very early times: Moti Chandra introduces us to vicitra-patolaka (variegated patola) in the Lalitavistara, a work of the first century AD. Phyllis Ackerman has traced its use in some of the costumes in the Ajanta cave paintings which are “unmistakably in ikat stripes.” The term patola also occurs among species of valuable fabrics obtained

from Deogir in the fourteenth century.\textsuperscript{187}

It seems that ‘Patola’ was a special fabric of Gujarat town of Patan\textsuperscript{188} although owing to the antiquity of the term, the similarity in names is totally accidental. ‘Patola’ is essentially a simple weave: only the warp and the weft are pre-dyed in sections to produce designs, as against complex weaves with threads each entirely of one colour where the two sides must be different from the other. In order to achieve the desired patterns, both warp and weft threads were tied and dyed in different lengths according to a planned design in the fabric. It is thus possible to produce fabrics with monochrome or polychrome ornamentation.\textsuperscript{189}

Notwithstanding the advantage thus gained, the Indian horizontal loom remained simple owing possibly to the absence of certain useful mechanisms. In the first place, the Indian horizontal loom perhaps did not incorporate the use of the lever by releasing which the warp was

\begin{itemize}
  \item \textsuperscript{187} Ziauddin Barani, \textit{Tarikh-i- Firuzshahi}, ed. Saiyid Ahmad, Bib. Ind., Calcutta, 1862, p.223.
  \item \textsuperscript{188} \textit{E.F.I. 1618-21}, pp.101-2; \textit{E.F.I.}, 1646-50, p.161; The name of manufacturing town is spelt ‘pattinee’ which the editor identifies with Patan. Tavemier reports that ‘patoles’ were made of silk with flowers of different colours at Ahmadabad also, see Jean Baptiste Tavernier, \textit{Travels in India}, tr. V. Ball, London, 1889, 2nd edn. of this tr., rev. William Crooke, London, 1925, 1st Indian edn., New Delhi, 1977, II, p.3.
  \item \textsuperscript{189} A Buhler and E. Fischer, \textit{The Patola of Gujarat}, Basle, 1979, p.222.
\end{itemize}
periodically paid out and the woven cloth wound on the cloth beam.\textsuperscript{190} This deficiency was probably met by the less efficient indigenous practice of bringing the warp closer to the weaver with the help of a string tied to a peg of breast-beam on the left side of the weaver. It is portrayed in all the available depictions of Indian horizontal loom, ranging from the fifteenth to the nineteenth century (Pls.XII, XIII & XIV & XV).\textsuperscript{191} Secondly, we do not hear of the use of more than two treadles and a consequent multiplication of heddles. Such horizontal looms were operating as early as AD 1400 in Europe.\textsuperscript{192} It seems quite possible that the absence of more heddles as well as treadles would have considerably limited the range of woven patterns. Another significant feature missing in the Indian horizontal loom is the use of two pegs on which warp beam was placed. Instead, the warp beam is straightened on one peg. Also, in

\textsuperscript{190} R. Patterson in Singer, ed., \textit{History of Technology}, II, p.212 explains the use of lever in a loom from a thirteenth century manuscript.

\textsuperscript{191} Cf. \textit{Miftahu’l Fuzala}, f.262a (for fifteenth century); \textit{Indian Heritage}, Pl.23, (for the sixteenth century); Falk and Archer, Pl.3, Ct. 4 p.47 (for late sixteenth century); \textit{Album of India and Persian Miniatures}, Pl.66 (for seventeenth century); Col. J. Skinner, \textit{Tashrihu’l Aqwam} (AD 1825) (Rotograph), Br.Mus. Add. 27, 255, f. 51 & Painting of weaver with the loom on opp. p.244 (for early nineteenth century). The warps are tied to a warp beam and the warp beam was tied to pair of strings (or ropes) which were used to move the warp closer to the weaver. The string is not indicated but the chances of a lever mechanism is not possible on the loom depicted.

\textsuperscript{192} Lynn White, p.118.
none of the depictions do we find any evidence of the use of a pulley to operate the heddles. At Boppard (Rhineland) in Europe, by the thirteenth century even the pulley was being replaced by an overhead spring in conjunction with treadles.\textsuperscript{193} The more primitive techniques of the Indian horizontal loom naturally had an adverse effect on its efficiency. The Indian weavers employed the subtlest tricks for saving on cotton and providing some width to the cloth on this loom. This was done by manipulating the construction of reeds which helped in manipulating the warp threads. Georges Roques (1678-86) informs us that the weavers had four kinds of reeds. The first kind consisted of equal gaps. In the second the gaps were put in the middle, the third had gaps twice more than the second one, and the fourth took away one full \textit{vissa} (one hundred and sixty threads in the warp).\textsuperscript{194}

A pattern achieved through complex weave demanded a different weaving technique than either for the simple weave or its \textit{patola} variation. This was achieved best of all in the draw-loom. The draw loom multiplies the number of sheds which are controlled by cords pulled by a person assisting the weaver. Although figured silks, cottons and brocades of the highest quality were woven in India, it is not certain that ancient India ever had a draw-loom. Vijaya Ramaswamy’s suggestion that the draw-loom...

\textsuperscript{193} Ibid.

loom was known in South India in the 11th century is not based on a clear identification of the term *achchutari* with the draw-loom since *tari* means loom and *achchu* means mould or print only.\textsuperscript{195}

Thus, there is a view that India was familiar with the draw-loom or pattern loom as early as eleventh century.\textsuperscript{196} But the evidence for this seems inadequate. The use of the compound word *achchutari* induces Vijaya Ramaswamy to suggest that the drawloom was indicated. This could possibly refer to a loom where more harnesses are attached for a more detailed control of the warps.\textsuperscript{197} Besides, nothing is said of figured patterns. Had India of the eleventh century been familiar with the drawloom, before the arrival of the Muslims, the weavers’ guild would not have decided in 1538 that “this mode of weaving should be done only by the Muslims”,\textsuperscript{198} in lieu of which they were authorized “to collect


\textsuperscript{196} Ibid., p.232. Ramaswamy thinks that *achchutari* refers “to the process by which certain cords are attached to the wooden frame on top of the loom, and patterns are produced by pulling the cords in a correct sequence (by an assistant) while the weaver threw the shuttle through the resultant sheds. There is no evidence for this explanation (Ibid., p.232). P. Shanmugam, “Textile Production during Vijayanagar Rule” in K.A. Manikumar, ed., *Essays in Honour of Prof. S. Kadhirvel, History and Society*, Madras, 1996, pp.45-47, also finds it difficult to accept the term *achchutari* identified as drawloom.

\textsuperscript{197} Forbes, IV, p.218.

\textsuperscript{198} Cited by Ramaswamy, “Notes on the Textile Technology in Medieval India with special reference to South India” *I.E.S.H.R.*, 
the income from the gifted lands for their weaving”. This regulation did not only forbid its practice but also prescribed fines and punishment for any violation of it by the native weavers in the whole of South India. The Chinese were in earlier times most advanced in loom construction, especially in the evolution of drawloom. They already had the essentials of drawloom developed as early as the first century if not the fourth. India possibly received it from Iran, where the term for drawloom is dastgah-i naqshbandi, dastgah-i zaribafi. If the term naqshband exclusively means drawloom weaver, then the drawloom arrived in India in the thirteenth-fourteenth centuries probably from Iran. Another source of diffusion could also have been China because Isami (1350) speaks of the arrival of “Chinese naqshbands” (Chinese pattern weavers) at Iltutmish’s Delhi. Muhammad Tughlaq was reported to have employed

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XVII(2), p.233, for arguing in favour of the presence of drawloom in the eleventh century.

199. Ibid.
200. Ibid.
500 manufacturers of golden tissues, who wove gold brocades. This was perhaps a new and expensive loom, because the two references we have relate to two kings. The next reference to drawloom is implied in Abul Fazl's reference to a certain weaver named Ghiyas Naqshband. The reference to a weaver in the A'in-i Akbari reflects not only Akbar's interest in the craft but also the esteem in which it was held. Did it have only limited use in medieval times, because it was more expensive in comparison to ordinary looms? The use of the drawloom survived into modern times for we have a clear description of the drawloom in the last decade of the nineteenth century at Murshidabad. The Murshidabad loom had a draw harness which operated on the figure warp only. It consisted of a large number of vertical draw strings. Each draw string was connected to a horizontal gut string in a cross harness. With the lifting of one draw string, the cross harness gut string was lifted and with it mails attached to warp threads were raised, the resulting pattern could be repeated. Besides, the reference to the drawboy sitting on an elevated platform manipulating the draw strings makes the identification with the drawloom beyond dispute. Therefore, if the naqshband distinctly


means a weaver working with the drawloom, it could have been introduced in India as early as the thirteenth-fourteenth century possibly from Iran. Another reason behind our acceptance of Iran as the source of dissemination of drawloom technology is the structural similarity between the two devices whereas the alternate Chinese model was quite complicated, with fifty to sixty heddles and identical number of treadles as early as the third century AD.\textsuperscript{207} In the third century the multiplicity of heddles and treadles were reduced to the manageable number of twelve in a drawloom by an ingenious inventor Ma Chun (fl.269 AD).\textsuperscript{208} On the basis of available evidence, Iran seems to have been the only source of dispersal of drawloom to India. All these suggest that the drawloom and this particular technique was a recent arrival, which probably came with the Muslims.

What is surprising still is the limited use to which the drawloom was put. At Dacca and in Kashmir, where the complicated designs of the fabrics might make one expect its use, it is not found. At Dacca, J. Taylor found as late as 1800 that Indian weavers wove flowered cloth on the ordinary throw-shuttle horizontal loom.\textsuperscript{209} Two weavers put a number of threads desired for the flowers or parts of the design to be formed. They

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\textsuperscript{207} Needham, IV(2), p.39.

\textsuperscript{208} Ibid.

\textsuperscript{209} J. Taylor, “Process of Weaving Jamdannies or flowered cloth”, \textit{J.A.S.B.} VII(2), 1862, pp.339-40.
\end{flushleft}
drew each of these threads between as many threads of the warp as might be equal to the breadth of the part of the flower or design desired. The weavers would laboriously count and lift together the opposite numbers of warp threads through a bamboo stick, before throwing the shuttle. In this way, the Jamdani or flowered cloth was woven in the ordinary throw-shuttle-horizontal loom.

Shawls and Carpets

So far as the weaving of shawl is concerned, it seems that Kashmir had a monopoly of it prior to Akbar’s times, for Abul Fazl writes, that previously they were brought from Kashmir. Akbar is given credit for encouraging the manufacture of shawls in Kashmir. Not only that, by the last decade of the sixteenth century, Lahore had ‘more than a thousand workshops” presumably to weave shawls. Lahore had become famous for weaving of a particular kind of shawl called mayan which was a mix of silk and wool. They were used for chiras (turbans), fotas (loinbands), etc.

Essentially the same technique prevailed for weaving patterned shawls in Kashmir, of which Moorcroft and Trebeck (1822) have given

211. Ibid.
212. Ibid.
213. Ibid.
214. Ibid.
a careful description.\textsuperscript{215} They remarked that the loom of Kashmir did not differ in principle from that of Europe. In the first place, the warp was fixed in the loom. Now the \textit{Naqqash} or pattern drawer drew the pattern in black and white; the \textit{tarah guru} settled the colours and threads; and the \textit{talim guru} wrote his directions in shorthand and used to deliver a copy of the document to the weavers to follow in arranging the various coloured threads for the weft. The weft threads were then knotted to the warp. The face or right side of the cloth was placed next to the ground, the work was carried on at the back or reverse, on which the needles were hung in a row. Their number differed from four hundred to fifteen hundred, according to the nature of embroidery. In weaving, each weft thread knotted to the warp was separately led across the warp threads by a needle, according to the directions of \textit{tarah guru}. Here too, therefore, there was no drawloom and each weft thread was led through the warp threads by guiding the needle directly by the hand.

Carpet weaving was an important industrial craft in medieval India, apparently, much influenced in its technique by Persia. In Iran itself, carpet weaving was practised as early as 6\textsuperscript{th}–7\textsuperscript{th} century A.D.\textsuperscript{216} References to carpet-weaving in India before the Mughals are rather rare. Abul Fazl


\textsuperscript{216}. Hans. E. Wulff, p.213.
says that during Akbar's reign, Akbar took care to appoint experienced workmen to weave carpets of wonderful varieties and charming textures in imperial workshops.\textsuperscript{217} Chief centres were located in Agra,\textsuperscript{218} Fatehpur,\textsuperscript{219} Jaunpur,\textsuperscript{220} Zafarabad,\textsuperscript{221} Alvar,\textsuperscript{222} and Lahore.\textsuperscript{223} Ahmadabad in Gujarat was particularly famous for carpets of gold and silver and silk.\textsuperscript{224} Pile carpet weaving had spread to as far as Ellur in Deccan in the 16\textsuperscript{th} century.\textsuperscript{225} Muhammad Kazim refers to the pile carpet weaving in Assam in the 17\textsuperscript{th} century wherein he writes of \textit{pari}, as thick (\textit{gunda}) cloth, with much pile (\textit{purz}), woven from thread (\textit{risman}) used for covering the floor.\textsuperscript{226}

\textsuperscript{217} \textit{Ain-i Akbari}, I, p.50.

\textsuperscript{218} \textit{Ain-i Akbari}, I, p.50; \textit{E.F.I. 1618-21}, pp. 168, 188; Pelsaert, p.9.

\textsuperscript{219} \textit{Ain-i Akbari}, I, p.50; Pelsaert, p.9; Tavernier, II, p.2.

\textsuperscript{220} \textit{A'in-i Akbari}, II, 423; William Foster, ed., \textit{Early Travels in India, 1538-1618} (henceforth \textit{Early Travels}), 1st pub. 1921, 1st Indian edn., Delhi, 1985, p.177; Pelsaert, p.7.

\textsuperscript{221} \textit{Ain-i Akbari}, II, p.423.

\textsuperscript{222} Ibid, II, pp.442, 451.


\textsuperscript{224} Pelsaert, p.19; Thevenot, p.17.

\textsuperscript{225} \textit{Diaries of Streynsham Master}, II, p.171.

The author of the *Bahar-i-Ajam* (1740) describes ‘pari’ as the “name of valuable cloth (*qumash*) which is very nice and soft, and has plush (*khwabagi*) like velvet; it is multicoloured and they make pillows and floor coverings of it”.227 This somewhat recent import of technique and its rapid extension to so many places suggests an expansion in demand for this commodity. This logical assumption finds further support when in 1679 Streynsham Master observes at Ellur, Andhra Pradesh, the manufacture of carpets on vertical looms (pile carpet weaving) with coloured woollen wefts woven in accordance with patterns set on paper. His observation that this industry had been established a century earlier by Persian immigrants, further strengthens the contention that the technique referred to earlier (1558) was a recent importation and possibly referred to pile carpet weaving on the vertical loom. He writes, ‘The Loome is stretched right up and downe, made of cotton thread, and the Carpett wrought upon them with the woollen yarn of severall collours by young boys of 8 to 12 yeares old, a man with the paterne of the worke drawne upon paper, standing at the backside of the carpett, and directing the Boyyes that works it how much of each collour of yarne should be wrought in. An every thread being wrought, they share it with a pair of sizers, and then proceed to the next’.228 His observation that “every thread


228. Streynsham Master, *Diaries of Streynsham Master 1675-1680 and other Contemporary Papers relating thereto*, ed., R.C. Temple,
being wrought, they share it with a pair of sizers, and then proceed to the next”; it makes the identification certain. In pile carpet weaving, this technique of cutting the thread end of the tightened knot, with a “pair of sizers’ is apparently very close to the Persian method of weaving pile carpets. It seems that Persian weaving technique and tools were imported during the sixteenth century. As late as first half of 20th century, Persians were held responsible for introducing the vertical loom used for qalin manufacture in Bihar. Moorcroft and Trebeck describe carpet-weaving with vertical looms in a manner very similar to the one observed by Streynsham Master at Ellur. That too might be construed as belonging to the Persian zone of influence.

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London, 1911, II, p.171. Any identification of this pile carpet weaving vertical loom with drawloom proper will be grossly misleading as they employ different techniques which apparently look similar. Vijaya Ramaswamy has fallen into this temptation of oversimplified identification, P.I.H.C., pp.453-54) the details of the techniques of drawloom, are discussed by Hans E. Wulff, pp.205-217.

229. Ibid.

230. See Hans E. Wulff, pp.214-16 for a detailed description of this craft.

231. N.G. Mukarji, Carpet Weaving in Bengal, Calcutta, 1907, pt.1, description of the loom, pp.16-19, See also G. Watt, Indian Art at Delhi 1903, Pl.55, opposite p.430.

In another region, where the Persian technique could have come during the fifteenth-sixteenth century, was Kashmir. During Zainul Abidin’s reign (1459-70), a large number of artisans adept in original designs had arrived in Kashmir. The Kashmiris mastered the intricacies of shuttle (turi) and looms (vema) started weaving beautiful and costly silks. "The special woollen textiles of foreign origin were woven by the Kashmiris". The painters seeing the patterns (citra) and creeper designs (latakritih) obtained by intricate weaving process (vicitrayarayan) are reduced to silence as the figures in a painting. But the loom is not described. This could be a reference to the look described in the classic account of Moorcroft and Trebeck, 1822.

Prior to the application of any dye to the woven cloth, it was washed and bleached. Tavernier (1667) emphasises the use of lemon in bleaching


236. Ibid., VI, p.30.


cotton. Roques in his account refers to ‘half-bleaching’. Elsewhere he advises to wash the cloth to remove its mash which fills up the gaps. He says, that ‘by beating the cloth with a thick wooden mallet, they crush its (canji) grains which get congealed with the mash, and gives body to the piece of cloth.\footnote{\textsuperscript{241}}

\footnote{239. Tavernier, II, p.5.}


\footnote{241. Tavernier, II, p.3.}
2. SILKS AND SERICULTURE

Silk industry in India has been divided into two important categories: (a) the silk produced by the domesticated or mulberry-feeding, and (b) that by wild or non-mulberry-feeding worms, though some worms of the latter categories have been completely domesticated in India as well as in China.¹

The first category is called the Bombycidae and the second the Saturnidae. The chief Indian Bombycidae silks are subdivided into four sub-groups. viz., (I) Bombyx (II) Ocinara, (III) Theophila and (IV) Trilocha.²

The true mulberry-silk belonged to the Bombyx sub-group. Their habitats and their chances of utilization were explored by several persons over a number of years mainly in the 19th century. The earliest evidence of wild silk comes from Nevasa (1500-1050 BC).³ In recent past, some attempts have been made to identify India as the homeland of sericulture proper. We have tried to check those assertions in the light of hard facts available to us in literature. Hutton had asserted as early as 1864 that all the domesticated forms of the mulberry-feeding insects came to India

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2. For their distinguishing characteristics, see, D.E.P.I., VI (3), pp.2-6, 67-96.

3. Bridget and Raymond Allchin, The Birth of Indian Civilization, Suffolk, 1968, p.179; Bridget and Raymond Allchin, The Rise of Civilization in India and Pakistan, Delhi, 1983, p.276. They have revised their earlier suggested date of 1375-1050 B.C to 1500-1050 B.C.
from China. He was of the opinion that they had originated in the northern, colder tracts of India and were thus exotics in the tropical districts of Bengal. This change of climate led to degeneration and disease. Therefore instead of periodic renewal of stock, he had suggested transfer of its cultivation from Bengal to northern colder tracts of Punjab and North West Provinces. N.G. Mookerji, on the contrary, held that all the domesticated mulberry insects originated on unidentified slopes of the Himalayas.

D.C. Sarkar went a little further and suggested that the Indian Bombyx Mori may have developed from Bombyx (Theophilia) religiosae, an indigenous wild mulberry silkworm widely distributed in the Himalayas. His suggestion is based on the possibility of a range of mutations over successive generations. M.A. Buch thought that silk was probably introduced into India from China about the fourth century BC. Lallanji Gopal, on the basis of his survey of ancient texts had also


5. Ibid., p.24.


7. M.A. Buch, Economic Life in Ancient India, Baroda, 1924, pp. 120-122. See also, Sushil Malti Devi, Economic Condition of Ancient India (From A.D. 750 to A.D. 1200), Delhi, 1987, pp. 76-79.
suggested ‘great antiquity’ for silk industry in India. He holds that mulberry fed silkworms were introduced from China into India sometime during the fourth century B.C. Lotika Varadarajan argues that cultivated silk derived from the mulberry fed worm was localised to the eastern sector and obtained prominence in a period after the compilation of the Arthasastra, she identified the worm as Bombyx fortunatus i.e. the Bengal desi, multivoltine one associated with cold season yielding a golden yellow cocoon.

According to her Bengal had the Bombyx mulberry feeding worm sometime between seventh century and eleventh century A.D. It was transmitted to Assam along with the migration of a Bengal weaving community, called Katani jugis in the 12th century. She considers that the Bodos served as intermediaries in the trade between China and the north east and Bengal. She bases her argument on the assumption that


12. Ibid., p. 569.

13. Ibid., p. 566.

14. Ibid.
the Bodos, a Tibeto-Burman group, were traditionally associated with silk weaving. Elsewhere she considers them responsible for the dissemination of wild silk in north eastern and eastern India.\(^5\) She identifies the Bodos as the Kirata of Sanskrit literature.\(^6\) Her identification of Kirata with Bodos is little perplexing for it was a generic term used for degraded mountain tribe in general.\(^7\) Secondly we hardly find direct evidence of association of Bodos with sericulture in any inscriptive or any other literary evidence. For example as early as ninth century A.D. the Sagar Tal (Gwalior) inscription of Pratihara king Vatsaraja speaks about capture of hill forts of Kiratas amongst his extensive achievements without identifying them with any practice of sericulture.\(^8\) We could trace earliest reference to Kiratas in Manusmriti (c.200 BC -- AD 200) as one of the twelve mixed castes branching off from the principal Kshatriya

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15. Kirata were not exclusively Bodos. They could also be a Tipera or Tripura tribe (see K.S. Singh, ed., People of India, Tripura, XII, Calcutta, 1996, p.7. Besides, the Kiratas of ancient times were hardly familiar with silk and not confined to North East of India alone. They are represented as wearing skins. The presents they had sent to Yudhisthira represented the products of their country: these were skins, precious stones and gold, See Moti Chandra, Geographical and Economic Studies in the Mahabharata: Upayana Parva, Lucknow, 1945, pp.84-85.


18. Epigraphia Indica, XVIII, New Delhi, 1983, No.13, p.108 (text), 112 (tr.).
caste without their any association with any particular occupation. As early as 10th century AD we hear from Sravana-Belgola epitaph of Mahasinha I (980 AD) that the Gurjara king Satyavaaka – Kongunivarman “dispersed the bands of the Kiratas who dwell on the outskirts of the forests of the Vindhyan mountains (emphasis added) ....". The location of the Kiratas in the Vindhyan range assumes additional significance in the sense that it was never known to have been a mulberry silk producing area. Even as late as 13th century, we hear about Latas turning into Kiratas. Undoubtedly the agency of man in the causation and diffusion of certain forms of life is great, but it does not follow that he had necessarily carried to remote sections of the tribal area the genera or species of moths, from a long list of whose useless forms, one alone came to be recognised and selected for human purpose. Secondly according to traditions prevailing in 19th century, Manipur silk


culture and manufacture was introduced from China and thus not from Bengal as claimed by Varadarajan, even if we accept that the migration of *Katani jugis* had taken place in the 12th century A.D.²³ By the 19th century Manipur did possess the knowledge of mulberry silk culture though it was pursued on a limited scale.²⁴ However we cannot be certain about the exact date of introduction of sericulture in Manipur in the absence of adequate evidence. Lallanji Gopal was the first to take note of the *Yuktikalpataru* evidence but he did not try to identify it with mulberry silk proper.²⁵ Lotika Varadarajan elsewhere has relied heavily on the material from the *Yuktikalpataru*.²⁶ The main problem regarding chronology of sericulture arises owing to her acceptance of this text as of eleventh century A.D.²⁷ This is a controversial text and is considered to have been fabricated by someone under the name of Bhoja Parmara of

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²⁷ Ibid.
Dhara. It was actually a work of thirteenth century or even later. Secondly, her acceptance of four caste division of cocoon silk and their identification with various silks is also questionable. The four-caste division of silk lies in the fact that it was a well accepted practice of classification of various crafts. Her rendering of the verse too is not correct. It does not say that Brahmana variety is small in size. Therefore the supposition of an allusion to Bombyx fortunatus appears to be a little far fetched. The verse states that “Those silkworms born in the southern marshy forests were the finest and whitest and were produced by the Brahmana silkworms”. The author of this verse is perhaps referring to the region covered by Bengal and Orissa.

28. See for a critical assessment of this text, Sreeramula Rajeswara Sarma, “The Sources and authorship of the Yuktikalpataru”, Aligarh Journal of Oriental Studies, III(I), Spring 1986, Aligarh, pp.39-54. It has been argued that the Yuktikalpataru is not a work of Bhoja Pramara of 11th century but that of an unknown compiler who had drawn heavily on the texts belonging to periods of as late as the thirteenth century.

29. Ibid.

30. Apart from Varahamihira, all ratnasastaras classify the diamond into four: Vipra, Ksatriya, Vaisya and Sudra, see S.R.Sarma, pp. 45-46; see also Moti Chandra, p. 66.

31. The silk from Bombyx fortunatus could not be exceptionally white. It is of a golden yellow colour. The Yuktikalpataru is very specific about the whiteness of the Brahmana variety. For the specific characteristics of Bombyx fortunatus, see D.E.P.I., VI (3), p.2, 12. The cocoons were generally golden yellow in colour.

It is not possible to identify this variety of silk with any of the Bombyx groups because they all yield yellowish thread.\(^{33}\) This was perhaps a reference to some other silk than Bombyx. The *Yuktikalpataru* in its classification of silks as four castes, does not refer to kshtriya caste, that is to say, second category of silks. The remaining three could possibly be identified as Brahman referring to Tasar silk, Vaishya to Muga and Sudra to Eri.

R.N. Saletore has asserted that silk was not only known but also cultivated in India a long time prior to Kautilya.\(^{34}\) At the same time he is conscious of the fact that raw silk was imported into India in the first century A.D. from Thinae (Sing Fanu) in China.\(^{35}\) The author of the *Periplus of Erythraean Sea*, which Saletore cites, is very clear about the source of origin of silk. It tells us that "there is a very great inland city called Thinae, from which raw silk and silk yarn and silk cloth are brought through Bactria to Barygaza (Baroch); these are also exported to Damirica by way of the river Ganges."\(^{36}\) But this was a difficult route and very few men came from there.\(^{37}\) The author of the *Periplus* thus makes it amply


\(^{35}\) Ibid., p.383.


\(^{37}\) Ibid.
clear that silk was imported from China; and this was undoubtedly the cultivated mulberry variety of silk that reached India through Bactria. In India the raw silk was woven and then reexported through the ports of Barygaza and the regions of Ariana (Afghanistan). Ptolemy refers to the land route (through Ariana) in 150 A.D. In the famous lexicon Amarakosa, Amarsimha refers to Kausheyam Krimikoshotham. It seems that Gujarat had evolved as a major silk-weaving centre. In one of the inscriptions of Kumaragupta (473-4 A.D.) there is a reference to the immigration of a number of silk weavers from the Lata vishaya (southern Gujarat) to the city of Dasapura (Mandasor). Bana in early seventh

38. R.N. Saletore, p. 268.

39. Ibid.


century refers to the practice of using cloth made of Chinese silk at various places in the \textit{Harshacharita}.\textsuperscript{42} Hemachandra in his \textit{Abhidhanachintamani} (12th century) refers to the generic term \textit{Kausheyam} as the product cocoons of insects.\textsuperscript{43} All these reference show that mulberry-silk was known, but it was an article of import, not yet an indigenous product.

The \textit{Arthasastra} provides interesting information with regard to the silk-yielding regions of India: “The \textit{patorna}-silk comes from the Magadhas, the Pundras and Suvanakudya. The \textit{naga}-tree, the likucha, the \textit{bakula} and the banyan tree are the sources. That from the \textit{Naga} tree is yellow. That from the \textit{likucha} is wheat-coloured. That from the \textit{bakula} is white. The remaining one is of the colour of butter. Of these, that from Suvarnakudya is best. By that are explained the silk and silk cloth from land of China.”\textsuperscript{44} This is a crucial passage in terms of identification

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\textsuperscript{43} \textit{Abhidhanachintamani}, p.165, verse no. 333; see also, Harprasad Ray, \textit{Trade and Diplomacy in India China Relations, A Study of Bengal during the Fifteenth Century}, Delhi, 1993, p.92.

\textsuperscript{44} R.P. Kangle, tr., \textit{The Kautilya's Arthasastra}, II, Delhi, 1986, pp.104-105.
of silk. The *Arthasastra* leaves no ground for any speculation while it refers to silk and cloth from the land of China.\(^\text{45}\) Next the references to the staple foods for the worms first the naga-tree, which could be *Mesua ferorea*, Linn. It is an evergreen tree, wild in the mountains of Eastern Bengal, the eastern Himalaya, Assam, and was widely cultivated. It was very common in Dinajpur and Rangpur districts of North Bengal.\(^\text{46}\) The second source of worm feeding on Likuca, was perhaps the *Artocarpus lakoocha.*\(^\text{47}\) The third tree *bakula*, was perhaps the *Mimusops Eleng.*\(^\text{48}\) the fourth, the *vata* tree, is the banyan tree, *Ficus Bengalensis*.

The mulberry tree is thus not involved. The reference to two common sources of *Patrorna* silk from a Magadh and Pundra indicates the productions of similar kind of silk from both regions. Magadh a covered a large area\(^\text{49}\) embracing a region famous for the production of

\(^{45}\) Ibid., p. 105.


\(^{47}\) *D.E.P.I.*, I, p.333; see also Lotika Varadarajan, op.cit., p. 566. Closely allied to the species of *Bombyx* (=the true mulberry feeding silk worms) was the *Theophila bengalensis*, *Hutton*. It was a wild silk worm of lower Bengal. Similarly, *Theophila affinis* could also be reared on the mulberry of *Artocarpus Lacoocha*; it was also a wild silk worm. See *D.E.P.I.*, VI (3), pp. 2-3.

\(^{48}\) *D.E.P.I.*, V, pp. 570-571.

Tasar silk.\textsuperscript{50} Pundra (=Pundravardhana) refers to North Bengal.\textsuperscript{51} There is no unanimity over the identification of Suwarnakudya.\textsuperscript{52} Here it is most likely that the area described really produced Tasar, Muga and Eri silks. \textit{Patrona} need not be accepted as a reference to mulberry cultivated silk, because the \textit{Amarkosa} gives it a special meaning of washed silk cloth as \textit{Patrona dhauta Kausheyam}.\textsuperscript{53}

Xinru Liu is the latest addition to the debate about sericulture in India. She argues, on the basis of elves from contemporary literature and textile fragments from Central Asia\textsuperscript{54} that there is no evidence of origin of domesticated silk in India. Indians only acted as middlemen in the silk trade between China and the Mediterranean.\textsuperscript{55} In this capacity, they also kept some of the fabric for themselves.\textsuperscript{56} Besides, the Indians

\begin{itemize}
  \item \textsuperscript{50} Irfan Habib, \textit{An Atlas of the Mughal Empire}, 10B, \& 12B.
  \item \textsuperscript{52} Lotika Varadarajan, “Silk identifications within the Indian traditions”, p. 197.
  \item \textsuperscript{54} Xinru Liu, \textit{Ancient India and Ancient China, Trade and Religious Exchanges A.D. 1-600}, Delhi, 1988, pp.64-65.
  \item \textsuperscript{55} Ibid.
  \item \textsuperscript{56} Ibid.
\end{itemize}
were familiar with some other varieties of silks.\textsuperscript{57}

Sometime during the 4-5th centuries Chinese monopoly in silk was challenged by Byzantine and Sassanian silk, and around this time Chinese silk textiles compensated the loss by gaining more consumers in India.\textsuperscript{58} There were two routes between India and China: (a) the route from the western India coast to the Gandhara region and (b) the one connecting the Ganges valley to China through the Kashmir region which gained importance after the mid fifth century.\textsuperscript{59} Yuan-Chwang had found popular use of silk clothes in the Takka region (in modern Punjab) and Satadru.\textsuperscript{60} Xinru Liu explains that the Indian demand for Chinese silk was owing to quality style and methods of processing. At Khotan in the seventeenth century the artisans did not unreel silk fibre before the moths had gnawed through their cocoons. It produced short fibre and consequently a different style of silk textile.

Xinru Liu suggests that artisans of the Gupta period had possibly adopted a different techniques of weaving than their Chinese counterparts; and Chinese silk technology rather spread from south-west China to India through Assam in the early Christian era. However she does not give

\textsuperscript{57} Ibid., p.69.
\textsuperscript{58} Ibid., p. 67.
\textsuperscript{59} Ibid.
\textsuperscript{60} Ibid., p. 68.
any source for such a route of diffusion. Nevertheless she also very rightly admits that much Indian silk was made from different species of silk worms other than the mulberry-worm. She notes that Chinese artisans had designed certain patterns like pearl-rounded designs, the rounds of lotuses, striped or chess board designs to meet the demand from India.

The evidence of silks from fragments found by Sir Aurel Stein in Central Asia were exclusively of Chinese origin and hence had nothing common with Indian silk. They dated form 300 A.D. to 8th century A.D. The absence of any evidence of Indian silk can be explained by the fact that India was not familiar with mulberry silk during the period under discussion i.e. up to the 8th century A.D.

Another important region where sericulture came to be practised was Kashmir. The annual insect found in Kashmir was accepted as the true *Bombyx mori*. Thomas Watters, apparently committed a mistake in identifying Yuan Chwang’s reference to *kausheya* as of the *Bombyx mori* variety. It is surprising to note that in the account of one of the

61. Ibid., pp. 68-69.
62. Ibid., pp. 72-75.
63. Ibid., pp. 71-72.
greatest of all the Buddhist-scholar diplomates who visited India (between 629-645 AD), there is scarcely any reference to sericulture in Kashmir if we check the internal evidence of the text. Yuan Chwang refers to Pai-tich (calico) or woollen cloths as the clothing material of the people of the region, from Udyana to Kashmir. He refers to local products and writes, “The district was a good agricultural one and produced abundant fruits and flowers: it yielded also horses of the dragon stock, saffron, lenses, and medicinal plants.... The people wore serge and cotton (pai-tich)...”. He does not refer to pure silk being produced or worn. He refers to clothes of Indians and refers explicitly to the use of wild silk. He writes, “Their garments are made of kau-she-ye (kauseya) and of cotton. Kiau-she-ye (kausheya) and of cotton, kiau-she-ye is the product of the wild silk worth...”. His explanation of the term kiau-she-ye conclusively settles the problem. At other place, on the other hand, he noted that Khotan produced “silk of artistic texture”. It is possible that Kashmir did not begin to produce silk till the 15th century. It does not


67. Ibid., p.261.

68. Ibid.

69. Ibid., II, p. 295. He writes about Ku-Sa-Tan-va (Khotan), “The country produced rugs, fine felt, and silk of artistic texture....”
find a place in Alberuni’s description of Kashmir. There is no reference to silk production in Kalhana’s *Rajatarangini* though it refers to many of the important products of Kashmir. There is almost a unanimity of opinion among scholars that the domesticated rearing of silkworm had spread into Iran only just before Byzantium period, that is possibly by the 6th century A.D. It is to be remembered that the Chinese technical skill and artisans tended to travel far and wide. Chinese metallurgists and well-drillers were formed in 2nd century BC in Parthia and Ferghana and textile technologists, paper makers, goldsmiths and painters at Samarkand and Kufah in the 8th century A.D. Chinese artisans were demanded by the besieging Chin Tartars from Khaifeng in the 12th

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Century. Similarly in the 13th century the Chinese traveller Chhiu Chhang - Chhun reported about the presence of Chinese workmen in large numbers from Shantung to Samarqand. He also reported a large number of settlements of Chinese artisans and craftsmen between Samarqand and the valley of the Upper Yenisei in the north. Such settlements of Chinese in Central Asian territories and their proximity with Iran must have facilitated the diffusion of certain techniques, and the culture of mulberry silk was presumably one of them. Persia had witnessed the second impetus to development of sericulture in Persia under Mongol rule (thirteenth-fourteenth centuries). That silk was an item of commerce between India from Iran and western Afghanistan in the 13th century is attested by Minhaj Siraj Juzjani. This might also have encouraged the Kashmiri silk weavers to produce their own mulberry silk.

If we correlate the information provided by Yuan Chwang and Srivara (1459-1486) it seems that the silk could well have been imported

74. Ibid.
75. Ibid.
76. Ibid.
from Khotan or even China till the 15th century. Srivara refers to influx of various craftsmen into Kashmir during Zainul Abidin’s reign. He writes that with the help of these craftsmen “Kashmiris could skillfully operate the shuttle and the loom and thus weave precious and attractive silk cloth”. But silk-weaving is, of course, different from silk-raising and Srivara also does not refer to the introduction of sericulture in Kashmir. It seems similarly, we do not find any reference to silk production in the very interesting account of Kashmir in Yazdi’s Zafarnama, a work of early 15th century. But in India, despite its familiarity with a wide variety of the saturnidae group of silks, the earliest firm evidence for sericulture in Kashmir comes from Mirza Haider Dughlat’s Tarikh-i Rashidi. (1547 A.D.). Thus the first firm evidence


80. Ibid., p. 237.


82. Mirza Muhammad Haidar, Tarikh-i Rashidi, tr. E. Denison Ross, Patna, 1973, p. 425, observes, “Among the wonders of Kashmir are the quantities of mulberry trees, (cultivated) for their leaves, from which) is obtained [silk]”. See also, Walter R. Lawrence, The Valley of Kashmir, London, 1895, pp. 366-367. C.E. Bates, A Gazetteer of Kashmir, Delhi, 1980 edition, p. 61 refers to another tradition where it is said that the silk worm was introduced into Kashmir shortly before the reign of Emperor Akbar by Mirza Haidar of Kashgar who had imported eggs from Bokhara. It seems that this tradition arose out of the first literary reference to silk we find in Mirza Haidar Dughlat.
for sericulture in Kashmir is to be found in Mirza Haider Dughlat’s *Tarikh-i-Rashidi* (1547). It seems then that sericulture was introduced into Kashmir sometime during the 16th century. It could be reasonably ascribed to the spread of sericulture from Sinkiang (Xinjiang) via Gilgit and Baltistan (Little Tibet). This argument is further strengthened by the fact that the practice of importing eggs of the worms continued to be from the same route i.e. from Gilgit and Little Tibet till as late as the 16th century. In the Himalayan regions, Kumaun was another place where Abul Fazl reports about the practice of sericulture. It seems that the silk weavers of India especially of Kashmir were encouraged to pursue this profitable craft, and in turn to create a market for locally produced

83. Ibid.

84. Irfan Habib, “Note on Indian Textile Industry in the 17th Century”, pp.186-7; also his chapter, “Agrarian Economy”, in Tapan Raychaudhuri and Irfan Habib, eds., *The Cambridge Economic History of India (CEHI)*, I. The practice continued down to the 19th century, William Moorcroft and George Trebeck, II, p.155. They observed that silk was extensively raised in Khotan, and it extended from there to Kashmir through Yarkand and Balti.


silk. In the 17th century sericulture was noticed even in Sind.87

Thus soon after its introduction, mulberry silk began to diffuse widely in India. It reached the western coast by the late 17th century.88 So far as the southern coast is concerned, it seems that some efforts were made to introduce it at Nagapatnam in the second half of the 17th century. But due to the hostile policy of the Naik, it was not possible for the peasants to leave any piece of land uncultivated. They were forced to cultivate paddy instead of planting mulberry and rearing of silkworms on it.89

But the major silk-producing region was now Bengal. There seem to be no firm evidence for silk cultivation in Bengal before the specific


88. Irfan Habib, *Agrarian System of Mughal India 1556-1707*, p.57. In a recent study of Coromandel Coast it has been stressed on the basis of Chauju-kua (late 12th century) that mulberry trees were grown in the Chola kingdom and coloured silk threads were woven into cloth and exported from ports (of south India). see, S. Jeyaseela Stephen, p.73. What surprises us is the fact that Chau-ju-kua refers very briefly to "cotton stuffs with coloured silk threads, and cotton stuffs" which hardly mentions mulberry silk, see P. Hirth and W.H. Rockhill, *Chau-ju-kua: His work on the Chinese and Arab trade in the twelfth and thirteenth centuries, entitled chu-fauchi*, St. Petersburg, 1911, p.96.

reference to it by Ma Huan (1432 A.D.) in the 15th century. It seems that *Bombyx sinensis* variety of a small multivoltine mulberry silk worm was introduced into Bengal from China in the 14th-15th centuries and it initiated thereafter a rapid extension of the cultivation of mulberry trees. The manner in which mulberry (*morus*) trees were planted in Bengal was known to the Dutch as Bengal bush method.

The Dutch report tells us that the peasants used to take the old *tut* (mulberry trees) or small mulberry trees, cut them into small pieces of the length of a palm, land was ploughed up and tilled, and the small pieces were planted in October in the pot-holes across each other in a crosswise manner. Then they were covered with a little earth and straw. After the passage of a few days, the shoots became very green and these were plucked off daily for feeding the worms. Thus, the Bengal mulberry suited the multivoltine silkworm.

90. "Mulberry trees, wild mulberry trees, silk-worms, and cacoons—all these they have, [but] can only make fine silks, embroidered silk kerchiefs and coarse silk; they do not know how to make silk-floss" (Ma Huan, *Yeng-yai Sheng-lan, The Overall Survey of the Ocean Shores*, transl. G.V.G. Mills, Cambridge, 1970, p. 163. It may be pointed out here that in spite of the later importance of Bengal as a silk producing region, till as late as the middle of the 14th century Ibn Battuta does not refer to silk among products of Bengal (Cf. Ibn Battuta, *The Rehla*, tr. Mahdi Husain, Baroda, 1953, pp.234-241 (Account of Bengal).


92. Ibid.
Very few particulars of the methods employed for silk-worm rearing have come down to us. It is, therefore, fortunate that the Dutch report (19 March, 1683) tells us about as many as seven ‘bunds’. It says that the names of the ‘bunds’ (harvest) of silk was characterised by successive harvests in a year in addition to their qualities. First bund was called “ageny’ (aghan), falling in January and February, being wel the largest and best of the year, is good yellow, that does not fade.

“Tzeyt (Chait), in the month of March, very small, still nearly as good as ageny, the colour little less.”

“Bezacq (Vaisakha) in the month of April and May, large and of good quality, but not so good as the previous two bunds.”

“Azaar (asadha), in June and upto half July, falling usually in the rainy season, being bad and colourless.

“Sauwen (sravana), from half of July to the end of August, falling good, thus none is allowed during rainy season, is obtained in good quantity”.

“Aszin (Asvina), September and half of October, bad and is of no significance.”

“Katch (Karttika), from half of October to the end of December,

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very small, still better in colour than of Aghani.\textsuperscript{94}

It was estimated that 5000 bales of aghani was cultured in one year alone.\textsuperscript{95} However, subsequently, J. Ovington in 1689, gives us a long and detailed account of sericulture as practiced in Bengal.\textsuperscript{96} He does not specifically mention Bengal, but the terms used by him make it quite certain that he is referring to that province. He gives minute details of the November 'bund' indigenously called 'aggoued' 'bund'.\textsuperscript{97} This 'bund' reputedly produced the best silk of all. Presumably the eggs were locally produced. In the November 'bund', silk-worms remained in the eggs for twelve successive days. This period could be termed as one of hatching. Ovington does not refer to any artificial aid to hatching.\textsuperscript{98} After twelve days from the first of November, worms were hatched or came out of

\textsuperscript{94} Ibid.

\textsuperscript{95} Ibid.

\textsuperscript{96} J. Ovington, \textit{A Voyage to Surat in the year 1689}, 1696 edition, It contains an appendix setting out, ‘Observations Concerning The Nature of Silk-worms’. See the Appendix-A to this thesis.

\textsuperscript{97} This is after the Indian month \textit{agrahayana} which corresponds to November-December. Cf. A.L. Basham, p.492, wherein he gives the details of the Indian Calendar.

\textsuperscript{98} A.Yusufi Ali, \textit{A Monograph on Silk Fabrics}, Allahabad, 1900, p.19, says that artificial heat was also given sometime to assist in hatching. A woman was employed to warm the eggs by the heat of her person under the armpits or \textit{angia} (bodice). This primitive technique is said to have been followed universally in the East. It was known in Kashmir and is referred to in \textit{`Ajaib-ul Makhlufat}, according to Yusuf Ali.
their eggs and were laid upon the mats.

For the first four days after hatching the caterpillars kept eating mulberry leaves (cut into small thin pieces) four times a day, viz., morning, noon and at 3 and 9 o'clock. On the fifth day they were not fed at all.

On the sixth day the worms were bigger and were fed with big pieces of leaves, four times a day, i.e. morning, noon, 3 and 9' o'clock. They were thus fed for the next three days. On the 10th day feeding ceased.

They were given bigger or even full leaves from the 11th day and on 12th day, four times a day as formerly. They were not fed on the 13th and 14th days. From 15th to 18th, they were fed whole leaves, four times a day. On the 19th day, they were fed five times a day viz., morning, noon at 3 and 9 O'clock and at mid-night. They were fed in this fashion to the 26th day.

From about the 14th day, the worms used to get a green hue and on the 26th day they would be about 2½ inches long. On the 27th day, they became white and yellow. At this stage feeding was abandoned for the worms now began spinning.

On the 28th day, the worms were put upon ledges of mat fastened to a large piece of round matting. The ledges used to be about an inch high from the mat. The pattern of putting them on the mat was very curious. The silk-rearers began by putting the worms at the centre of the mat in a circular fashion. The distance could be a handful or three inches to the circumference. Once the worms were put upon those ledges, the
mat was put under the sun twice a day, once in the morning for one and a half hour and secondly in the late hours of afternoon from 4 o’clock till sunset. Then they put them in the house or in a shade, leaning against the wall. During this period, the worms started making cocoons.

On the 29th day, the worms with their cocoons were placed on flat mats, devoid of ledges or partitions. Mats were piled upon frames.

From the 30th to 33rd day, the worms went on spinning within their cocoons. On the 33rd day, the silk-rearers would shake each cocoon to distinguish the worms alive from those which were dead, did not make any noise, and were separated. The fluctuation in temperature brought variance in the ratio. The scorching heat and bitter cold used to take a heavy toll. Accordingly, the ratio of those alive could be only 1/8, ¼, 1/16.

The live worms continued spinning for the next four days (i.e. 34th, 35th, 36th and 37th).

On the 38th day, the worms who had turned into moths would eat through their cocoons. After this the rearers collected the cocoons and put the silk moths upon new mats. At this stage, the selection was made for seed. Males were distinguished by their slenderness in comparison to females. They were placed near each other for mating. This continued for a day. In case of a numerical superiority of either males over females or vice-versa, an equal number was first put near each other for reproduction; then they were joined with the rest and were left for the
whole night.

On the 38\textsuperscript{th} day, the males were thrown away. Two days later the females laid their eggs and they were also thrown away likewise. Thus the whole life span of a worm lasted for fifty two days i.e. twelve days in the eggs and forty days out of it.

Next to the November ‘\textit{bund}’ was the ‘\textit{maug}’ ‘\textit{bund}’ (\textit{magha ‘bund’}).\textsuperscript{99} It began in January. In this, the life span of worm was fifty four days, fourteen days in the egg, and forty days afterwards prior to their death. It was the poorest of the silk from the ‘\textit{bunds}’. The matings of worms used to end by the 14\textsuperscript{th} of February.

The next ‘\textit{bund}’ was made from the 14\textsuperscript{th} February to the 24\textsuperscript{th} of March and was called ‘\textit{cheita}’ ‘\textit{bund}’ (\textit{caitra ‘bund’}).\textsuperscript{100} Of the forty days of the worms lifespan, the first eight days were spent in the egg. Silk spun in this ‘\textit{bund}’ was considered next to November ‘\textit{bund}’ in quality.

The next was the ‘\textit{sauk}’ ‘\textit{bund}’ (\textit{vaisakha ‘bund’}).\textsuperscript{101} In this also, the period was again of 40 days (8 days in eggs). The silk was made by the first week of June.

The ‘\textit{sowaud}’ ‘\textit{bund}’ (\textit{sravana ‘bund’})\textsuperscript{102} was esteemed as the third best. It was completed by the end of July.

\textsuperscript{99} January-February

\textsuperscript{100} March-April.

\textsuperscript{101} April-May.

\textsuperscript{102} July-August.
No silk was made in August and September and very little was made in October.

The seasons of production and the nutritious nature of the mulberry on which the worms fed, were the determining factors of estimation and value of the produce.

Of the Saturniidae or partially wild silk producing insects, the tasar, eri and muga, were the most important. Tasar was commercially the most valuable of the Saturniidae. Its entomological names varied and equally numerous have been the vernacular names given to it in different parts of the country.¹⁰³

The antiquity of tasar silk is established by the statements ascribed by Strabo to Nearchus, Alexander’s admiral, who left an account of his experiences in India. Nearchus reports, “The serica also are of this kind. Byssus being dried out of certain barks”¹⁰⁴ This is probably out of confusion between the cocoon and the bark of tree to which it was attached. Such confusion as we shall see, persisted in later times as well.


¹⁰⁴ “Geography of Strabo” in The Classical Accounts of India, R.C. Majumdar, Calcutta, 1960, p.253. R.C. Majumdar says that by the word byssus, probably silk is meant (p.287). The Oxford English Dictionary defines byssus (s.v.) as “an exceedingly fine and valuable textile fibre and fabric known to the ancients apparently the word was used, or mis-used of various substances linen, cotton and silk, but it denoted properly (as shown by recent microscopic examination of mummy cloths which according to Herodotus were made of Bvooos), a kind of flax and hence is appropriately translated in the English Bible ‘fine linen’.
We do not find any direct reference to the word Tasar in Ancient India. Yuan Chwang (629-645 A.D.) specifically refers to kauseya as “silk from wild silk-worms”. He is obviously referring to Tasar silk. By the time of Abul Fazl, the word tasar had received a wider currency and he uses the word in the elaborate list of clothes in the imperial wardrobe.

Europeans who visited India in the 16th century referred to tasar as ‘Herba or Yerva’ owing to the way it seemed to grow out of trees. It was believed that silk was prepared from the bark of a tree, since the cocoons were very neatly constructed, fixed with a pedicel and suspended from the branches of the trees on which the worms fed in such a manner that it appeared as if the cocoons were the fruits of the tree. The notice of tasar occurs as early as 1567 when Caesar Frederick says, “Cloth of herbes” (panni d’erba which is a kinde of silk, which growth among the woodes without any labour of man. Ralph Fitch (1585) especially uses the word ‘Yerva’ wherein he says, “......a great store of cloth which is made of grasse, which they call yerva, it is like a silk”. Similar observation was made by Pyrard de Laval in 1610.

109. Quoted in Hobson-Jobson, s.v. grass-cloth. Pyrard de Laval says, “Likewise is there plenty of silk, as well that of the silk-worm as
Laval points out that this silk was of the brightest yellow colour. It agrees with the peculiar bright yellow colour of tasar silk. The identification of 'herba' with tasar occurs as early as 1619. Streynsham Master confirms the identification of tasar with 'herba'. This refutes the speculations about 'grass-cloth' by Yule and Burnell. G. Watt identifies, abandoning his earlier identification of 'herba' with 'rhea' fibre, later thought 'herba' was eri silk on the basis of Streynsham Master's reference to 'arundee' or 'eri' silk, but here he obviously using 'herba' in the sense of silks other than mulberry. Master says that this was the first time he saw such silk, whereas he was already familiar with tasar known as 'herba'. However, Rumphius was the first European

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of the (silk) herb, which is of the brightest yellow colour, and brighter than silk itself'. (Hak. Soc. I, p.328).

110. *E.F.I. 1618-1621*, p.112, “There is also a kind of Bengala stuff of silke (or) grasse called tessar.....’, Foster, ibid, suggests that a confusion was here between silk and the grass-cloth (herba) of Bengal.

111. *Diaries of Streynsham Master*, II, pp.81, 84.

112. *Hobson-Jobson*, s.v. *grass-cloth*.

113. *Diaries of Streynsham Master*, II, pp.299-300. Master says, “.....And observing the beggs in which the Merchants brought their silke to be a different sort of cloth from any he had seene, he was informed that it was called Arundee (arindi), made neither of cotton nor silke, but a kind of Herba spun by a worme that feeds upon the leaves of a stalke or tree caled Arundee.....”. See also *D.E.P.I*, VI (3),p.99.

114. Ibid.
to recognise the tasar worm feeding on the leaves of Sonneratia acida — a small tree which inhabited the swamps on the coast of Bengal. He describes the tasar worm and the reeling of its silk in considerable detail.\textsuperscript{115}

It seems that Indian reellers used the same technique of reeling for both the Bombyx and Saturniidae groups of silk.\textsuperscript{116} They had not become familiar with Chinese tools of reeling.\textsuperscript{117} Silk reeling means taking up the ends of several fibres and combining them into thread. Each of the fibres has twin filaments, known as brins, which is gummed together by sericin. Both together make the cocoon. It is spun in a figure-eight form by the caterpillar before its transformation into a chrysalis. Silk reeling starts just before the moth tries to break through the cocoon. This timing is very crucial for obtaining long silk threads. The length of the cocoon-filaments varied. But it is necessary to have a silkwinding instrument, a reel, and a water basin to float the cocoons. Despite the early evidence of silk in India, the beginnings of Indian silk reeling techniques are


\textsuperscript{117} Ibid., p.146 quotes Rumphius's (1619) observation that the natives of India had understood the method of reeling tasar silk sometime during the late 15th century. It appears to be a casual remark in the light of the fact that India was familiar with wild silks from ancient times as seen earlier in this paper. Harprasad Ray, p.92; Dieter Kuhn, 5(9), p.347.
obscure. Since there was no alternative to reeling if a continuous filament was needed, it is clear that there ought to be a reel. The earliest evidence of silk reeling in China comes from the Shang and Chou period, 8th century B.C.\textsuperscript{118} Subsequently Chinese silk-reeling had a continuous upward movement in terms of innovations and their applications.\textsuperscript{119} One may suppose that once the spinning wheel had arrived in India by the 14th century, wheel-reeling could also have been diffused in Bengal. The preparation of this silk yarn began with winding of silk from cocoons. Silk winding was done on wheel.\textsuperscript{120} The \textit{charkh} (spinning wheel) was also used for twisting silk, silk being twisted (on it) for making it fine (\textit{barik}).\textsuperscript{121} However, India never received the Chinese silk-reeling wheel with crank and treadle, illustrated in China from 11\textsuperscript{th} century onwards.\textsuperscript{122} Besides the wheel, the silk was also twisted on hand spindles.\textsuperscript{123} But the earliest evidence of native mode of reeling comes from a Dutch report of 1687.\textsuperscript{124} It says that the cocoons were first put in hot water. This facilitated

\textsuperscript{118} Dieter Kuhn, pp.354-404.

\textsuperscript{119} Ibid.

\textsuperscript{120} \textit{Bahar-i-Ajam}, s.v. \textit{charkh abrishamtab}

\textsuperscript{121} Ibid., s.v. \textit{charkh tab}.

\textsuperscript{122} Needham, IV (2), p.107, Pl. CLIV.

\textsuperscript{123} \textit{Bahar-i-Ajam}, s.v. \textit{duk}.

\textsuperscript{124} Van Dam, II(2), pp. 68-69.
the melting of the gummy staff. It thus became pliable and the sticks of the unreeled cocoons were picked up according to the demand for raw silk yarn, (i.e. according to thickness of the required thread). The number varied from 10, 12, 15, 20 to 25 according to the required quality of yarn and fineness of unreeled cocoons. Their ends were tied to one reel. The report says that there should be something between the reel and cocoons in the hot water to prevent them from any entanglement. Water was tempered in such a manner due to the distance and the air around, that the silk coagulated in such a manner that it run to one particular thread. It says that a certain amount of viscosity should be retained so that when they were collected on the reel, they did not bind or (break) upon each other.

Unlike tasar silk, the thread is only softened during the process of reeling. In this regard the Indian system was considered better than the Chinese and Persian methods.

This process facilitated the separate strands cohering in the reeled thread or “single”. Thus a fixed and definite number of fibres were wound together into the single (i.e. the fibres from a required number of cocoons being wound together and slightly twisted into a thread known as “single”). It was found that some silks used to adhere very firmly

125. Ibid.
126. Ibid.
127. Ibid.
with each other. The Report points out that this was owing to the excessive heating of the water and insufficient regulating of the air. According to this report the quality of the silk depended on the uniformity in the general conditions of the air. If the air with which it came into contact did not vary then the chances of yielding of similar threads were greater. Thus the similarity of nature of thread/yarn was heavily dependent upon general weather conditions. Secondly, it reports that the cocoons were first boiled in water and then gathered and put into fresh water. The silk obtained from fresh water would retain its lustre and natural sheen. They were stirred by hand which led to dimming of the sheen. This dimness was caused by the large number of threads ranging from 12, 15, 20 to 25 which passed through the water. This made the water thick and rendered the silk dimmer. If it was boiled further then the chances of loss of weight increased more than the gloss. Therefore prolonged boiling was to be avoided. Silk thus obtained was categorised according to their quality and length. Filaments drawn from the better-grade cocoons were known as pattani and the lesser quality was termed as poot or potti.\(^\text{128}\) The raw silk reeled from the pattani filaments were of two distinct varieties: tannabanna and tanny.\(^\text{129}\) Under these two broad categories three sub-

\(^{128}\) Ibid.

\(^{129}\) Om Prakash, The Dutch East India Company and the Economy of Bengal 1630-1720, p.55, found that the ‘tanny’ was a considerably superior variety that used a larger number of cocoons per unit of output. He claims that this variety was introduced only
categories. The *cabessa* (Portuguese usage for head) indicated the best quality; then came *bariga* and, finally *peeu* (Portuguese ‘foot’). Thus this classification was akin to head, belly and foot of contemporary English references. The last sub-category was also known as *gertkerckerie* or *poot /potti* (the raw silk originating from the cocoon). It was subdivided into two categories: the best was the *pattani* and lesser quality, the *poot* or *potti*. The last came from the worst cocoons and both ends of the coarse silk was tied with either rearheads or heads. The *tanny* had seven subgroups namely (1) *fayn* (name for certain quality Bengal silk); (2) *Kora* (fine quality silk); (3) *dom* (silk of fine quality, woven *pattani* silk); (4) *zeem* (certain quality Bengal silk; (5) *pangium* (or *pangia*, silk of the best quality, produced in Bengal), (6) *szesum* and (7) *ketsier* (one of the worst quality) and so forth. This report is also very helpful in determining the quality of silk on the basis of their cost of production. While 1 *ser* of *pattany* was equal to 1 *ser* of *tanny*, i.e. Rs. 3.4½ the tanny for *tannabana* was priced at the rate of Rs.2.6½ and 1 *ser* of *poot* or potty at Rs.2.4.

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in 1669 at the initiative of silk merchants from Agra, who were the major buyers of raw silk in Bengal. This claim is however not supported by the Dutch report.

130. Van Dam, II (2), p. 68.
Table I
Cost of Production of Seer of Tannabanna, Tanny Raw silk and Poot silk.

<table>
<thead>
<tr>
<th>Item of Cost</th>
<th>Tanna banna (in rupees)</th>
<th>Tanny (in rupees)</th>
<th>Poot (in ruppes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocoons at 6½ seers per rupee wages of the drawers of the pattani filaments.</td>
<td>1.88</td>
<td>2.37</td>
<td>1.62</td>
</tr>
<tr>
<td>Food provided to the pattani drawers.</td>
<td>00.30</td>
<td>00.50</td>
<td>00.60</td>
</tr>
<tr>
<td>Wood used as fuel</td>
<td>00.13</td>
<td>00.20</td>
<td>00.10</td>
</tr>
<tr>
<td>Wages of the reelers</td>
<td>00.30</td>
<td>00.60</td>
<td>00.40</td>
</tr>
<tr>
<td>Total cost</td>
<td>2.69</td>
<td>3.80</td>
<td>2.82</td>
</tr>
</tbody>
</table>

Source: Pieter van Dam, II (2), pp.69-70.

From the above analysis, we find that real wage bill works out at 32.36 per cent in the case of tanny silk, 25.27 per cent in the case of tanna banna silk, and 39% in the case of Poot silk.¹³¹

The above table also gives us an indication as to why a particular kind of silk was preferred. Poot silk procurement was discouraged admittedly on ground of its inferior quality.¹³² Along with inferior quality of the filament drawn from poot cocoon, the cost of production was also very high.¹³³ Therefore it is not very surprising the Dutch company’s preference was or pattani filaments alone.¹³⁴

¹³¹ Ibid.
¹³² Ibid., pp. 69-70.
¹³³ Our reading of the information provided by Pieter van Dam is quite different from that of Om Prakash, see Om Prakash, op.cit., p.55-56.
¹³⁴ Om Prakash, p.56.
Besides these three categories and their sub-categories, there was another kind of silk called mochta silk, which was florette yarn of the Company records.

By the seventeenth century silk had become one of the major export commodities of Bengal. Tavernier says that Qasimbazar in Bengal alone was annually providing 22,000 bales of 100 livres which would mean a production of 3.1 or 2.4 million livres. Tavernier further says that the Dutch procured around 6000-7000 bales annually i.e. 6-7 million livres. This estimate only of the produce possibly of the chief market, compares well with total Indian silk production of 3 million lbs in of 1917.

135. This is identified as matka silk because of the nature of origin of this silk. It was produced from the cocoons from which the moth had flown by piercing them. Machta is, therefore, from the word 'released themselves', muchkata. See J.C. Ray, “Textile industry in Ancient India”, p.219.

136. Om Prakash, p.56.

137. Tavernier, II, p.2.

138. Irfan Habib, Agrarian System of Mughal India, p.52.

139. Om Prakash, The Dutch East India Company and the Economy of Bengal, 1630-1720, p. 57 doubts the veracity of this statement of Tavernier.

140. Irfan Habib, Agrarian System of Mughal India, p.52.
3. WOOL

Wool held a very subordinate position among the fibre of medieval India. This was due partly, of course, to climate. Cotton-quilts often served as warm clothing in India's relatively mild winters. R. Fitch observed that in winter, instead of wool, "the men weare quilted gownes of cotton like to our mattraces and quilted caps...." Secondly, the relative dearness of woollen cloth and cheapness of cotton also restricted the spread of its use. J. Salbank wrote from Agra, "...indeed wollen cloth is so rare a matter to be seen\worn by the people of this country, by reason of the dearness of it and the cheapness of their own cotton clothes, that I do not remember I have seen as much as one woollen garment of our English cloth worn by an person in all this country." Moreover, the sheep of the Indian plains produced wool that was comparatively of inferior quality. The European travellers remarked that it was coarse and considered it suitable only for blankets.

Nevertheless, woollen clothes were manufactured in India, particularly in Kashmir and Shrinagar, Alwar and Merta in Rajasthan.

1. Ralph Fitch, Early Travels, p.32.
3. Terry, Early Travels, p.297; Letters Received, VI, p.200.
Punjab, Agra and Fatehpur Sikri in Uttar Pradesh, in Ellur in Coastal Andhra.

Wool was collected in Kashmir. Kashmir also received fine wool from both greater Tibet and Lesser Tibet. Wool was also collected in the northern mountains of Uttar Pradesh. Sheep were raised in Kabul. Sheep were also raised in Sind. Assam also produced wool of a kind known as 'bhut' or 'phut'.

Apart from wool proper, very high priced cloth was woven in Kashmir from goat's hair called 'tus'. These goats (tus) were domesticated


7. *Ain-i-Akbari*, I, p.50; Pelsaert, p.9; Thevenot, p.56.


and raised in Greater Tibet\textsuperscript{15} and Rudok.\textsuperscript{16}

Unfortunately, our medieval sources lack in furnishing the relevant details with regard to wool preparation. Perhaps, the Indians did not know the use of iron-shears for shearing sheep till as late as first half of 19\textsuperscript{th} century. As late as early 19\textsuperscript{th} century. Moorcroft and Trebeck tell us that knife and comb were used for this purpose.\textsuperscript{17} The iron shears were in use in Europe as early as 250 B.C.\textsuperscript{18}

In cleaning and separating the wool certain particular methods were observed. In Kashmir, husked rice was steeped in clean cold water, for four hours or longer to soften it. Afterwards it was powdered upon a stone slab. The picked wool and powdered husked rice were laid alternately in layers, and squeezed with the hand until they were completely intermixed. A little water was occasionally sprinkled over the heap in the hot and dry weather. Soap was not used because it made the wool harsh. In this manner, the powder was treated for an hour, and then it was removed. The wool was opened and nails were used to separate

\textsuperscript{15} Tuzuk-i-Jahangiri, p.301; Bernier, p.403; Cf. W. Moorcroft and G. Trebeck, Travels in the Himalayan Provinces of Hindustan and the Punjab, in Ladakh and Kashmir, in Peshawar, Kabul, Kunduz and Bokhara ... from 1819 to 1825, I, New Delhi, 1971.


\textsuperscript{17} Moorcroft and Trebeck, I, pp. 410-11.

\textsuperscript{18} Forbes, IV. p.8.
wool. The wool was made into nearly square, thin elastic pads, called ‘tumbu’.\textsuperscript{19}

Thus, the wool was ready for spinning. For spinning, it seems spinning-wheel was adopted.\textsuperscript{20} But, the finer yarn was spun on spindle.\textsuperscript{21}

Apart from woollen clothes woven on loom, felts were also made in India.

Felt is formed under pressure combined with moisture, and, preferably, heat. Crimp and scaliness are the two properties which facilitate felt formation. The fibres of wool interlace when it crimps in moist heat, the scales prevent the fibres from sliding back. An irregular fabric is produced by this interlacing process. Stronger fabric can be produced if the so-called fulling-agents (such as alkaline or fuller’s earth) are applied to intensify the natural properties of wool.

In Iran, felt-making is one of the traditional crafts and the technique has been described by Wulff.\textsuperscript{22} In preparing felts in Iran, first of all, large wool bats were placed on the ground, and were sprinkled with soap water. Then the fullers walked over them to obtain the first interlocking. The wool was worked on with bare feet. The mildly

\textsuperscript{19} Moorcroft and Trebeck, II, pp.168-9.

\textsuperscript{20} Bahar-i-Ajam, s.v. duk

\textsuperscript{21} Cf. Moorcroft and Trebeck, II, pp.170-1.

\textsuperscript{22} Hans. E. Wulff, pp.222-224.
compacted bat was rolled up in a canvas or reed-mat and was placed on an earthware mould heated from under-neath. This roll was again worked by several men before the felt was sufficiently dense.

Felt making in India may go back to the times before Christ. Writing in 1st century A.D., Strabo ascribed a statement to Nearchus, Alexander’s admiral (late 4th century B.C.). Nearchus reported, “that when they (the Indians) saw sponges in use among the Macedonians, they made imitations by sewing the tufts of wool through and through with hairs and light cords and threads, and that after compressing them into felts they drew out the inserts and dyed the sponge like felt with colours........”23 As late as Jahangir’s reign, we find reference to felts being made in the manner Nearchus had spoken of. Jahangir says that in Kashmir two shawls of wool were stitched together and pressed hard like suqarlat (felt).24 In the plains felt (suqarlat) was manufactured in Nagor.25 The felted wool was also called namad or namda.26 The Bahar-i Ajam defines a felt-maker (namad mal) as “the person who rubs and directs (mubasharat kunad) and this act is called felting (namad


26. Bahar-i-Ajam, s.v. namad.
malidan). It quotes a verse of Saifi: “If in the night of union (shab-i-wasl), the felt-maker (namad-mal) gives me moon like hand, I will rub face on face as the felt-maker rubs the felt with his feet”. The same dictionary notes that ‘weaving felt’ is wrong usage since there is no weaving involved in felt making. It also refers to the fuller’s earth (sang-i-qibti), but it does not connect it with the technique of felting.

27. Ibid., s.v. namad mal

28. Ibid.

29. Ibid., s.v. namad baftan.

30. Ibid., s.v. sang-i-qibti.
4. HEMP

San or Sunn-hemp was one of the bast-fibre yielding crops in the sixteenth and seventeenth centuries.¹ Irfan Habib has pointed out that the dasturs in the A’in assume its cultivation in almost every part of the zabti provinces (Lahore, Delhi, Agra, Ajmer, Awadh and Allahabad).²

In the suba of Multan it was grown in sarkars of Multan, Dipalpur and Sadkharah.³ It was presumably not cultivated in Malwa for it does not figure on the list of crops of the autumn harvest.⁴ So far Bengal is concerned, it was produced mainly for local market.⁵

In the peninsula Tavernier reports its cultivation at Vengurla on the western coast.⁶ He speaks about ‘toti’ which actually refers to hemp and not jute.⁷ Fryer reports its cultivation at Karwar and Mirjan.⁸

Havart reports about cultivation of hemp and manufacture of yarn

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¹ Cf. Irfan Habib, The Agrarian System of Mughal India, 1556-1707, p.46.


³ Ibid., p.385.

⁴ Ibid.

⁵ Irfan Habib, Agrarian System of Mughal India 1556-1707, p.46. Read especially his observations in the footnote number 62.

⁶ Tavernier, II, pp.148-149

⁷ Irfan Habib, An Atlas of the Mughal Empire, p.67, Sheet 16B.

from hemp and sailcloth made of hemp yarn in Coromandel. He tells us that it was generally sown in the month of February.

The plant used to come up in five or six days and was ready in three months for harvesting. Once the plants were cut, they were tied into small bundles and were put in the water for five or six days in order to rot. Then the stalks, now quite rotten, were taken out and laid to dry for eight or ten days. Thereafter they were peeled off with sticks. Once they were peeled off they were tied into bundles again and purchased by merchants. They were transported on oxen according to demand. The hemp was obtained mostly in the provinces of Eloer [Ellore] and 'Ragie mandry' (Rajah mundry). The hemp was brought to Palicol (Palakollu)


10. Ibid.


12. Ibid.

13. Ibid.

14. Ibid.

15. Ibid.

16. Ibid.

17. Ibid.
from a radius of five 'native' (jentieffsche) or twenty-five Dutch miles.\textsuperscript{18} Each ox used to carry 240 pounds of hemp.\textsuperscript{19} After being brought to Palicol, the fibre were first knocked soft with woods (houten) to be rendered pure so that they generally lost one pound out of three.\textsuperscript{20} Supplied to the Dutch Company their 'ropemaker' used to make fine sailcloth (zeyl-lijk) and cable yarn.\textsuperscript{21} They used to cost twenty-one guilders for four hundred eighty pounds.\textsuperscript{22} The cost of the yarn made of hemp differed between the places of cultivation and manufacture.\textsuperscript{23} Fine-sail cloth yarn cost eighty six guilders for 48 lbs.\textsuperscript{24} The ordinary cords spun from a rough kind of hemp used to cost twenty five guilders.\textsuperscript{25}

When the hemp was completely ready, it was spun into thread on a spindle, by both men and women.\textsuperscript{26} It was woven into cloth by men in the open air with the help of very rude loom.\textsuperscript{27}

\begin{footnotes}
\item[18]\textsuperscript{18} Ibid, pp.25-26.
\item[19]\textsuperscript{19} Ibid, p.26.
\item[20]\textsuperscript{20} Ibid.
\item[21]\textsuperscript{21} Ibid.
\item[22]\textsuperscript{22} Ibid.
\item[23]\textsuperscript{23} Ibid.
\item[24]\textsuperscript{24} Ibid.
\item[25]\textsuperscript{25} Ibid.
\item[26] Francis Buchanan, I, p.227.
\item[27] Ibid.
\end{footnotes}