THREAD OF TIME
~A HISTORY OF SILK

Part 8: SILK PRODUCTION

There are many varieties of silk moth: Cecropia in North America, Tussah, Muga and Eri in India, Anaphe in Africa but China's domination of silk production lies with one species. Over centuries Chinese sericultralists carefully selected those moths that were observed to produce the smoothest, finest silk thread until perfection was achieved. The breed they developed is known as Bombyx Mori or to give it it's official Latin name, Lepidoptera Bombycidae. It not only produces fine, smooth filaments but also produces them in vast quantities with each thread being between 600 and 900 metres long. It is the length of the threads coupled with the smoothness that gives Chinese silk or mulberry silk, whichever name you prefer, it's outstandingly unique qualities and makes it one of the most sought after fabrics in the world.

In order to better appreciate the supremacy of Bombyx mori, it helps if we know a little bit about the life-style silk moths. There are two strains of silkworm, the bivoltine and the multivoltine. Voltinism is simply the term used to refer to the number of broods a silk moth is capable of having in a year. So, a bivoltine moth can have two broods a year and a multivoltine moth can have more. The bivoltine moth tends to produce longer, smoother, higher quality silk than its multivoltine counterparts but they are more prone to disease and fussier about the conditions in which they are reared. Over time Chinese sericulturists selected the best bivoltine moths and created Bombyx mori. In addition to producing the longest, smoothest, highest quality silk filaments, the climate in the area of China where silk is produced is ideally suited to the moths delicate constitution. However, all this selective breeding came at a cost (for the moths that is). The breeding process has focussed so closely on producing the highest quality silk but it has left the moths disabled to the extent that they are both blind and flightless. As the moths only purpose is to mate so that the next generation of caterpillars can be guaranteed I can only assume that in order to mate both males and females need help but as to the nature of that help I know not.

A single female moth lays more than 500 eggs each the size of a pin head and then dies soon afterwards. Once hatched the worms from those eggs will go on to make cocoons that will produce around 90 grams of silk (about 3 ounces). That's enough silk to make about three ladies' scarves 90cm square or 180x45cm depending on weave and thickness of the threads. Put another way: 1 acre of mulberry yields about 4.5 tonnes of leaves. They will support about 200kg of cocoons giving about 40kg of raw silk. Put yet another way: you need a lot of cocoons to make a small amount of silk and the Chinese make a lot of silk - about 80% of the world's market. Each year billions of worms munch through thousands of tonnes of mulberry on racks stacked up in huge sheds on their way to giving us silk thread. But that is just one aspect of the process.

Eggs must be kept at a temperature of 65°F, increasing gradually to 77 degrees at which point the eggs hatch. Traditionally, women wrapped eggs around their bodies to incubate them but now they are kept in temperature and humidity controlled environments perfect for sericulture. Worms eat almost continually, night and day. A fixed temperature has to be maintained. Worms multiply their weight 10,000 times in one month. They have to be protected from loud noises, draughts and strong smells. When reach between 7cm & 10cm long start to make cocoon. The cocoon is made from a jelly like substance that hardens in air. Worms spend three to four days making cocoons and then 8-9 days in the cocoon. During cocoon stage, it used to be thought that the worm dissolved before being recreated as a moth. However, recent studies of hawkmoths have revealed that cells within the caterpillar change and are remodelled during the pupation process, which transform the plant munching worm into a delicate, elegant moth. Just before the moths are ready to break out of the cocoons they are baked or steamed to kill the pupas. If the moths were allowed to escape then the threads of the cocoons would be broken and the quality of the silk compromised. This was the secret of sericulture that the Chinese guarded so carefully for 2,000 years. Today, there are companies in India and USA that have discovered ways of allowing moths to escape the cocoons without damaging the quality of the silk using a technique is known as "ahimsa".

Next begins the skilled business of removing the silk filaments from the cocoons and turning them into usable thread that can be woven. Although silk has a greater tensile strength than steel each filament is so fine that it needs to be combined with others. Once the cocoons of the silkworms have been baked or steamed they are then dipped in hot water to loosen filaments. The filaments are unwound onto a spool and between five and ten filaments are twisted together to make a thread. (The process is different from spinning. Spinning is combining short lengths of combed fibres to produce a continuous length). The process of twisting the filament into usable silk thread is called throwing. The thread is then loosely coiled into what is known a “hank”, which can then be dyed. Once dyed the thread is ready to weave. Warp threads (that’s those that go up and down the length of cloth) tend to have more filaments and are known as "organzine". Weft threads (those that go across from side to side) are known as "tram". Weft threads are wound onto shuttles that then pass over and under warp threads to build up the cloth. The complex business of knowing which warp threads to lift to enable the shuttle to pass through is what took the apprentice journeyman seven years to learn. Raising the warp threads or creating the “shed” as it is known with a system of treadles, determines whether the warp or weft colour is seen, creates the pattern and texture of the finished cloth.

Since the invention of the loom about 5000 years ago, the design hardly changed until the coming of the Jacquard Loom in 1801. Even then the only real change was the addition of the punch card reader to control the treadles. This meant that the loom operator, or journeyman no longer needed to decide which treadles should be raised or lowered in order to get the desired weave. The punch cards automatically transmitted that information to the loom. The Jacquard Loom was also able to produce the delicately figured silks that have become synonymous with the name “Jacquard”. In a way, the punch card system was an early form of computerisation and its use meant that as the journeyman was no longer responsible creating the weave pattern, he was able to look after up to four looms at a time.

More recently though, significant changes have been introduced and modern weaving machines look very different. Non-stop weaving has been made possible by automatic pirnchanging, that is changing shuttles. Shuttleless weaving methods have also been developed. These use lances or other projectiles to shoot the weft yarns across the shed. Sometimes, jets of compressed air do the same job. It means that one worker can look after 20 weaving machines at one time. Modern weaving machines are capable of weaving cloth upto 3 metres wide. That means that three lengths of 90cm cloth can be woven at one time. It also explains how bed linen can be woven without the need for seam down the centre.