

SILK, a very soft, fine, bright thread, the production of different species of caterpillars. The phalæna, or bombyx mori, is most commonly propagated for that purpose in Europe; but the phalena atlas yields a greater quantity. See SILKWORM, ENTOMOLOGY, INDEX. A similar substance, indeed, is yielded by the greater number of the tribe of caterpillars. It is found enclosed in two small bags, from which it is protruded in fine threads, to serve the insect for a covering during its chrysalis state. The webs of spiders are obviously of the same nature with silk; though their fibres, at least in this country, are finer and weaker. Reaumur and other naturalists ascertained, that the larger species of spiders spun webs sufficiently strong to be manufactured, and that the produce was neither inferior in beauty nor in strength to the silk of the silkworm.

The ancients were but little acquainted with the use and manufacture of silk; they took it for the work of a sort of spider, or beetle, who spun it out of its entrails, and wound it with its feet about the little branches of trees. This insect they called *ser*, from *Seres*, a people in Scythia,

whom we now call the Chinese, who, as they thought bred it; whence the silk itself they called *sericum*. But this *ser* of theirs has very little affinity with our silk-worm, *bombyx*: the former living five years; but the latter dying annually, enveloped in a yellowish bag or ball, which, wound out into little threads, makes what we call silk. It was in the isle of Cos that the art of manufacturing it was first invented; and Pamphila, daughter of Platis, is honoured as the inventress.

After the conquest of the Persian empire by Alexander the Great, this valuable commodity was brought into Greece, and thence conveyed to Rome. Among the Romans, silk was deemed a dress too expensive and too delicate for men, and was appropriated wholly to women of eminent rank and opulence. Heliogabulus is said to have been the first man among the Romans who wore a garment of fine silk: Aurelian complained that a pound of silk was sold at Rome for twelve ounces of gold; and it is said he refused to give his wife permission to wear it on account of its exorbitant price. For several centuries the Persians supplied the Roman empire with the silks of China. Caravans traversed the whole latitude of Asia, in 243 days, from the Chinese ocean to the sea-coast of Syria, carrying this commodity. Sometimes it was conveyed to the ports of Guzerat and Malabar, and thence transported by sea to the Persian gulf. At length, two monks, coming from the Indies to Constantinople, in 555, under the encouragement of the emperor Justinian, brought with them great quantities of silk-worms, with instructions for the hatching of their eggs, rearing and feeding the worms, and drawing out the silk, and spinning and working it. Upon this, manufactures were set up at Athens, Thebes, and Corinth. The Venetians, soon after this time, commencing a commerce with the Greek empire, supplied all the western parts of Europe with silks for many centuries. About the year 1130, Roger II. king of Sicily, established a silk manufactory at Palermo, and another in Calabria; managed by workmen, who were a part of the plunder brought from Athens, Corinth, &c. of which that prince made a conquest in his expedition to the Holy Land. By degrees, the rest of Italy and Spain learned, from the Sicilians and Calabrians, the management of the silk-worms, and the working of silk; and at length the French acquired it by right of neighbourhood, a little before the reign of Francis I. and began to imitate them. In 1521, the French, being supplied with workmen from Milan, commenced a silk manufacture; but it was long after this time before they could obtain raw silk from the worms; and even in the year 1547, silk was scarce and dear in France. After the civil wars in that country, the plantations of mulberry-trees were greatly encouraged by Henry IV. and his successors; and the produce of silk is at this day very considerable. The great advantage which the new manufacture afforded made our King James I. very earnest for its being introduced into England: accordingly it was recommended several times from the throne, and in the most earnest terms, particularly in the year 1608, to plant mulberry trees, &c. for the propagation of silk-worms; but unhappily without effect; though from the various experiments we meet with in the Philosophical Transactions and other places, it appears that the silk-worm thrives and works as well in all respects in England, as in any other parts of Europe. However, towards the latter end of this king's reign, that is, about the year 1620, the broad silk manufacture was introduced into this country, and prosecuted with great vigour and advantage. In 1629, the silk manufacture was become so considerable in London, that the silk-throwsters of the city, and parts adjacent, were incorporated under the

name of master, wardens, &c. of the silk-throwsters; and in 1661, this company of silk-throwsters employed above forty thousand persons. The revocation of the edict of Nantes, in 1685, contributed in a great degree to promote the silk manufacture in this kingdom; as did also the invention of the silk-throwing machine at Derby, in 1719; which has been succeeded by many improvements.

The silk worm is an insect not more remarkable for the precious matter it furnishes for divers stuffs, than for the many forms it assumes, before and after its being enveloped in the rich cod or ball which it weaves for itself. From a small egg, about the size of a pin's head, which is its first state, it becomes a pretty big worm, or caterpillar, of a whitish colour, inclining to yellow. In this state it feeds on mulberry leaves, till, being come to maturity, it winds itself up in a silken bag, or case, about the size and shape of a pigeon's egg; and becomes metamorphosed into an aurelia; in this state it remains without any signs of life, or motion; till at length it awakes to become a butterfly, after making itself a passage out of its silken sepulchre, and, at last, dying indeed, it prepares itself, by an egg which it casts, for a new life; which the warmth of the summer weather assists in resumming. As soon as the silk-worm, or caterpillar, is arrived at the size and strength necessary for beginning his cod, he makes his web; for it is thus they call that slight tissue, which is the beginning and ground of this admirable work. This is his first day's employment. On the second, he forms his folliculus, or ball, and covers himself almost over with silk. The third day he is quite hid; and the following days he employs himself in thickening and strengthening his ball; always working from one single end, which he never breaks by his own fault; and which is so fine, and so long, that those who have examined it attentively, think they speak within compass, when they affirm that each ball contains silk enough to reach the length of six English miles.

When the silkworms have completed their balls or cocoons, they are collected, and put into little baskets; and thus exposed to the heat of an oven, to kill the insect, which, without this precaution, would not fail to open itself to go away and use those new wings abroad, it has acquired within. Ordinarily, they only wind the more perfect balls; those that are double, or too weak, or too coarse, are laid aside, not as altogether useless, but that, being improper for winding, they are reserved to be drawn out into skeins. The balls are of different colours; the most common are yellow, orange-colour, isabella, and flesh-colour; there are some also of a sea-green, others of a sulphur-colour, and others white; but there is no necessity for separating the colours and shades to wind them apart, as all the colours are to be lost in the future scouring and preparing of the silk. The goodness of silk is best distinguished by its lightness. The organzine silk is the best of any made in the country of Piedmont, and two threads are equal in fineness, that is, in smoothness, thickness, and length, for the thread of the first twist. For the second, it matters not whether the single thread is strong before the two are joined, unless to see whether the first twist proves well. It is necessary that the silk be clean; and it is to be observed, that the straw-coloured is generally the lightest, and the white the heaviest of all. The skeins should be even, and all of an equality, which shews that they were wrought together; otherwise we may with justice suspect that it is refuse silk, and cannot be equally drawn out and spun, for one thread will be shorter than the other, which is labour and loss. It will also be requisite to search the bale more than once, and take from out of the parcels a skein to make an essay; for unless it is known by trial, there is the greatest danger

of being cheated in this commodity. To wind silk from off the balls, two machines are necessary; the one a furnace, with its copper; the other a reel, or frame, to draw the silk. The winder then, seated near the furnace, throws into the copper of water over the furnace (first heated and boiled to a certain degree, which custom alone can teach) a handful or two of balls, which have been first well purged of all their loose furry substance. She then stirs the whole very briskly about with birchen rods, bound and cut like brushes; and when the heat and agitation have detached the ends of the silks of the cocoons, which are apt to catch on the rods, she draws them forth, and joining ten or twelve, or even fourteen of them together, she forms them into threads, according to the size required to the works they are destined for: eight ends sufficing for ribands; and velvets, &c. requiring no less than fourteen. The ends, thus joined into two or three threads, are first passed into the holes of three iron rods, in the fore-part of the reel, then upon the bobbins or pulleys, and at last are drawn out to the reel itself, and there fastened, each to an end of an arm or branch of the reel. Thus disposed, the winder, giving motion to the reel, by turning the handle, guides the threads; substitutes new ones, when any of them break, or any of the balls are wound out; strengthens them, where necessary, by adding others; and takes away the balls wound out, or that, having been pierced, are full of water.

In this manner, two persons will spin and reel three pounds of silk in a day, which is done with greater dispatch than is made by the spinning-wheel or distaff. Indeed, all silks cannot be spun and reeled after this manner; either because the balls have been perforated by the silkworms themselves, or because they are double, or too weak to bear the water: or because they are coarse, &c. Of all these together, they make a particular kind of silk, called floretta; which being carded, or even spun on the distaff, or the wheel, in the condition it comes from the ball, makes a tolerable silk. As to the balls, after opening them with scissars, and taking out the insects (which are of some use for the feeding of poultry,) they are steeped three or four days in troughs, the water of which is changed every day to prevent their stinking. When they are well softened by this scouring, and cleared of that gummy matter the worm had lined the inside with, and which renders it impenetrable to the water, and even to air itself, they boil them half an hour in a lye of ashes, very clear and well strained: and after washing them out in the river, and drying them in the sun, they card and spin them on the wheel, &c. and thus make another kind of floretta, somewhat inferior to the former. As to the spinning and reeling of raw silks off the balls, such as they are brought from Italy and the Levant, the first is chiefly performed on the spinning-wheel; and the latter, either on hand-reels, or on reels mounted on machines, which serve to reel several skeins at the same time. As to the milling, they use a mill composed of several pieces, which may mill two or three hundred bobbins at once, and make them into as many skeins.

Silk, as spun by the animal, is in the state of fine threads, varying in colour from white to reddish yellow. It is very elastic, and has considerable strength, if we consider its small diameter. It is covered with a varnish, to which its elasticity is owing. This varnish is soluble in boiling water; but alcohol does not act upon it. Hence it has been compared to a gum, though it approaches much nearer to a gelatine; since Berthollet has shewn that it is precipitated by tan and by muriate of tin. It differs, however, from gelatine in several particulars. Alum throws it down of a dirty white, sulphate of copper of a dark brown, and sulphate of iron of a brown colour. When the water is evaporated,

the varnish is obtained of a black colour, brittle, and of a shining fracture. Its weight is nearly one-third of the raw silk from which it was extracted. It may be separated from silk by soap as well as water, and the soap leys containing it soon putrefy. Besides the varnish, silk contains another substance to which it owes its yellow colour. This substance possesses the properties of resin. It is yellow, soluble in alcohol, and in a mixture of alcohol and muriatic acid. Beaumé has ascertained, that by this last mixture it may be separated completely, and the silk deprived of it assumes a fine white colour.