

ROMAN TEXTILE MANUFACTURES.

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Weaving is an art of the highest antiquity. In the Vedas, VI, ix, 2, the Rishi declares that he knows "neither the warp nor the woof of religious rites." In the Iliad, the Bible, the Zendavesta, in the earliest writings of every nation of antiquity, it is distinctly described. Whether man learnt it from the weaver-bird, or it grew out of plaiting, we know not. Its origin is plainly Oriental; and a loom of apparently the most elementary form is still used in India; and what is yet more strange, it is capable of producing the most delicate tissues known to the art. There the village weaver stretches his warp between two bamboo rollers, one of which is suspended from a tree, while the other is fastened to the earth by wooden pins driven into the turf. The earth also forms his seat, and two holes dug into it accommodate his legs. The shuttle which carries the woof is shaped like a netting-needle, and being somewhat longer than the breadth of the fabric, it is employed also as a batten, to shove the threads of the woof close up to each other.

From the Orient, the names of staples, tissues, and fabrics enable us to trace the art of weaving into Asia Minor, Egypt, and Europe. In the Augustan age the woolen industry had been established in the Levant for upward of a thousand years; the weaving of silk, both from unraveled Indian tissues, from Oriental yarns, and from the threads of native silk-worms, had been practised in the island of Cos for over 500 years. The weaving of cotton cloths belongs practically to the Alexandrian age; while the manufacture of linens in Rome was comparatively new, it having but recently been imported from Egypt. The Roman manufacture of other textiles, such as hemp, esparto, and asbestos, though interesting, was comparatively unimportant.

We are indebted to Ovid, Met. vi, 53, for an account of the woolen manufacture; dressing the wool; picking or teasing, combing, and carding it; spinning the yarn with distaff and spindle; winding, or forming the thread into clues, and dyeing. The earlier looms, like their Indian prototypes, were perpendicular, hence the warp was called *stamen* and the woof *subtemen*, and the shuttle, *radius*. The looms, the fulling-mills (for cleaning, scouring, and solidifying the cloth) and the dyeing-works, were run by water power; and although the principal works were in the city of Rome, numerous others were established in all parts of the empire, especially in Spain, Gaul, and Britain. Among the woolen fabrics were *phrygians*, a coarse shaggy cloth, made in the Asiatic provinces, and out of which the Roman tailor fashioned the brown lacerna, or great-coat, a garment with a hood, like the French military tunic of the present day. A shorter overcoat or cape, also with a hood, was called *penula*. It was made of a hairy cloth called *gousapa*. Another fabric called *frigus*, was like the Scotch and Irish frieze of modern times. A fabric similar to our broadcloth was called *rasa*, or smooth. *Virgata* was a striped cloth; *scutulata*, a spotted or figured tissue; *galbina*, a green or grass-colored fabric, worn by women; *palla* meant black or gray mourning-goods, etc. Among the other products of the Roman woolen looms were damasks; embroideries made on the loom, sometimes with gold and silver threads and figures; tapestries, shawls, bunting, rugs, and carpets. The bunting was used for signal flags and for the colors carried by contestants in the chariot races. These last were organized in four companies, the Greens, Reds, Blues, and Whites; and they were championed with such *esprit de corps* and zeal that even the women became partisans, and wore silk ribbons of their favorite colors.

Before that great influx of the precious metals which followed the conquests of Scipio, Titus, Mummius, Lucullus, Sylla, Pompey and Cæsar, the linen industry, like many other industries of Rome, consisted of importing the fabric from other countries, in this instance from Egypt. The culture and treatment of flax and its manufacture into a variety of fabrics had grown to considerable perfection in that country; and until Rome became a great center of capital, but feeble efforts were made to transplant this great branch of trade. With the reign of Augustus came that unity of the empire and universal peace which afforded security and assurance to its overflowing treasuries; and among the industries adopted or greatly extended was the culture of flax and manufacture of linen, either in Italy or in the Roman provinces, of which, of course, Egypt was now one. Among the various fabrics mentioned in the works which are left to us are damask tablecloths, table-napkins, and handkerchiefs, *sudaria*. A fine linen cloth from Sidon was called *sindon*; although Martial says that the same or similar stuff came also from Egypt. A twilled linen fabric, or diaper, had long been worn in Asia Minor, Egypt, and Greece. This industry was now taken up by the Romans and introduced into Italy and several of the western provinces. Linen sails for ships were also made in various parts of the empire.

The Roman costume consisted chiefly of the woolen toga and tunic; the shirt, *camisia*; and leg-cloth, *tibialia*. The overcoat, mittens and cap, *pileus*, were only for cold weather. Of these various articles, the shirt

and leg-cloth were of linen, sometimes, also, the tunic. The purple border to the toga was a survival of the purple thread of the Hindu. The latter was made from the staple of the purple cotton plant; the former was dyed with the famed murex of Tyre.

Flax was cultivated successfully in many parts of Asia Minor, including Palestine, and in most of the Greek states. Pausanias wrote that "the fine flax which is produced in Elea, is a very proper subject of admiration; for it is not to be found (in such perfection) in any other part of Greece. . . . But the fine flax (produced) within Elea, is not inferior in tenuity to that of the Hebrews; while it is less yellow." After being retted in running water for about a month, it was taken out, dried, and made ready for extracting its fibers. For this purpose a bunch of it was taken in the hand, laid upon a table, and beaten with a wooden instrument. It was afterward drawn forcibly over the angle of the table, in order to free it from fragments of the stem. Then it was heckled or passed through iron combs, beginning with coarse and ending with finer ones. In this condition the fibers were free and ready for spinning into threads or yarn. The various machines and devices for retting, heckling, spinning, and weaving this staple, though derived from the older industry of hemp-manufacturing, were much improved by the Romans, who paid great attention to the details of the linen trade and exported their products to numerous places in Asia Minor and Europe.

The cotton plant and cotton fabrics are mentioned as of Indian origin by Herodotus, 450 B. C. The culture was brought westward by the followers of Alexander and Seleucus, and established in Egypt under the Ptolemies. After the battle of Actium, Egypt became a Roman province, and both the cotton fields and cotton mills of that country fell into the hands of Roman capitalists. The earlier Roman name for cotton was probably *byssus*, because its fabrics resembled linen ones, just as in England it is still called "cotton-wool," because the staple looks like bleached wool. The later Roman name was *gossypion*. *Xylon* rather meant the cotton-tree; though it was sometimes used to mean the staple. It is well known, of course, that cotton-fabrics have been found in Egyptian graves older than the Ptolemaic period; but this does not prove that they were made in Egypt, any more than a silk fabric found in an American grave of the present day would prove it to be American, the probability, amounting almost to certainty, being that it was manufactured in Europe or Asia. Cotton fabrics, however, do not appear to have become popular in Italy. The finer cotton tissues still came from India, and were very expensive; while the coarser ones were hardly so well suited to the Roman climate as linens. Before the Egyptian cotton manufacture became sufficiently improved in quality and cheapened in price to command the Italian market, it fell into the hands of the Arabians, and Rome lost the control of what was destined to become the greatest of the textile industries.

Silk, though it had been imported from the Orient for many centuries, and cultivated to a small extent in some of the Greek islands, was nevertheless so scarce during the Augustan period as to command its weight in gold. The common name for it was *serica*, or *vestis serica*, sometimes *bombycina*, from *bombyx*, the silk-worm. The Roman ladies wore a broad ribbon around the waist called *strophium*, which served for the modern bodice, or stays. This ribbon or sash was made of silk. Soft clinging stuffs of silk for the *stola* were next worn; and finally the *palla* came to be made of the same expensive material. Its use was forbidden to men. Elagabalus is said to have been the first male Roman who wore a robe of pure silk; and Aurelian to have refused the empress, his wife, a garment of this fabric, on account of its exorbitant price. Yet in Pliny's time, which was much earlier, the importation of Indian silks, to be unraveled by Roman girls in order to work up the threads with woolen yarns and so make from them new and less expensive fabrics, appears to have become an important industry; from which it would seem that stories about the parsimony of distinguished people are not always to be relied upon for historical accuracy.

Hemp is an East Indian plant which was brought into Europe probably during the first Buddhist period. Herodotus mentions a species so closely resembling flax that the Thracian women made fabrics from it which could hardly be distinguished from linen. The best hemp known to the Romans was grown at Alabanda, on the banks of the Meander, and the next best at Mylasa, near the Gulf of Jasus, both of these places being in Asia Minor. In Italy it was chiefly cultivated in the territory of the Sabines, a very ancient people. Hemp was at first employed for the ropes and rigging of ships. Moschion, about 200 B. C., records the use of hempen ropes for rigging the ship "Syracusia," built for Hiero II. some fifty years previously. Twine, hunting nets, and finally coarse fabrics, for household use, were successively made of it. The various machines and devices for retting, heckling, combing, spinning, and weaving this staple were applied to flax when that textile came to be manufactured in Rome.

Human hair was also employed as the basis of sev-

eral Roman industries, chiefly by wig-makers and jewelers. A Roman matron's wig, of a beautiful brown color, full, rich, glossy, and ending in a heavily plaited chignon, is preserved among the curiosities of the York Museum. Although 1,800 years old, it can scarcely be distinguished from a modern peruke of the most fashionable design.

The grass fibers employed by the Roman weavers, such as esparto, corn-husks, and straw, the latter for ladies' hats, were as numerous as they are at the present day. Many of them were also used for stuffing mattresses and upholstering furniture—for example, corn-husks, wool-flocks, and grasses of various sorts.

Asbestos, like many other substances which formed the bases of Roman industries, was originally obtained from India, but afterward from Arcadia. The Greeks gave it the name of *asbestinon*, which means inextinguishable; while the Romans called it *vivum*, or live (linen). They made table-napkins of it, which could be cleansed during the meal, by throwing them for a minute or so into the fire. Shrouds for the dead were also made of this substance, though it was so excessively dear that only the wealthiest people could afford to purchase it. In the year 1702 there was dug up near the Nævian Gate at Rome a funeral urn, in which human remains of the classical period were found wrapped in asbestos cloth, many yards in length. This interesting example of Roman textile art is still preserved in the Museum of the Vatican.

SCIENCE NOTES.

That common simile in which the various divisions of science are represented as branches of the tree of knowledge, is a grotesque survival of a time when neither trees nor science were understood. No simile is perfect or even approximately correct, but one better than the tree and its branches for the origin and relationships of any inductive science is that of a river, rising from various and often obscure sources, growing in size and importance as it proceeds both from the springs within its own bed and by the entrance and contributions of tributary streams, and finally pouring its substance into the mighty ocean of accumulated human knowledge.

Some of the arts are nearer to the welfare of man than others, and the same is true of the sciences. Two arts, however, lie very near human welfare, and if we were called upon to give up all of the arts but two there would be little difference in choice as to which two should be preserved. The one most important would be the art of agriculture and the next the art of healing. Man first of all must be nourished, and next to this, kept in health. We might look forward to a time when lawyers would disappear. We might even grow so perfect as to be able to do without ministers of the gospel. Even the histrionic art might be abandoned, and yet mankind be reasonably happy. But strike down agriculture and you strike a blow which is fatal; banish the healing art and you leave man to the ravages of disease.

Enormous as is the annual loss which may now be fairly charged to insects, it would undoubtedly be vastly greater if such pests were left absolutely unchecked and no efforts were made to limit their operations. Were it not for the methods of controlling insect pests, resulting from the studies of the Bureau of Entomology and of the official entomologists of the various States, and the practice of these measures by progressive farmers and fruit-growers, the losses from insects would be greatly increased. Familiar illustrations of savings from insect losses will occur to anyone familiar with the work in economic or applied entomology in this country. The cotton worm, before it was studied and the method of controlling it by the use of arsenicals was made common knowledge, levied in bad years a tax of \$30,000,000 on the cotton crop. The prevention of loss from the Hessian fly, due to the knowledge of proper seasons for planting wheat, and other direct and cultural methods, results in the saving of wheat to the farm value of from \$100,000,000 to \$200,000,000 annually. Careful statistics show that the damage from the codling moth to the apple is limited two-thirds by the adoption of the arsenical sprays, banding, and other methods of control, representing a saving of from \$15,000,000 to \$20,000,000 in the value of this fruit product alone. The existence and progress of the citrus industry of California were made possible by the introduction from Australia of a natural enemy of the white scale, an insect pest which was rapidly destroying the orange and lemon orchards, this introduction representing a saving to the people of that State of many million dollars every year. The rotation of corn with oats or other crops saves the corn crop from the attacks of the root worm to the extent of perhaps \$100,000,000 annually in the chief corn-producing regions of the Mississippi Valley. The cultural system of controlling the boll weevil is already saving the farmers of Texas many millions of dollars, and, in fact, making the continuance of cotton growing possible; and scores of similar illustrations could be cited.