and its comparative cheapness gives it an important place among the products of textile industry. It is used very largely in mixed fabrics, as well as for the cheaper ribbons, velvets, hat plush, and for many other silk woven fabrics, as also in the hosiery and glove trades and for sewing, knitting, and embroidering yarns.

*Silk Weighting.—*Into the dyeing of silk it is not here necessary to enter, except in so far as concerns a nefarious practice, carried on in dye-houses, which has exercised a most detrimental influence on the silk trade. Silk, we have seen, loses about one-fourth of its weight in scouring. To obviate that loss it has long been the prac­tice to dye some dark silks “in the gum,” the dye combining in these cases with the gum or gelatinous coating, and such silks are known as “souples.” Both in the gum and in the boiled-off state silk has the peculiar property of imbibing certain metallic salts largely and combining very firmly with them, the fibre remaining to external appearance undiminished in strength and lustre, but much added to in size and weight. Silk in the gum, it is found, absorbs these salts more freely than boiled-off ; so to use it for weighting there are these great inducements—a saving of the costly and tedious boiling-off, a saving of the 25 per cent. weight which would have disappeared in boiling, and a surface on which much greater sophistication can be practised than on scoured silk. In dyeing a silk black a certain amount of weight must be added ; and the common practice in former times was to make up on the silk what was lost in the scouring. Up to 1857 the utmost the dyer could add was “weight for weight,” but an accidental discovery that year put dyers into the way of using tin salts in weighting with the result that they can now add 40 oz. per lb to scoured silks, 120 oz. to souples, and as much as 150 oz. to spun silks, and yet call these compounds “silk.” Not only so, but the use of tin salts, especially stannic chloride, SnCl4, enables dyers to weight all colours the same as black. In his “ Report on English Silk Industry ” to the Royal Commission on Technical Instruction (1885) Mr Thomas Wardle of Leek says:—

“Colours and white of all possible shades can very easily he imparted to this compound of silk and tin, and this method is becoming extensively used in Lyons. Thus weighting, which was until recently thought to apply only to black silks, and from which coloured silks were comparatively free, is now cheapening and deteriorating the latter in pretty much the same ratio as the former. Thus the proto- and per-salts of iron, as well as the proto- and per-salts of tin, including also a large variety of tannin, sumac, divi-divi, chestnut, valonia, the acacias *(Areca Catechu* and *Acacia Catechu* from India), from which are obtained cutch and gambier, &c., are no longer used solely as mordants or tinctorial matters, but mainly to serve the object of converting the silk into a greatly-expanded fibre, consisting of a conglomeration of more or less of these substances.”

Sugar also is employed to weight silk. On this adulterant Mr Wardle remarks:—

“With a solution of sugar, silk can have its weight augmented from 1 oz. to 3 oz. per lb. I am not quite sure that this method of weighting was not first used by the throwsters, as sugar is known to have been used for adulterating and loading gum silk for a very long time, and then the idea was afterwards applied to silk after the dyeing operations. It is much resorted to for weighting coloured silks by dyers on the Continent, and, though a very clumsy method, no substitute has been found so cheap and easy of application. Bichloride of tin, having chemical affinity for silk fibre, bids fair to extinguish the use of sugar, which, from its hygrometric qualities, has a tendency to ruin the silk to which it is applied, if great care be not taken to regulate the quantity. There is not the slightest use or excuse for the application of sugar, except to cheapen the silk by about 15 to 20 per cent.”

*Wild Silk Dyeing.—*Among the disadvantages under which the silks of the wild moths long laboured one of the most serious was the natural colour of the silks, and the extreme difficulty with which they took on dyes, specially the light and brilliant colours. For success in coping with this difficulty, as well as in dealing with the whole question of the cultivation and employment of wild silks, the unwearying patience and great skill of Mr Thomas Wardle of Leek deserve special mention here. The natural colour of tussur silk is a greyish fawn, and that shade it was found impossible to discharge by any of the ordinary bleaching agents, so as to obtain a basis for light and delicate dyes. Moreover, the chemical character of the tussur silk differs from that of the mulberry silk, and the fibre has much less affinity for tinctorial

substances, which it takes up unevenly, requiring a large amount of dye-stuffs. After protracted experimenting Mr Wardle was able in 1873 to show a series of tussurs well-dyed in all the darker shades of colour, but the lighter and bright blues, pinks, scarlets, &c., he could not produce. Subsequently the late M. Tessie du Motay found that the fawn colour of natural tussur could be dis­charged by solution of permanganate of potash, but the oxidizing action was so rapid and violent that it destroyed the fibre itself. Gentler means of oxidation have since been found for bleaching tussur to a fairly pale ground, but the dyeing of light colours cannot yet be said to be a commercial success. The silk of the eria or castor-oil worm *(Attacus ricini)* presents the same difficulties in dyeing as the common tussur. A portion of the eria cocoons are white, while the others are of a lively brown colour, and for the dyeing of light colours the latter require to undergo a bleach­ing process. The silk takes up colour with difficulty from a strong vat, and is consequently costly to dye. Moonga silk from *Antheræa assama* has generally a rather dark brown colour, but that appears to be much influenced by the leaves on which the worm feeds, the cocoons obtained on the champaca tree *(Michclia champaca)* giving a fine white fibre much valued in Assam. The dark colours are very difficult to bleach, but the silk itself takes dye-colours much more freely and evenly than either tussur or eria silk.

*Trade and Commerce.*

About the commencement of this century the chief silk- producing regions of the world were the Levant (including Broussa, Syria, and Persia), India, Italy, and France, the two first named sending the low-priced silk, the other two the fine qualities. Between 1840 and 1850, after the open­ing of trade with China, large quantities of silk were sent from the northern port of Shanghai, and afterwards also from the southern port of Canton. The export became important just at the time when disease in Europe had lessened the production on the Continent. This increased production of medium silk, and the growing demand for fine sorts, induced many of the cocoon-growers in the Le­vant to sell their cocoons to Europeans, who reeled them in Italian fashion under the name of “Patent Brutia,” thus producing a very fine valuable silk. In 1857 commenced the importation of Japan silk, which became so fierce a competitor with Bengal silk as gradually to displace it in favour; and recently the native silk reeled in Bengal has almost ceased to be made, only the best European filatures, produced under the supervision of skilled Europeans, now- coming forward.

China and Japan, both of which contribute so largely to the supplies that appear in European and American statistics, only export their excess growth, silk weaving being carried on and native silk worn to an enormous extent in both countries. The other Asiatic exporting countries also maintain native silk manufactures which absorb no inconsiderable proportion of their raw material. The silk production of the world, including only the amount exported from these Oriental countries, amounts on an average to from 20,000,000 lb to 25,000,000 lb yearly; but the crop is subject to great variations.

The supply available for European consumption during recent years was thus stated, in bales of 100 lb, by the *Moniteur des Soies* of Lyons, 25th July 1885:—

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1854-55. | 1875-76. | 1876-77. | 1877-78. | 1878-79. | 1879-80. | 1880-81. | 1881-82. | 1882-83. | 1883-84. | 1884-85. | 1885-86 (estimates). | |
| Italy | 92,400 | 57,000 | 25,000 | 40,500 | 62,500 | 32,000 | 68,500 | 70,000 | 52,000 | 73,000 | 65,000 | Maximum.  45,000 | Minimum.  40,000 |
| France | 44,000  3,300 | 16,000 | 2,000 | 19,000 | 13,500 | 8,500 | 9,500 | 9,500 | 17,500 | 14,500 | 10,000 | 10,000 | 8,000 |
| Spain | 2,500  16,000 | 1,500 | 750 | 1,100 | 800 | 1,500 | 1,500 | 2,300 | 1,750 | 1,500 | 500 | 500 |
| Greece and Asia Minor | 6,600 | 10,000 | 6,000 | 6,000 | 5,000 | 5,000 | 5,000 | 6,000 | 12,000 | 12,000 | 10,000 | 8,000 |
| Total bales | 146,300 | 91,500 | 38,500 | 66,250 | 83,100 | 46,300 | 84,500 | 86,000 | 77,800 | 101,250 | 88,500 | 65,500 | 56,500 |
| China.. | 55,000 | 68,000 | 65,000 | 46,000 | 53,000 | 55,000 | 67,000 | 44,000 | 47,000 | 50,000 | 50,000 | 45,000 | 42,000 |
| Canton | 19,800 | 14,000 | 10,000 | 12,500 | 9,000 | 12,500 | 5,000 | 14,500 | 11,500 | 16,000 | 7,000 | 12,000 | 12,000 |
| Bengal | 11,000 | 8,492 | 6,000 | 5,000 | 6,000 | 5,000 | 4,000 | 3,000 | 3,000 | 3,000 | 3,000 | 2,000 | 2,000 |
| Japan |  | 14,000 | 13,000 | 22,000 | 22,000 | 14,000 | 15,000 | 15,500 | 25,000 | 25,000 | 20,000 | 15,000 | 12,000 |
| Total bales | 85,800 | 104,492 | 94,000 | 85,500 | 90,000 | 86,500 | 91,000 | 77,000 | 86,500 | 94,000 | 80,000 | 74,000 | 68,000 |
| Grand total of bales | 232,100 | 195,992 | 132,500 | 151,750 | 173,100 | 132,800 | 175,500 | 163,000 | 164,300 | 195,250 | 168,500 | 139,500 | 124,500 |
| Price of Tsatlee No. 4 | 15s. | 15s. | 28s. | l7s. 6d. | 15s. | 15s. 3d. | 13s. 9d. | 17s. | 14s. 6d. | 16s. | 13s. | 12s. 6d. | 12s. 6d. |