hard, firm and compact shells with some straggling flossy filaments on the exterior, and the interior layers are so closely and densely agglutinated as to constitute a parchment-like mass which resists all attempts at unwinding. The whole cocoon with its enclosed pupa weighs from 15 grains for the smaller races to about 50 grains for the breeds which spin large cocoons. From two to three weeks after the completion of the cocoon the enclosed insect is ready to escape; it moistens one end of its self-made prison, thereby enabling itself to push aside the fibres and make an opening by which the perfect moth comes forth. The sexes almost immediately couple; the female in from four to six days lays her eggs, numbering 500 and upwards; and, with that the life cycle of the moth being complete, both sexes soon die.

*Sericulture.*

The art of sericulture concerns itself with the rearing of silk­worms under artificial or domesticated conditions, their feeding, the formation of cocoons, the securing of these before they are injured and pierced by the moths, and the maturing of a sufficient number of moths to supply eggs for the cultivation of the follow­ing year. The first essential is a stock of mulberry trees adequate to feed the worms in their larval stage. The leaves preferred in Europe are those of the white-fruited mulberry, *Morus alba,* but there are numerous other species which appear to be equally suitable. The soil in which the mulberry grows, and the age and condition of the trees, are important factors in the success of silkworm cultivation; and it has been too often proved that the mulberry will grow in situations where, from the nature of the leaf the trees put forth and from other circumstances, silkworms cannot be profitably reared. An elevated position with dry, friable, well-drained soil produces the best quality of leaves. Throughout the East the species of mulberry cultivated are numerous, but, as these trees have been grown for special purposes at least for three thousand years, they show the com­plex variations peculiar to most cultivated plants.

The eggs of the silkworm, called *graine,* are hatched out by artificial heat at the period when the mulberry leaves are ready for the feeding of the larvae. These eggs are very minute — about one hundred weighing a grain; and a vast number of hatched worms may at first be kept in a small space; but the rapid growth and voracious appetite of the caterpillars demand quickly increasing and ample space. Pieces of paper punctured with small holes are placed over the trays in which the hatching goes on; and the worms, immediately they burst their shell, creep through these openings to the light, and thereby scrape off any fragments of shell which, adhering to the skin, would kill them by constriction. The rearing-house in which the worms are fed (Fr. *magnanerie')* must be a spacious, well-lighted and well- ventilated apartment, in which scrupulous cleanliness and sweetness of air are essential, and in which the temperature may to a certain extent be under control. The worms are more hardy than is commonly supposed, and endure variations of temperature from 62° to 78° F. without any injury; but higher temperature is very detrimental. The lower the temperature at which the worms are maintained the slower is their growth and develop­ment; but their health and vigour are increased, and the cocoon they spin is proportionately bigger. The worms increase in size with astonishing rapidity, and no less remarkable is their growing voracity. Certain races moult or cast their skin three times during their larval existence, but for the most part the silkworm moults four times—about the sixth, tenth, fifteenth and twenty-third days after hatching. As these moulting periods approach, the worms lose their appetite and cease eating, and at each period of change they are left undisturbed and free from noise.

Laurent de l'Arbousset showed in 1905 that 1 oz. of seed of 30 grammes producing 30,000 to 35,000 silkworms (30,000 may be depended upon to reach the cocoon stage) will give a harvest of 130 to 140 lb fresh cocoons and an ultimate yield of about 12 lb raw silk properly reeled. The amount of nourishment required for this rearing is as follows:—hatching to first moult, about 9 lb of leaves of tender growth, equal to 40 to 45 lb ripe leaves; first to second moult, 24 lb, representing 100 lb ripe leaves; second to third moult, 80 lb, representing 240 lb ripe leaves; third to fourth moult, 236 lb, representing 472 lb ripe leaves; fourth moult to mounting, 1430 lb, representing 1540 lb ripe leaves, totalling to about one ton of ripe leaves for a complete rearing. The growth of the worms during their larval stage is thus stated by Count Dandolo:—

|  |  |  |
| --- | --- | --- |
|  | Weight per 100. | Size in Lines. |
| Worms newly hatched | 1 gr. | **I** |
| After 1st moult .... | 15 ,, | 4 |
| „ 2nd „ .... | 94 ,, | 6 |
| „ 3rd „ .... | 400 ,, | 12 |
| ,, 4th ,, | 1628 ,, | 20 |
| Greatest weight and size . | 9500 „ | 40 |

When the caterpillars are mature and ready to undergo their transformation into the pupa condition, they cease eating for some time and then begin to ascend the brushwood branches or echelletes provided for them, in which they set about the spinning of their cocoons. Crowding of positions must now be guarded against, to prevent the spinning of double cocoons *(doupions)* by two worms spinning together and so interlacing their threads that they can only be reeled for a coarser and inferior thread. The insects complete their cocoons in from three to four days, and in two or three days thereafter the cocoons are collected, and the pupa killed to prevent its further progress and the bursting of the shell by the fully developed moth. Such cocoons as are selected for the production of graine, on the other hand, are collected, freed from the external floss, and preserved at a temperature of from 66o to 72° F., and after a lapse of from eleven to fifteen days the moths begin to make their appearance. The coupling which immediately takes place demands careful atten­tion; the males are afterwards thrown away, and the impreg­nated females placed in a darkened apartment till they deposit their eggs.

*Diseases.—*That the silkworm is subject to many serious diseases is only to be expected of a creature which for upwards of 4000 years has been propagated under purely artificial conditions, and these most frequently of a very insanitary nature, and where, not the healthy life of the insect, but the amount of silk it could be made to yield, was the object of the cultivator. Among the most fatal and disastrous of these diseases with which the cultivator had long to grapple was “ muscardine,” a malady due to the development of a fungus, *Botrytis bassiana,* in the body of the caterpillar. The disease is peculiarly contagious and infectious, owing to the develop­ment of the fungus through the skin, whence spores are freed, which, coming in contact with healthy caterpillars, fasten on them and germinate inwards, giving off corpuscles within the body of the insect. Muscardine, however, has not been epidemic for many years. But about the year 1853 anxious attention began to be given in France to the ravages of a disease among silkworms, which from its alarming progress threatened to issue in national disaster. This disease, which at a later period became known as "pebrine ” —a name given to it by de Quatrefages, one of its many investi­gators—had first been noticed in France at Cavaillon in the valley of the Durance near Avignon. Pebrine manifests itself by dark spots in the skin of the larvae; the eggs do not hatch out, or hatch imperfectly; the worms are weak, stunted and unequal in growth, languid in movement, fastidious in feeding; many perish before coming to maturity; if they spin a cocoon it is soft and loose, and moths when developed are feeble and inactive. When sufficient vitality remains to produce a second generation it shows in increased intensity the feebleness of the preceding. The disease is thus hereditary, but in addition it is virulently infectious and contagious.