

A HISTORY OF THE SILK WORM,

The best method to obtain Silk from it.

OF THE SUBSTITUTES FOR THE MULBERRY LEAVES.

No leaf is known yet which ought to be substituted for that of the white mulberry, when it can be obtained; but the late frosts frequently deprive the worms of their food, when a substitute must be sought. The surest, undoubtedly is the lettuce. It seems certain even that some worms have been fed upon it through all their ages. The cabbage-lettuce is perhaps the best. The leaves of the rose tree and the white raspberry bush have been used with some advantage. The dandelion, one of the first plants which appear in the Spring, is said to have been employed for feeding worms until the fourth change. As a substitute for green mulberry leaves, the same, dried in the sun in Autumn, and kept during the winter in a dry place, are said to have been used with success. Ined there seems to be no doubt that the Chinese use that method constantly to feed the young worms, but Loiseleur Deslongchamps, who tried it, entirely failed. Some other persons however have succeeded in Europe. Those dried white mulberry leaves are reduced to powder when needed, and moistened with a little water just before giving them to the worms.

It seems that there are some plants still unknown to those who attend the silk worms, which are capable of sustaining them through all their ages, and enabling them to spin their cocoons; for some worms abandoned in a small garden, for want of food, lived there, and after a certain period their cocoons were found in the same place. They may have fed however on the lettuce or the dandelion which in the north are found in most gardens at an early season. The writer of this paper has seen the worms feed on various kinds of leaves. He has seen some which were attacked with the disease called the yellows, eating greedily the leaves of the chinkapin (*castanea pumila* Lam.) and it is said that worms attacked with the same disease in Pennsylvania devoured oak leaves and were cured by them. It is to be regretted that the specific name of that oak was not mentioned; but it will not be difficult to make trials which in a short time, may make us acquainted with a very important fact, if that be true, as that disease destroys a vast number of worms.

OF THE SEED OF THE WHITE MULBERRY TREE.

In the Southern States, and perhaps in Pennsylvania, the berry may be sown immediately after being gathered, and the young plants will resist the winter, particularly if they be covered with straw, and thus one season shall be gained. But usually the ripe berries being gathered from strong middle-aged trees, are put in water pressed with the hand and washed till the pulp is separated and the seed is perfectly clean. The seeds fall to the bottom; and the water being poured off, they are spread upon a cloth and dried in the shade in a warm airy situation. That method is to be preferred to drying the berries in the shade, as it is done sometimes; when kept in that way, they are apt to heat and mould, and the seed is often impaired or destroyed. The trees from which the berries are gathered should not be stripped of their foliage that year, that the fruit may not suffer and come to full maturity.

OF THE CULTIVATION OF THE TREE.

The soil selected for the purpose of planting the white mulberry trees should be rather light than rich, neither moist nor too dry. It ought to be ploughed as deeply as possible; and digging in the fall preceding the sowing is found to be the best method. In France, the soil is dug as much as three feet when practicable. The ground being harrowed or raked; the seed is sown in drills. If in the fall, nothing will be required but covering them with straw or manure, if much snow or great cold be expected. When the seed is sown in the spring, the ground must be kept free from weeds and the young plants thinned till they are ten or twelve inches apart. They must be watered frequently, if rains do not often moisten the soil, and if the surface of the ground harden, that should be lightly stirred.

When a year old, the plants may be put in nursery rows, about three feet distance between each. And when the young tree is about one inch diameter it ought to be planted where it is intended to remain. The hole should be six feet square. When it has been made several months before however, the bottom should be dug up with a spade to lighten the soil. The roots should be trimmed carefully with a knife wherever they have been injured by taking up the tree. It will depend on the nature of the soil how deep the tree should be planted; but it will be found useful to plant with it a stake to which it may be tied, in order to make it steady. In filling up the hole, the best earth should be thrown first, to cover the roots, and the soil should be pressed on them, as with other trees. Great care should be taken lest the roots should be long exposed to the air during the operation of planting.

If it be intended to plant the trees in the usual way, only two or three buds should be left on each branch, those on the

outside being allowed to remain, in order to spread the head of the tree. About the month of March, the next year, the ground is ploughed round the foot of the trees, and they are tied with new strings to the stakes. It is well to continue to take off the buds, which are turned towards the centre of the tree, as the gathering of the leaves would be rendered difficult if branches were allowed to grow in that direction. It ought however to be particularly noticed that the leaves should not be plucked for food for the worms till the fourth or fifth year. If a mulberry hedge be intended, plants of one year old, are put in a furrow eighteen inches apart; the tops are cut, leaving two buds only for branches. The next spring, one of these branches is cut, about one foot from the ground, so that each tree has a long and a short branch. The preserved branches are then bent horizontally, and tied with willow-twigs. At the beginning of the third year, the branches must be cut about two feet from the ground, but the leaves must not be used till the next season. In Germany some trees planted near a canal were saved from the frost of 1825. It would be well to ascertain whether that be a constant fact.

The propagation of the mulberry tree from the seed, is by far the best mode and the quickest also; but there are some cases when it may be necessary to have recourse to other methods. Independent of the preceding methods, there are three different ways to propagate it, namely by means of the roots by layers and from cuttings.

1st. When a tree has not grown well, if cut near the ground at the third or fourth year, several suckers will soon appear on the surface of the ground. These may be covered with some of the mould raked round the main trunk, till a sufficient number of roots are grown with each. They may then be separated and planted with care in a place where they shall be watered often.

2d. When the sap is rising in the spring, young branches of low trees may be bent down and fastened with forks. They are then buried at that place under ground. In the course of one year, or little more, they have usually taken roots. They must then be separated from the parent stem, and they may be planted as the roots.

3d. Branches about a foot long are taken from the best grown trees, and buried in fine mould so deep that only three or four inches are left out of the ground. This method requires constant watering during the first season; and notwithstanding the greatest care, many cuttings always fail.

OF THE PRUNING AND PULLING OF THE LEAVES.

Before this subject is dismissed, it may be observed that a methodical pruning of the branches is attended with great advantage, particularly the invigorating of the tree; but great caution must be used lest a part should be pruned more than the rest, and the sap should be unequally divided. Observe particularly that when the leaves of a tree are pulled off for worms, all without any exception should be gathered, for if some are left, they will attract the sap exclusively, and the rest, for want of nourishment, are destroyed. There is even a prejudice in France that these trees in order to thrive, must be stripped yearly of their leaves; but though it seems to be an error, yet it is certain that this operation does not injure them materially, and these trees become covered with new leaves before the end of the season. The leaves should not be pulled off whilst the dew is on them, and never after sunset. It is well to employ a double ladder to gather leaves, in order to avoid hurting their branches as much as possible.

OTHER USES OF THE WHITE AND RED MULBERRY TREES.

These trees afford a delightful shade; and on account of their quick growth might be planted in rows in streets and high-ways. The wood is excellent for making casks, pails and hoops, and is used for various purposes by Cabinet-makers. Their berries are an excellent food for poultry, and may be preserved in sugar or vinegar. Superb linen has been lately manufactured from the bark, in Europe, paper and ropes, twine, &c. &c. may be made of the same part of that valuable tree.

ON THE GRAFTING OF THE MULBERRY TREE.

As it is doubted, even in Europe, whether grafting is of any use, and as that operation is performed on the mulberry tree, as it is on any other tree, it would seem useless to say any thing on this subject. Yet considering that grafting is constantly practised in Italy, that the varieties of the white mulberry tree enumerated above, can be propagated only in that way, and that it has been grafted with great success on our native red mulberry tree, it is of importance, at least to observe, that grafting is practised with success often in this country, and that the operation of budding particularly has succeeded in Missouri. The mode of grafting most commonly used, is the pipe grafting, which is done by slipping off a cylinder or tube made of the bark of the tree from which you wish to graft, with one or more buds on, just as the boys make whistles in the spring with the bark of young branches. That cylinder is then applied to a branch of the same size on the tree which is to be grafted, which branch has been deprived of its bark, so as to admit of the cylinder precisely. If the cylinder is too large it may be slit and fitted to the branch, if too small it must also be slit, but a piece of the same bark or of the bark

of the grafted branch is added in order to fit the space exactly, and the whole is secured in the usual way, preferring the composition made of turpentine, wax and rosin spread on thin leather, to the mortar of clay, which is usually employed. To be continued.

Number 18. HISTORY OF RAILROADS.

Railways, according to the ordinary implication of the term, are doubtless of English origin. This species of road was first thought of in the collieries of that country, in the counties of Northumberland and Durham, to facilitate transportation from the mine to the river, for extensive distribution. The distance between the two places would be a few miles only. A road must be prepared and maintained, and a proprietor of one of these mines would soon discover, that with wagons heavily loaded and constantly running, the ruts would become deep, the track miry, and great difficulty perpetually recurring to keep it in repair. It would appear extremely desirable to prevent this trouble, and ever returning expense, by setting regularly to work, and constructing at once, if possible, a road such that it should not be broken up, nor need repair in many years. It would cost a little more at first, but when once completed, all anxiety about it would be at an end, and the funds thus laid out being soon repaid, it would afterwards be an instrument of clear and continual profit. This would evidently reduce the price of coal to the people all over the country, and at the same time would be the means of vast advantages to the owner of the mine. And here we might stop to remark how obvious it is, that by such improvements injury is done to none, and all are benefited; for every miner may avail himself of the same means, and derive the same advantages, while warmth and comfort are extended to the poorest people of the country.

In constructing a road, the first expedient might possibly be to sink stones into it, or to place rails across to furnish an unyielding foundation. These, however, though covered with earth, would soon become exceeding rough, and the draught heavy. Upon such a road large loads could not be taken in, the wear of the carriage would be great, the horses would be harassed, and their sinews strained for want of a sure and regular footing, and their muscles would be shattered and their strength broken down, by the incessant shocks and obstructions of the wheels. Different methods would occur, such as removing the ground completely, to make a firm foundation, cutting down sharp ridges, banking across ravines, and paving regularly with stones mutually fitted. But even in this case it would be found that by rains and the frosts of winter, and the constant action of wheels, and ironed hoofs, and cumbrous loads, the whole would be converted into confused masses of stones and mud, at least as bad, if not much worse, than if such a system had never been adopted. Men are ingenious when their interest is concerned, and necessity is the parent of invention. To a reflecting man, it would be evident, that if only lines of support could be provided for the wheels, it would not be difficult to make the track for the horse of such materials as not easily to be deranged. All that was necessary then, was to lay down two parallel lines of compact & enduring timber, on which flanged wheels might run, taking care to secure the timbers in their places upon sills resting on solid earth.

Such was the first origin of Railways. "At the coal-works in the neighborhood of Newcastle upon Tyne," says Wood, "the expense of conveying the coals from the pits to the shipping places would be very great. Down to the year 1600, the only mode appears to have been by carts, on the ordinary roads; and in some instances by 'panniers' on horseback."

From 1602 to 1649.

"A record," continues Wood, "in the books of one of the free companies in Newcastle, dated 1602, states, 'That from time out of mynd yt hath been accustomed that all cole-waynes (coal carts) did usually carry and bring eight baulls (17 cwt.) of coles to all the staythes upon the river of Tyne; but of late several hath brought only, or scarce, seven baulls.' The cost of transporting so heavy an article as coal along the common roads, which may be supposed would not be of the best description, in carts containing seven or eight bolls, would operate very powerfully in accelerating the introduction of some improvement in the mode of conveyance to lessen the expense." In 1649, Gray tells us, "Many thousand people are employed in this trade of coales. Many live by conveying them in wagons and waines to the river Tyne. Some south gentlemen hath upon great losse of benefit, come into this country to hazard their monies in coale pits. Master Beaumont, a gentleman of great ingenuity and rare parts, adventured in our mines with his £30,000, who brought with him many rare engines not known then in those parts, as the art to boore with iron rods, to try the deepness and thickness of the coale; rare engines to draw the water out of the pits; waggon with one horse to carry down coales from the pits to the staythes to the river."

In the former of these passages the carriages are called "waynes," and the lat-

\* Wood and Tredgold on Railroads. † One of the best works to which I can refer, is a "Practical Treatise on Railroads, and Interior Communication in general, with original experiments, and tables of the comparative value of Canals and Railroads. Illustrated by engravings. By Nicholas Wood, Colliery-viewer. London, 1825." ‡ Wood on Railroads. pp. 34, 35.

ter speaks both of "waynes and waggones," and these are said to be drawn by "one horse." Hence Wood thinks it probable that between the first and second dates, that is 1602 and 1649, the Railway began to be used, especially as Beaumont bro't along with him not only a vast sum of money for those times, but many rare arts and engines.

From 1649 to 1767.

In the life of Lord Keeper North, the Railway is distinctly mentioned. "The manner of the carriage is by laying rails of timber from the colliery to the river, exactly straight and parallel. And bulky carts are made with four rollers, (four wheels) fitting those rails, whereby the carriage is so easy, that one horse will draw down four or five children of coals, and is an immense benefit to the coal-merchants."

In 1765, a description is given of a railway as then constructed, to this effect: A road was traced six feet in breadth. It was then excavated to level the ground and to arrive at a proper basis for the road. Across the excavation were laid down pieces of oak, four, six, or eight inches square, and at the distance of two or three feet from each other. The pieces, it is said, need to be square at their extremities only. Upon these are laid down and fastened other pieces of wood in the direction of the road. These are sawed six or seven inches broad by five deep, and secured to the other pieces with pins of wood. They extend on each side of the road along its whole length. Commonly they are placed at four feet distance from each other, and form the interior breadth of the road.

Originally, but little was done in reducing these roads to a level, or in contriving machinery for drawing the wagons up the hills, and letting down with safety and a proper speed. For this last purpose, an instrument was used called a "convo." It was an iron or wooden rod, acting as a lever, known to mechanics as a lever of the second sort, turning at one end round a pin or fulcrum, by which it was secured to the side of the wagon between the wheels. From this lower extremity it ascended in a form somewhat curved over the hind wheel, and rested near its upper end in a hook, at the highest rear corner of the wagon body. Upon this lever next to the supporting pin or bolt, and towards the hind wheel, a piece of wood was fastened called the breast, which was shaped to the curvature of the wheel. Sometimes a convo was provided on each side to act with greater power in commanding the movement of the wagon, and then the upper extremities were connected by a piece of wood reaching across between them, by means of which the attendant could act upon both at the same time. When the wagon was to descend a hill, the manager released the upper extremity of the convo from the hook, and pressing the breast against the wheel produced such a degree of friction, as to make the carriage descend with a proper motion. Sometimes the horse was unhitched from the front of the vehicle, and fastened by a breast-chain behind it, so as to aid in retarding the descent. This whole process, however, was not a little dangerous. When the roads were wet, the wheels would lick up dirt from the rails, and cause them to become exceedingly slippery. The gravitating force of the wagon and its load, down the steep declivity, would then set at defiance the utmost powers of the convo, the attendant was compelled to consult his own safety, the carriage was precipitated with an increasing velocity, "running amain," as it was common to say, killing horses, overturning and dashing in pieces every thing it encountered, and finally itself with its contents broken and scattered in smoking fragments. By extending the convo beyond the bolt at its lower end, and adding another breast to act upon the forewheel also, it was made more effectual in preventing these consequences. Still, such accidents happened not unfrequently, as we are told, while these were the only methods of conducting wagons over unretarded hills.

Because the wooden rails were apt to have their fibres shivered and damaged by the wheels, a second rail was added on the top, which as soon as it became materially injured, could be taken off and replaced by another, with little trouble, and without weakening the sleepers by frequent boring for the purpose of pinning the new rails upon them. At length, instead of these second rails, iron bars began to be substituted, of sufficient breadth and thickness; and thus the wooden railway attained its perfection, both for durability and ease of draught.

1767—1828.

The next change was to make the rails of cast iron instead of wood. This was first done, we are informed, about 1767, "by way of experiment," at the iron-works of Colebrook dale. But if such a trial was then made, they were probably not successfully applied until the year 1776, when Mr. Carr says they were first introduced as an invention of his own, at the Duke of Norfolk's colliery near Sheffield. That which is denominated the "Plate-rail," was the first. The most approved rails of this sort are 4 feet long, 4 inches wide, and an inch thick. They meet at their ends in a strict joint, and are pinned to the supports. They form a continuous flat surface for the wheels which are not flanged, but are prevented from passing off by an upright ledge or flange three inches high, along the edge

§ Jaa's Voyages Metallurgiques, quoted by the same writer. ¶ Idem. p. 87. † Wood, p. 45. Strickland, p. 25. Tredgold, pp. 26, 33.

of the rails, by which also, the rail is greatly strengthened. Thus they resemble the corner post of a house wrought out of the solid timber. To fortify this rail still more, an additional comb or rib of iron projects underneath, perpendicularly downwards, growing deeper in the form of a curve, as it recedes from the sleeper on which its extremities rest.

Shortly after the introduction of the plate rail, an iron rail of a different form was invented called the "edge rail." The breadth of the upper surface is about two inches and a half. After keeping this breadth a little way down, they gradually diminish to three-quarters, tapering out to give strength to the lower edge. The depth is varied according to the distance from the supports, it being the greatest midway between these. The ends of the edge-rails do not rest immediately upon the blocks of stone, but upon cast-iron chains, as they are styled, which are fastened down by pins driven through them into the blocks, and are so shaped with upright parallel sides, as to receive the ends of the rails in an exact joint with one another, and confine them steadfastly in their places.

Two inconveniences were experienced in cast iron rails: one from the fragility of that species of iron; the other from their shortness and frequency of the joints, these rails being at the utmost not more than four feet in length. It was found, that at every joint, the block or sleeper was apt to change its position. If it acquired the least degree of obliquity, and did not retain its original level posture, an end of one rail would be elevated above the end of the adjacent rail, and a concussion or jolt must occur to the wheel passing from one to the other. Attempts were made to prevent this, by different forms given to the chain in which the rails rested upon the blocks.

About the year 1805, trial was made by Mr. C. Nixon, of wrought iron rails, each piece being a bar from one to two inches square, and two feet long, connected by a lap joint, so that one pin fastened down two contiguous bars, by passing through both. "In October, 1820, Mr. John Birkinshaw, of the Bedlington iron works, obtained a patent for an improvement in the form of malleable iron rails. He made his rails similar in shape to the cast iron edge rail," giving to each a length of eighteen or twenty feet, and fastening them down upon supports at every three feet. In consequence of this, the joints were less frequent, the rail less liable to fracture, and a number of the blocks being bound together by one piece, were not so apt to change their original position. Whether the malleable rail is preferable to the cast, appears to be a question still unsettled. It is one which will be ultimately determined by experience, as all that is known in regard to the railways has already been. In 1817, Mr. Hawks, of Gatehead, attempted to combine the advantages of malleable and cast iron, by making the lower part of one sort, and the upper surface of the other. Cast iron not bearing as much flexure as wrought, without cracking, it was thought not to succeed well in practice. But Strickland is of opinion that greater perseverance and skill in forming these rails is all that is necessary to prove their superiority.

It was discovered in the use of the edge-rail, which was at first made round or convex on the top, that it tended continually to wear "a rut or groove in the periphery of the wheels." To prevent this, the top of the rails was flattened, and the rims of the wheels case-hardened. This is done in casting, by running the liquid iron against a cold cylindrical iron surface. This rim being thus suddenly cooled, a hardness is imparted to it, on which the file will not act, and which endures unaltered for many years.

The account here given of the origin and progressive improvement of the rail road, is a brief sketch in comparison with what it were easy to detail on this interesting subject. It presents, however, the most prominent circumstances of the history. The difficulties and trials through which it has advanced to its present perfection, might have been more fully and minutely displayed, and if any thing has occurred to the intelligent reader, as promising greater advantages, perhaps he would find on larger inquiry, that the very expedients suggested to him by the nature of the subject, have been already put to the test, and dismissed as of little or no value. It was very desirable to exhibit many of the objects of which we have spoken, by figures representing them to the eye; but in our own part of the country these are not easily attainable. From the narrative we have given, derived from authorities entitled to our most perfect confidence, it is evident, that the railway, if it has been unknown to any of us till recently, is far from being new in other parts of the world. It is recollected, that in one of our counties, during the present season, a speech was delivered to an assembly of the people, in which the orator felt himself sustained in asserting, that the railroad was never heard of, till it was mentioned by Carlton the last year! Such language as this needs no comment. Placed by the side of the facts which have been stated, it speaks volumes: to such as listened with credence to one who gratuitously assuming the office of a guide and counsellor, ought not to have been so very far wide of the capacities and qualifications necessary for such an office. There is rashness in undertaking to speak confidently on subjects on which we have taken no pains to be informed. One who will do this, is apt presently to find some-

\*\* Idem. †† Wood, pp. 61, 71. Strickland, p. 26. Tredgold, p. 31.