

ON A FUNGOID DISEASE AFFECTING THE PEAR TREE.

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The Historic Society of Lancashire and Cheshire having lately extended its field of operations, and included under the general term "Science" all subjects connected with Botany and Natural History, I offer no apology for bringing before the members the subject of the present notice. I am induced to do so as I consider, first, that all questions relating to Natural History are acceptable; and, secondly, that when those subjects have any bearing upon the cultivation or domestic use of the vegetable kingdom, their value is greatly enhanced. In the present instance, I fear I shall not be able to throw much light on the peculiar formation I have brought under notice, but I lay before the Society the little I have been able to acquire, in the hope that it may lead to further observations, by botanists better able to investigate the subject than I am.

In the garden of Mr. Edward Higgin, at Walton Breck, near Liverpool, are several pear trees. Three of these trees have suffered from a disease, to such an extent as to render the fruit unfit for food. As the disease did not make its appearance to any extent until after the fruit was gathered, Mr. Higgin supposed his gardener had bruised the fruit in collecting it; but upon further investigation, he found such was not the case, as all the pears had been picked by hand and housed with great care. When the fruit was first gathered it appeared perfectly sound, and it was not until several days after it had been deposited in the store-room, that a change took place. It soon became apparent, however, that a large portion of the fruit of three of these trees was rapidly decaying, whilst the fruit of the other trees remained perfectly sound. Upon a more careful examination of the pears, Mr. Higgin discovered, in every one, a nucleus from which the disease appeared to spread, thus confirming him in the opinion that the decay arose from some peculiar disease, and was not accidental.

Mr. Higgin, in forwarding specimens to me for microscopical examination, states that Tree No. 1, a *Maria Louise*, is a well-grown tree four or five years old, growing against the end of his stable, on a brick wall facing nearly south. It was barren until last year, when it produced a large crop, which was gathered in October, the fruit remaining in perfection until Christmas. This year it had only thirty-nine pears, which duly ripened and were gathered in October, immediately after which, part became infected. He is not aware that any showed signs of the disease until a day or two after being placed in the store-room.

Tree No. 2. *Jalousee de Fontenoy Vendee* is a dwarf standard, growing in the open garden, (near a hotbed frame, heated by manure from the stable). It was purchased last year from Davis's Nursery, Green Lane, West Derby, and bore a large crop for so small a tree. On it, two of the pears were diseased before being gathered, and before the fruit became mellow and ripe, each pear became rotten.

Tree No. 3. *Nelis D'Hiver*, a new dwarf tree similarly purchased, also in the open garden. It bore perfectly. None of the fruit became ripe before it was diseased.

None of these trees had liquid or other manure. The garden is three years old, the soil is good loam with eighteen inches of yellow clay, and sand-stone rock below.

I have examined the fruit sent to me by Mr. Higgin, and I find it affected by a fungus, to a very considerable extent. I received some of the specimens of the *Maria Louise* apparently sound; I have therefore been able to trace the progress of the disease, and in the following observations I shall confine my remarks to this tree.

In the fruit, the disease first makes its appearance in the shape of a small thickened spot, rather darker than the natural color of the pear: this gradually becomes black and ultimately cracks. From this time a slight swelling takes place around the spot, which assumes a reddish appearance. This increases very rapidly, until the greater part of the pear is absorbed, giving the whole fruit a soft and shrivelled appearance. If a section be made through the decayed part, it is found that decomposition extends a considerable distance into the heart of the fruit, and that it is very watery in appearance. On placing a section under the microscope, the cause of this rapid decay becomes apparent, the whole of the diseased part being

FIG 1.

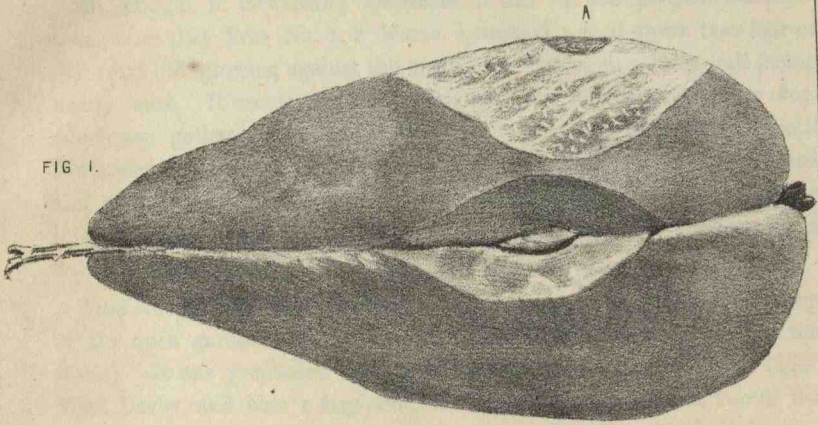


FIG 2.

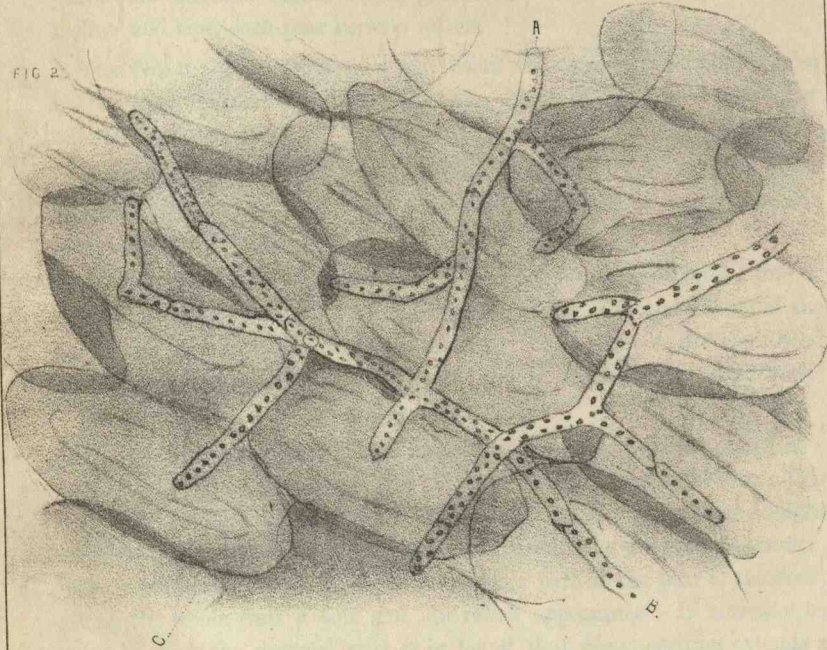
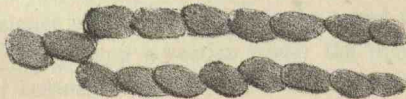


FIG 3.



interwoven with the filaments or mycelium of a fungus, which ramifies through the tissue in every direction, until the whole of the cellular part of the pear becomes decomposed apparently to afford nourishment to the fungus.

The mycelium consists of long and very thin filaments, frequently branched, its size varying from $\frac{1}{100000}$ to $\frac{1}{10000}$ of an inch in diameter; it is often mixed with sporidæ, which are generally much broken up or dispersed in making a section for examination, but when found entire they are ranged in long rows, and when ripe assume a dark color. The plant appears to be a species of *Penicillium*, or is very nearly allied to that genus.

Figure 2 represents a portion of the mycelium of the plant as seen pervading the cellular tissue of the pear. (A) the mycelium in its natural state magnified 400 diam. (B) the granular contents of the articulations, and (C) the remains of the cellular tissue of the pear.

On examination of sections made through the dark spot or eye, it would appear that this is the principal seat of the fungus, and that at this spot the plant is more fully developed, and produces fructification, as shown in figure 3.

It having been supposed that in the potatoe disease the fungus first attacks the leaf and is thus communicated to the tuber through the vessels of the plant, I have endeavoured to discover traces of this fungus in the leaves of the tree, and also in sections of the branches and roots, but without success; the disease not having been observed before the autumn, it is impossible to trace its cause with certainty so late in the season.

It appears certain that the fungi are capable of multiplying by their filamentous matter, as well as by spores. This is partly proved by the common mushroom (*Agaricus campestris*) which is commonly cultivated from what is called the spawn. This spawn consists of the filamentous matter. M. Audouin found that he could as readily inoculate caterpillars and other larvæ with minute portions of the spawn of fungi as by its spores. It is believed that there is a filamentous spawn to all fungi, although seldom seen by observers, as it is developed out of sight, under ground, in the midst of decaying matter, on which fungi generally grow, or occasionally through the substance of living matter. It would appear that for the filamentous growth darkness is necessary, and that for the growth of spores

a certain quantity of light is requisite. In the present case the bulk of the fungus consist of filamentous matter.

It is curious to observe the great similarity between the present disease and several that have lately been investigated by botanists; and a study of these may, to some extent, assist us in understanding our present subject. In the potatoe disease particularly, and also in the disease which the vines, in almost all the wine-growing countries of Europe, have fallen a prey to, fungi very nearly allied to that found in the pear form a very prominent feature, and their presence is considered by some to be the sole cause, and not the effect of the disease.

In the former disease, as you are aware, the root of the potatoe, after reaching perfection, and sometimes before, is found to be covered with spots or apparently slight abrasions of the skin. These rapidly enlarge, the tuber becomes soft, and ultimately putrefies. The Rev. M. I. Berkeley attributes this disease entirely to a fungus which he believes first attacks the leaves; and so rapid is its development, that the period for examination of its leaves is past in the course of a few hours. The fungus, in his opinion, does not live on decayed matter, but is one which produces decay and renders the plant unhealthy.* Various other causes have been assigned for this extraordinary disease, but all have appeared unsatisfactory, and the subject is still involved in mystery. Professor Balfour, after reviewing the various explanations given, both chemical and physiological, says, "the general conclusions to be drawn from all that has been said relative to the potatoe disease are that changes are induced in the cells and vessels of the potatoe by certain obscure meteorological and epidemic causes; that an attraction takes place in the cellulose and in the contents of the cells, which speedily leads to decay; that parasitic *Fungi* find a nidus in the decaying organic matter, so as to accelerate and give a character to the disease; and that as yet no remedy has been devised."

The vine disease also results from a parasitic fungus, the *Oidium Tuckeri*. The ravages of this plant, as in the former case, have entailed great distress on the inhabitants of the wine-growing countries; the crops in some districts having been entirely destroyed. As yet no certain method has been discovered to stop its increase. This, like the *Botrytis infestans*,

* In the Journal of the Horticultural Society, vol. i, page 25, Mr. Berkeley enters very elaborately into this subject.

or potatoe fungus, attacks the leaves of the vine, and spreads to the fruit. It is supposed by many that it makes its first appearance in the roots, but as yet I believe there is no proof that this is the case.

The currant is the fruit of a small grape, the *Uva Corintha*. This has also suffered much; and being so commonly used as an article of food, has made almost all classes in this country familiar with the disease, indeed it is now so common that it is with difficulty that a sample of currants can be obtained without being more or less affected with the disease. The *Oidium Tuckeri* and the *Botrytis infestans* belong to the same order of fungi as that found in the pear. The disease called dry rot is also caused by the mycelium of a fungus decomposing the tissues of the wood.

It is not in the vegetable kingdom alone that these parasites are found; the animal kingdom is also attacked by them in various forms, and man suffers to a considerable extent by them. Parasitic fungi may be found in the ringworm, thrush, and many cutaneous complaints; also in that fearful and dreaded disease cancer. The muscadine so destructive to the silkworm is caused by the growth of *Botrytis Bassiana*. It is a well ascertained fact that many of the diseases commonly called blight, are caused by the growth of parasitic fungi, and the more the microscope is used the more easily will they be traced to their proper origin.

In cases like the present, however, the most important question for consideration is, how can these diseases be eradicated? and this is a subject of no inconsiderable difficulty; for when dealing with living plants or animals, we cannot apply stringent remedies without great danger of sacrificing the life of the parent plant or animal. In Kyan's process for the prevention of dry rot, the timber is impregnated with a solution of corrosive sublimate, a most powerful poison; but what living plant or animal could be so treated? hence the great difficulty experienced in stopping the ravages of disease in such cases, for most chemicals that will kill the parasite will also kill the plant on which it grows. As this disease has so lately made its appearance, it is impossible at present to suggest a remedy. Several washes however have been tried, and it is said with some success, to stop the progress of the vine disease; and as our present disease is so similar in its nature, I would suggest a similar treatment. Mr. Quarles Harris, in his paper on the vine disease, gives the following remedies as those which have been found most efficacious; and as they

have been found not to affect the health of the plant, I would suggest them as likely to be useful in this case.

1. Mix one-half of black powdered sulphur with one-half of potash; make into a wash of the consistency of usual whitewash, and with a brush paint the stems and shoots, and rub it well into all crevices.

2. Mix one-half of common sulphur with one-half of quick lime, make into a wash as above, and apply in the same manner.

3. One pound of slack lime and one pound of black sulphur, boiled for twenty minutes in five pints of water, allowed to cool and fall bright; to be then drawn off into bottles. One pint to be mixed with 100 pints of water, and the trees well syringed with the mixture.

Mr. Higgin intends to apply the last remedy, and I have little doubt that before the next fruit season he will be able to throw additional light on the subject.

POSTSCRIPT.—Since the above paper was written, I have examined the fruit of a pear tree from the neighbourhood of Maghull, which has been completely destroyed by the same disease. The fruit, when examined under the microscope, presented a similar appearance to that described in the foregoing paper.

EXPLANATION OF PLATE.

FIGURE 1. Section of diseased pear.
A. Decayed part affected by fungi.

FIGURE 2. A. The mycelium in its natural state magnified 400 diameters.
B. The granular contents of the articulations.
C. The cellular tissue of the pear.

FIGURE 3. Fructification.
