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OBSERVATIONS

REGARDING THE

POTATO DISEASE IN IRELAND

IN

1890.

WITH ILLUSTRATIVE DRAWINGS FROM THE
MICROSCOPE.

BY

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FIG. 1.

POTATO FUNGUS.
Peronospora-infestans, MONT.
Drawn from the Microscope.

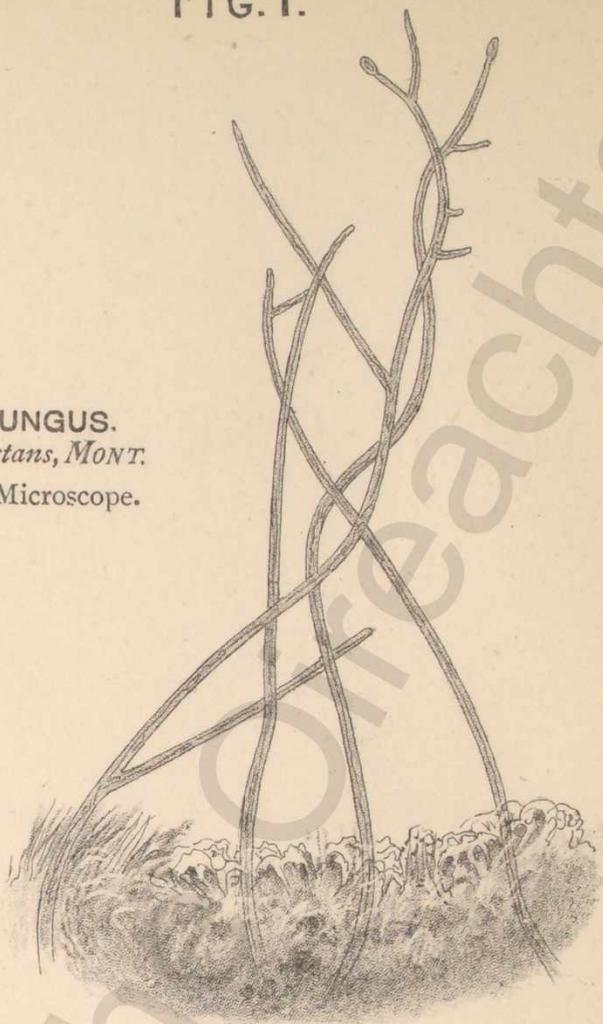
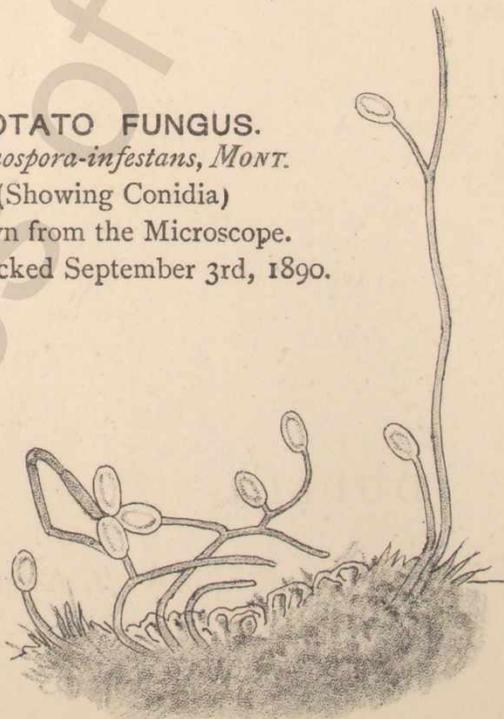


FIG. 2.

POTATO FUNGUS.
Peronospora-infestans, MONT.
(Showing Conidia)
Drawn from the Microscope.
Leaf plucked September 3rd, 1890.



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THE POTATO DISEASE IN IRELAND
IN 1890.

IN view of the published reports as to the extent of the Potato Disease, it appears desirable that some information as to its character, and the remedies and means of prevention available, should be circulated as widely as possible amongst Irish Agriculturists, with the view of mitigating the injury, and preventing, as far as possible, the spread of the disease next year.

It is well known to scientific observers that the disease is caused by a microscopic fungus (*Peronospora infestans*, Mont.) which grows as a parasite on the potato. The home of this plant is South America, and it appears to have been imported into Europe in 1845, causing the terrible potato blight of that year. The fungus usually shows itself in the months of July and August.

Its first appearance is marked by a yellow colour on the leaves, with discoloration in spots, the under side of the leaves presenting a whitish flocculence.

The fungus rapidly spreads over the whole plant, which becomes blackened and putrid.

When examined under the microscope the whitish substance under the leaf is found to consist of filaments knotted and branched in a peculiar way, as shown in annexed Plate, Fig. 1. These branches develop minute egg-shaped bodies (conidia), Fig. 2, containing spores, each of which is capable of producing a new plant. The conidia ultimately burst, and the spores are then set free.

The disease is carried over the winter not only by the spawn threads (mycelium) of the fungus, but also by "resting spores," possessing great vitality, which remain in the ground and in the diseased stalks and tubers.

The atmospheric conditions favourable to the growth of the fungus are heat and rain.

The spores of the disease are carried about by various agencies, such as rabbits, rats, birds, and insects, but the most powerful instrument in their diffusion is the wind. This was doubted at first by some scientists until established by actual experiment, and there appears to be now no doubt that myriads of these spores are blown about in all directions.

It has been noticed that in fields attacked, plants have escaped which were sheltered by nettles and thistles growing overhead. An interesting case occurred in my own neighbourhood illustrating this point. There was a gap in the hedge dividing a field of mine from the adjoining property. At the other side of the hedge were planted potatoes. The spores of the fungus were blown through the gap, opening out in fan shape, the hedge sheltering the ground immediately behind it.

The disease undoubtedly descends to the tubers through the stalks, but it has been noticed that in some cases the tubers have been attacked while the plant above is perfectly healthy. This indicates that the fungus reaches the tubers in other ways, and it is evident that the spores resting on the surface percolate with the rain through the ground until they come in contact with the tubers, when they take root and immediately form fresh fungoid growths.

In considering what remedies are available, the great point is the stage which the disease has reached.

If the spores have not been liberated, and the potatoes have been planted in drills, a method of saving the crop, which has been found efficacious, is to bank up the drills

at an angle of about 45 degrees, the effect of which is that the spores instead of percolating vertically where they fall, are washed by the rain down the bank into the channel at the side of the drill; and thus in most cases escape contact with the tubers.

This simple means of meeting the difficulty is recommended by M. Jensen, Director of the Bureau Cérès at Copenhagen, in his paper published in 1882, and entitled "La Maladie des Pommes de Terre vaincue au moyen d'un procédé de culture simple et facile." M. Jensen's experiments show that three to seven days elapse between the appearance of the disease on the leaves and on the new tubers, that the disease affects the tubers in proportion to their distance from the surface, and that the spots of the fungus show themselves first on the part of the tuber nearest the surface of the ground.

The result of his experiments went to show that if the potatoes are banked up before, or immediately after, the disease appears on the leaves, in such a way as to conduct the rain and the spores into the trench, it forms an efficient protection to the tubers.

M. Jensen gives the following rules for the working of his protective system.

1. The ground must be thoroughly worked, so that the potatoes may be planted in friable earth, which affords a better means of protection than a lumpy soil.

2. The potatoes should be planted (pretty early) at a distance between the rows of at least 28 in. or 30 in. A greater distance is not required by the system, but if closer it would impede the protective moulding.

3. The first moulding must be flat, so that the formed ridge be broad on the top and only about 4 in. wide. This moulding may be repeated if it is thought advisable.

4. The protective moulding must be applied as soon as the disease-blotches make their appearance on the leaves of the haulm. If this has not occurred before wheat-harvest time, the moulding ought to be executed then without waiting for the appearance of the disease-blotches.

5. The protective moulding is performed by throwing up from one side of the row of plants a high ridge with a broad base, and running to as sharp a point at the top as possible. The covering of earth thereby produced over the upper surface of the uppermost tubers must be about 5 in. to begin with ; later, by the settling of the earth, and by sliding down it will, as a rule, preserve a thickness of about 4 in. Simultaneously with this moulding, the potato-tops are gently bent over towards the opposite side of the row, so as to give the top at least a half-erect position.

6. The flat and the protective moulding, where potatoes are only grown on a small scale, may be done with a hand hoe ; on a larger scale these operations ought to be performed with a moulding-plough, the "protector," which is constructed to meet the necessities of the described system.

7. In order to prevent after-sickness, which may often be exceedingly great, the potatoes must not be lifted before about three weeks after the last leaves in the potato-field are withered.

8. If the potato-tops are cut off and carried away, which for the sake of the quantity and quality of the crop, ought not to be done before the leaves, in the main, are withered, the lifting may, as it seems, without danger of after-sickness, take place about six days after such removal."

M. Jensen's plan has the approval of distinguished botanists, and it has the advantage that it cannot injuriously affect the crop in any way.

If the spores have been liberated, so far as is at present known, nothing can practically be done to stop the progress of the disease. If the tubers are mature they can be saved by digging up.

In cases where disease has appeared potatoes should not be stored in pits, but in out-houses, where they can be kept cool and free from damp. Potatoes in pits are liable to heat, the damp of the pit creating conditions favourable to the growth of the fungus.

Great care should be taken in storing not to put in any diseased tubers, which should be burnt. A case came under my own notice where a few diseased potatoes were put in a pit which otherwise contained apparently sound tubers, and when the pit was opened it was found to contain a mass of black jelly.

It is, unfortunately, too much the practice to throw the diseased stalks on the manure-heap to rot. This is a fertile source of the propagation of the disease. All diseased stalks should be carefully burned.

Great care should be taken not to plant any diseased sets, and, where disease has appeared, potatoes should not be planted the following year in the same ground, as the spores of the fungus remain in the ground, and, it has been ascertained, retain their vitality for at least three years.

Where disease has occurred the drill system should be adopted in fresh planting, so as to admit of banking up should it re-appear. As the fungus does not usually appear till July and August, early varieties as a rule escape, and this fact should be taken into consideration in fresh planting after an outbreak of the disease.

While the potato is the plant on which the fungus *Peronospora infestans*, naturally grows, it will also attack

the tomato, and has been found on a poisonous weed belonging to the same family (The Bittersweet, *Solanum dulcamara*), as well as on other plants. Tomato plants where growing near potatoes, will need watching; and care should be taken to destroy any plants of Bittersweet in the vicinity.

The only real means of preventing the potato disease appears to be the periodical introduction of new varieties of good potatoes. In consequence of the Report of the Committee of the House of Commons which sat in 1880, the Champion potato was introduced largely into this country. This was undoubtedly a good variety; but the Committee were duly warned by scientific witnesses that, however good it might be, it would, after a time, deteriorate and become liable to disease.

To practical agriculturists evidences were not wanting that the Champion potato has been gradually deteriorating; and if, as appears to be the case, the Champions have at last given way, the problem remains to be solved afresh as to what potato, suitable to this country, is to be substituted for them.

According to the General Abstract of Agricultural Statistics recently issued, the acreage under potatoes in the present year is 780,801 acres, being 6,433 acres less than in 1889.

In the Registrar-General's Annual Report on Agricultural Statistics for 1889 a valuable table appears giving the acreage under the different kinds of potato—information of much importance at the present juncture.

From that table it appears that the Champions occupied 79·5 per cent. of the total acreage; 7·4 being under Flounders, 3·7 under Skerry Blues, 2·0 under White Rocks, 1·9 under Magnum Bonums, 1·1 per cent. under Scotch Downs, 1·0 per cent. under Kemps, and 3·4 under other varieties.

It will thus be seen that the great bulk of the

potatoes grown in Ireland are Champions. The Skerry Blues and Magnum Bonums appear almost altogether in Ulster, while the Scotch Downs and Kemps are principally confined to Ulster and Leinster.

An analysis of the figures, published in the Reports on Agricultural Statistics since 1879, shows that whereas in 1880 there were but 220,934 acres under Champions the acreage under these potatoes in 1889 amounted to 625,691. In the same period the White Rocks, which occupied in 1880 an area of 194,778 acres, decreased in 1889 to 16,165, the Skerry Blues from 116,959 in 1880 to 28,786 in 1889, and the Scotch Downs from 98,342 acres in 1880 to 8,566 acres in 1889.

As the temperature and rainfall are essential elements in the spread of the disease, it is interesting to note the mean temperature and rainfall for the nine weeks of July and August in 1879 and 1890 at the principal Meteorological Stations in Ireland, as published in the Registrar-General's Weekly Returns.

According to the observations made at the Ordnance Survey Office, Phoenix Park, Dublin, the average mean temperature for the nine weeks in July and August of the year 1879 was 56.3° ; in 1890 it was 55.3° ; and in the ten years 1880-89 it was 57.8° . The rainfall for the nine weeks in 1879 amounted to 7.957 inches; in 1890 to 5.665 inches; and the average in the ten years was 5.840 inches. During the nine weeks of 1890 the number of hours of sunshine was 333.7 against an average of 323.2 for the nine years 1881-9.

In the fourth of the nine weeks of 1890 the mean temperature was 0.7° , and in the sixth week it was 5.4° higher than the average for the corresponding week in 1879. In these weeks the mean temperature in 1890 was above the average for the corresponding weeks of the years 1880-1889. In the remaining seven weeks the 1890 mean temperature was below that of 1879, and also below the average for the ten years 1880-1889.

In the fifth, seventh, and eighth of the nine weeks of 1890, the rainfall was greater than in the corresponding weeks of 1879, that for the eighth week of 1890 being more than double the quantity for the eighth week of 1879.

In the remaining weeks the rainfall for 1890 was below that for 1879—the quantity in the first and second weeks being less than one half. Compared with the average for the ten years 1880-1889, the figures for the first, fifth, eighth, and ninth weeks show an increase in the rainfall in 1890, the quantity for the eighth week being 1·155 inches against an average of 0·662 inch.

At Donaghadee (County Down), the average temperature for the nine weeks of July and August in 1879 was 55·4°; in 1890 the average was 58·7°. The rainfall during the period in 1879 measured 10·70 inches; in 1890 it measured 3·77 inches only.

In all the weeks, except the eighth and ninth, the mean temperature in 1890 was above that in 1879; in the eighth and ninth it was somewhat below 1879.

The rainfall in the seventh week in 1890 was slightly above that for 1879, whereas in all the other weeks it was below.

At Markree Castle (County Sligo), the average mean temperature was 54·7° for the nine weeks of July and August, 1879; in 1890 it was 54·8°. The rainfall for the nine weeks in 1879 amounted to 11·50 inches; in 1890 it was 8·59 inches.

In the first, third, fourth, fifth, and sixth of the nine weeks, the mean temperature in 1890 was above, and in the remaining four weeks it was below, that for the corresponding weeks of 1879. The rainfall was above that for 1879 in the third, fifth, and seventh weeks, and below in the other weeks of the period.

At Roche's Point (County Cork), the average mean temperature for the nine weeks in 1879 was 58·2°;

in 1890 it was 57·9°. The rainfall in 1879 amounted to 10·89 inches ; and in 1890 to 5·26 inches.

The mean temperature for the fourth, fifth, and sixth weeks respectively, was above that for the corresponding weeks of 1879 ; for the remaining six weeks of the two months, the 1890 mean temperature was below that for 1879. With the exception of that for the second of the nine weeks, which shows a slight increase, the weekly rainfall in July and August, 1890, was below that for the corresponding period in 1879.

The Land Commissioners state in their report, just issued, that—

“At the time at which the last Returns were published (July 14), the potato blight had appeared to a slight extent in a few districts on the southern and western coasts, and the potato crop generally was reported as healthy. The inclement weather, which has since been experienced, has resulted in the appearance of the potato blight almost universally over Ireland. The blight appeared first in the poorer lands on the coast, including all the seaboard district from Donegal westward to Wexford. During the last week in July, the potato crop all over Ireland, with few exceptions, was struck by disease. It will be observed that at the date at which the present Returns were sent in, the disease, as a rule, affected the leaves and stalks only, and to a slight extent the tubers. This would appear to be the case in all the eastern and inland counties, where the soil is fairly deep and dry ; it appears, however, that in poor mountain lands and shallow or wet moory land, the blight has progressed rapidly, withering the stalks at such an early stage of growth as to result in a crop of small unmaturing tubers, which will prove to be deficient in nutriment, if not almost wholly unfit for human food ; this is accounted for by the effect of late frosts in May and June checking the growth of the potato, with the result that the blight attacked the crop before the tubers had grown to any size.”

The Commissioners add :—

“Some of the early varieties appear to have been sufficiently matured, before the blight became general, to enable them to escape without serious damage, but the main crop of champions, at the date on which the reports were sent in, was in too precarious a condition to enable a positive estimate to be made, as to the probable yield of sound eating potatoes ; excluding the western and southern seaboard already referred to, the majority of the reports state that the results of the potato harvest depend entirely upon the nature of the weather from after the date of the reports (August 16).

“In most cases the leaves only, or the leaves and stalks, had been blighted, but not to such an extent as to stop growth, and there is every reason to believe that a period of dry weather and sunshine would produce an average yield of potatoes, with possibly a larger amount than usual of diseased tubers ; whilst a continuance of wet would induce a further decay of stalks, resulting in a crop of soft, watery, and, to a large extent, unmaturred tubers. These would, doubtless, provide feeding for pigs, but would result in a short crop for human consumption.”

As, since the date of the collection of these returns, the weather has been favourable to the growth of the fungus, it is probable that there will be a deficit in the produce, the amount of which cannot at present be estimated.

In 1879, early inquiries were instituted with reference to the produce, the result of which was subsequently embodied in a report presented to Parliament.

In the Agricultural Statistics for 1880, a most useful table appears, showing the estimated proportion of the produce of the different potatoes then in use, which was (1) sound ; (2) partially diseased ; (3) lost by disease. A table framed on this model would be specially valuable with reference to the produce for the present year.

These remarks may be concluded with a warning as to the danger of eating diseased potatoes.

The *Lancet* (August 30) in an article headed "The Potato Disease in Ireland" remarks—

"Reports from Ireland state that in some districts disease has been markedly prevalent, and is believed to have given rise to fever of low type and to choleraic diarrhœa. It is not remarkable that symptoms like those of a semi-typhoid character should arise from this cause. Potato disease or blight, there is good reason to believe, is as much a parasitic and infectious disorder as typhus or typhoid fever itself. According to Berkeley and other authorities it is produced by a vegetable fungus, and the diarrhœa to which it gives rise in the human subject is probably septic. As regards the human sufferer, no remedy can, of course, give a satisfactory result until the poisonous diet is discontinued."

A death in Timoleague District, Clonakilty Union, alleged to have been caused by eating diseased potatoes, is reported in the Press of August 29.

It cannot be too widely known that eating diseased tubers is liable to cause illness and possibly fatal results.

PRIMROSE HILL,

KINGSTOWN,

3rd September, 1890.

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