PURPLE BLOTCH DISEASE OF ONION IN PUNJAB*

II. Studies on the Life-history, Viability and Infectivity of the Causal Organism
 _Alternaria porri_

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INTRODUCTION

Purple blotch disease may infect any part of the onion plant, but its importance is emphasized by its common occurrence on the seed stalks. Due to this disease, the yield is affected by nearly 25 to 50 per cent. under conditions of severe attack. The disease occurs from mid-January to mid-April in the Punjab State.

Primary infection occurs usually at the time when plants show vigorous growth just before the bulb formation stage and at the time of emergence of seed stalks. A consideration of the life-history of the fungus may begin with the lesions produced on the leaves. Majority of the leaf lesions probably originates on punctures made by thrips, as it has been shown by Pandotra (1964) that the causal organism _Alternaria porri_ is necessarily a wound parasite under Indian conditions.

The disease on the leaves has a profound effect on the growth of the plant, because the leaves fall over at the point of infection and considerable reduction in active leaf area is caused. The importance of the leaf lesions lies in the fact that they provide the principal source of inoculum for stalk infections and for disseminating the disease during the growing season. In addition, the frequent winds and dashing rains acting as excellent means of dispersing the conidia and mycelium by blowing and splashing them to the stalks and leaves. The fungus continues to develop in the tissues of both leaves and seed stalks until the crop is harvested during the month of April.

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Diseased debris left behind in the field after harvest appears to be the most important source of infection for the succeeding onion seed crop. It was, therefore, considered essential to test, if the causal organism of the disease could remain viable under Punjab conditions in diseased debris during the off-season. For this purpose, studies on the longevity of the fungus in leaves and seed stalks on the soil surface and in the laboratory temperature (15° to 40° C.) and in the diseased debris when buried in the soil, have been done.

Viability and infectivity studies have also been done to know as to how far the causal organism can be kept viable and infective in dried state.

**Material and Method**

For the longevity studies of the fungus, typically diseased leaves and seed stalks were placed on the surface of the soil filled in wooden flats kept in the open. Flats were covered with wire-gauze to prevent the diseased material from being blown about by winds or disturbed by other agencies. These flats were kept exposed from July 1957 to April 1958. Diseased material from the same lot, as was placed in flats was also kept in the laboratory during the same period, and was also exposed as such to weather in the open by slinging it on wooden pole.

For the longevity of diseased debris when buried in the soil, infected seed stalks and leaves of onion were buried 2 inches, 4 inches and 6 inches deep in replicated wooden flats filled with soil. The viability of *A. porri* in infected leaves and seed stalks used in the above tests was ensured beforehand by cultural tests in the laboratory. The infected seed stalks buried at different depths were regularly taken out from each flat at monthly intervals and bits thereof were transferred to agar slants after surface sterilization.

For the viability and infectivity of the dried culture, the fungal mats were produced by inoculating 20 petri plates, each containing 20 ml. of potato-dextrose agar and dried according to the method employed by Bedi (1949). Dried cultures were kept for further study at room temperature as well as at low temperature (Refrigerator). The fungus was also grown on potato-dextrose-agar in test-tubes and kept along with dried cultures.

Dried cultures and test-tube cultures were regularly tested for their viability by transferring the bits on PDA slants at monthly intervals from July 1957 to June 1958. Bits of dried culture were surface-disinfected with 0.1% mercuric chloride before transferring to slants.
EXPERIMENTAL RESULTS

(i) Longevity of A. porri in leaves and seed stalks on the soil surface and in the laboratory temperature.—Data presented in Table I distinctly indicate that this fungus remained viable in dried debris kept exposed under laboratory conditions throughout the experiment, but, in the case of debris exposed on the surface of the soils and to the weathering agencies, the fungus could only survive up to the month of March. The percentage viability diminished gradually in all the cases month after month. Jones in 1896, as quoted by Rands (1917), observed that the mycelium of the fungus of early blight of potato could remain viable for a year or more in diseased debris. In the present case it is clear that the fungus remained viable in diseased leaves and seed stalks during the period between two crops (Table I).

### Table I

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</thead>
<tbody>
<tr>
<td>Kept under Lab. conditions</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>32</td>
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<tr>
<td>Kept exposed on the surface of the soil</td>
<td>100</td>
<td>92</td>
<td>80</td>
<td>44</td>
<td>36</td>
<td>32</td>
<td>32</td>
<td>28</td>
<td>24</td>
<td>0</td>
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<tr>
<td>Kept exposed to weather in the open</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>72</td>
<td>60</td>
<td>40</td>
<td>40</td>
<td>32</td>
<td>12</td>
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N.B.—Percentage survival of the fungus are based on bits of debris in lots of 25 each.

(ii) Longevity of dried debris when buried in the soil.—The data presented in Table II show that debris buried 2 inches deep remained viable for only two months; thereafter no isolates of the fungus could be obtained. In case of debris buried at 4 and 6 inches deep, the fungus was devitalized even after one month. The debris that remained buried at different depths in the flats was found to have been completely disintegrated. Debris kept on the surface continued to give isolates of A. porri during the off-season (Table II).
**Table II**

*Showing the effect of burial of diseased debris at different depths in the soil on the viability of *Alternaria porri* from July 1957–April 1958*

<table>
<thead>
<tr>
<th>Diseased debris</th>
<th>Percentage of bits of infected seed stalks yielding <em>A. porri</em></th>
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<tr>
<td></td>
<td>1st month</td>
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<tr>
<td>2&quot; deep</td>
<td>24</td>
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<tr>
<td>4&quot; deep</td>
<td>20</td>
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<tr>
<td>6&quot; deep</td>
<td>12</td>
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<tr>
<td>Kept exposed on the surface of the soil</td>
<td>92</td>
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(iii) *Viability and infectivity in dried and test-tube cultures.*—In this experiment, it was observed that the fungus remained viable both at room and refrigerator temperatures throughout the period of experiment. Fungus in test-tubes also remained viable. Infectivity of the dried cultures was tested by inoculating artificially injured onion plants with small bits. Humidity was provided for 48 hours. The symptoms of the disease appeared after six days showing that the fungus retained its power of infectivity.

**Conclusion**

From the longevity tests it can safely be concluded that the causal fungus of purple blotch disease of onion can survive in debris left on the surface of the soil under Punjab conditions. If, however, the diseased debris is buried 2 to 6 inches deep in the soil, the fungus is completely devitalised during the off-season of the crop; as a matter of fact, even after a period of two months and thereafter the soil is rendered free from the pathogen.

The fungus in dried debris remained viable for nine months at laboratory temperature and for eight months when exposed to the weathering elements of the surface of the soil, showing that the pathogen can live over from one season to the next in the diseased debris left in the fields after harvest to cause primary infection to the next crop.
It is also concluded that the fungus *Alternaria porri* can be kept in a state of viability and infectivity in dry and test-tube cultures for a period of 12 months or more both at low and high temperatures confirming that Bedi's (1949) method of maintaining the viability and infectivity of *Ascochyta rabiei* can hold good for other fungi also.

**SUMMARY**

*Alternaria porri*, the causal organism of Purple Blotch disease, lives over from one season to the next as mycelium and spores in onion leaves and seed stalks left as debris on the surface of the soil from the last harvest. The diseased debris loses its viability when buried two inches or more, deep in the soil, but diseased debris retains its viability for eight and nine months when exposed to the weather and kept in the laboratory rooms.

The viability and infectivity tests with dried cultures and test-tube cultures have shown that fungus can be kept pure as dried cultures for a period of 12 months or more.

**ACKNOWLEDGEMENTS**

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**REFERENCES**