Plant diseases - Pear scab - Recent results of spray trials

R. F. Doepel
PEAR SCAB
Results of Recent Spray Trials

By R. F. DOEPEL, B.Sc. (Agric.), Plant Pathologist

SCAB or black spot is the most important disease of pears in Western Australia where for many years it has seriously affected both yield and quality of fruit. In seasons favourable to its development, the disease has proved difficult to control with the older copper and sulphur fungicides. Excellent control has been obtained in recent spray experiments with the newer organic fungicides captan and the phenyl mercury compounds. Eradication of the disease in isolated orchards has been achieved by the use of phenyl mercury sprays in the autumn before leaf-fall.

The varieties of pears grown in Western Australia vary somewhat in their susceptibility to attack by the scab disease. Bartlett, Josephine and Packham’s Triumph are very susceptible while Kieffer is more resistant.

SYMPTOMS

Leaves. — Symptoms become obvious within two or three weeks after infection as small, slightly sunken, dark spots occurring mainly on the undersurface of leaves. On closer examination corresponding swellings can be seen on the upper leaf surface. These spots enlarge rapidly and numerous conidia or “summer spores” are produced on them, colouring affected areas a dull olive-green or black (Fig. 1). Large spots cause curling and malformation of the leaves and give the surface a blistered appearance.

Fruit. — Infection may occur on flower stalks or developing fruits during the blossoming period. Small black spots are commonly found just below the calyx and are covered with masses of conidia. Infected blossoms often drop and so may cause a considerable reduction in fruit set.

Spots on the fruit are similar, in the early stages, to those found on the leaves. At first they are slightly sunken but, as the fruit develops, the spots enlarge and may cover a considerable area of the skin (Fig. 2). Conidia are produced in large numbers on the lesions which then become the same dull olive-green or black colour as that of the leaf spots. Older lesions develop a dry scabby texture and cause malformation of the fruit rendering them either unmarketable or else of an inferior grade.

LIFE CYCLE OF THE SCAB FUNGUS

The pear scab fungus, Venturia pirina, Aderh., overwinters from one season to the next in infected leaves which fall to the orchard floor. During winter the fungus continues to grow in the dead leaf
tissues and produces numerous flask-like fruiting bodies known as perithecia. Two-celled ascospores or "winter spores" develop in these perithecia and when mature are forcibly discharged into the air in the spring. Moisture, in the form of rain or possibly heavy dew, is necessary to bring about the discharge of mature ascospores. Depending on weather conditions the spores are ejected from the perithecia at intervals, commencing before bud burst in September and continuing for about three months. They can be blown considerable distances by wind and so are able to infect other orchards in the district.

Moisture must also be present on the leaves and fruit before the ascospores which land on them can germinate and infect the tissues. Showers of rain, therefore, serve a dual purpose in releasing ascospores from the perithecia and also enabling them to infect the trees in the orchard.

Germinating ascospores send out fungal threads into the leaf and fruit tissues and the black spot infections become obvious after an interval of two or three weeks. In general cool wet weather favours infection while dry warm conditions check development of the fungus.

A different type of spore, the one-celled conidium or "summer spore," develops in large numbers in the leaf and fruit spots giving them the dull appearance referred to earlier. These spores are spread by wind and rain causing further infections in addition to those initially caused by ascospores.

If temperatures are favourable, succeeding outbreaks of scab in the orchard can be traced to rain periods which occurred a few weeks previously.

Diseased leaves fall to the ground in the autumn and so enable the fungus to complete its life cycle.

**CONTROL ASPECTS IN RELATION TO LIFE CYCLE**

From a study of the life cycle it is apparent that control of the scab disease can be attempted in two ways—(1) by preventing carry-over of the fungus in fallen leaves and so stopping ascospore production; (2) by applying fungicidal sprays to prevent spring infection from ascospores and subsequently from conidia.

(1) In past years a measure of scab control was obtained by ploughing under the overwintering leaves in early September before bud-burst. Subsequent cross-cultivation was delayed as long as possible to prevent the buried leaves from being brought to the surface. In this way many of the ascospores were discharged harmlessly into the soil and as a result primary spring infection was reduced.
An alternative method of stopping the spore discharge has now been tested and consists of spraying the trees in the autumn after harvest but before leaf-fall, with phenyl mercury chloride (PMC). This method was first developed by the New South Wales Department of Agriculture for use against the closely-related apple scab disease. Hutton (1957) found that scabbed apple leaves sprayed with 0.1 per cent. PMC failed to develop ascospores in the spring. As these spores can be carried several miles by wind to neighbouring orchards, this method would be of value mainly for an isolated orchard or group of orchards in an isolated district. Investigations on the use of autumn PMC sprays against pear scab have been carried out in this State during the past three years.

(2) In most seasons, a reasonably clean crop can be assured only by adopting a regular fungicidal spray programme in spring and early summer. For many years spraying with Bordeaux mixture or lime sulphur has been the standard treatment for the control of scab. However, these fungicides cannot be safely used on certain varieties after the white bud stage because of russet damage to the fruit. In recent experiments several of the newer organic fungicides have proved more effective and safer to use than Bordeaux mixture.

These fungicides can be grouped into two types according to their mode of action:

- **Protectants**—such as captan, ziram and thiram, which are applied to protect healthy fruit and leaves from infection by the ascospores or conidia. They give best results when applied before a rainy period, i.e., before infection can occur. Hence these sprays should be applied in the spring and early summer at regular intervals not exceeding 14 days, to maintain a protective cover of fungicide on the new growth (Hey, 1956).

- **Eradicants**—such as the phenyl mercury chloride or nitrate compounds, which can kill out or eradicate recent infections following on rainy periods. These materials, however, have little value as protectants for their action in this regard does not persist for more than a few days (Hey, 1956). Sprays containing phenyl mercury compounds are best applied immediately after rain and are useful where the normal protectant spray programme breaks down because of adverse weather conditions.

**FUNGICIDAL SPRAY EXPERIMENTS**

**Results of Spray Trials.**

(a) **Spring.**—The performance of a number of the newer organic fungicides
has been tested for pear scab control over the past four years.

At Parkerville in the 1953-54 season, captan and phenyl mercury fixtan (PMF) proved superior to ziram and thiram on Packham pears. The best control was obtained with a five-spray schedule—at spur-burst, white-bud, petal-fall, and two subsequent cover sprays at 14 and 20 day intervals respectively.

In the 1956-57 season three spray schedules—captan, phenyl mercury nitrate (PMN) and captan plus PMN, were tried on Bartlett pears at Karragullen. Best results were obtained with the mixture of captan plus PMN which combined both protectant and eradicant action.

Additional information obtained from experiments can be summarised as follows:

1. Captan may be safely applied during bloom to give additional protection against scab infection.

2. The phenyl mercury chloride sprays (containing 0.002 per cent. mercury) caused severe russetting and dwarfing of fruits of the Josephine variety when applied at petal-fall (Fig. 3). Slight russetting also occurred with this spray on fruits of the Bartlett, Packham, Comice and Kleffer varieties when applied a fortnight after petal-fall (Fig. 4).

3. Leaf-mottle developed on all varieties sprayed with phenyl mercury chloride at the above strength but apparently had no adverse effect on tree vigour or yield.

(b) Autumn.—In the autumn of 1956 a phenyl mercury chloride spray at 0.1 per cent. strength (containing 0.067 per cent. mercury) was applied to 12 pear trees affected with scab in an isolated orchard at Dwellingup. This orchard was located in a heavily-timbered area about three miles from the nearest neighbouring pear orchard. Considerable leaf-fall had occurred at the time of spraying, on April 24, and it was not possible to contact all fallen leaves with the spray. However, most of these leaves were raked together and burnt. Sprayed leaves collected from the trees and overwintered at Perth produced few perithecia and no ascospores were detected.

The following spring there was no evidence of the disease in the orchard until after petal-fall, when scab was detected on a very few leaves and fruit. Captan at 2 lb. in 100 gallons was then applied twice to check the disease.

The autumn experiment was repeated in the 1956-57 season at Dwellingup and in addition, the PMC spray was applied to three severely scabbed trees in another
isolated orchard at Bedfordale. Both properties were sprayed at the end of March and complete defoliation occurred within a few days of spraying. This sudden defoliation was probably aggravated by hot weather conditions which followed the spray applications.

The trees at Dwellingup have remained free of scab this season and at Bedfordale scab lesions were found on four leaves only. No spring sprays were applied at either property.

**CONTROL MEASURES**

Based on the results of recent spray trials the following schedule is recommended for pear scab control:

A.—SPRING AND EARLY SUMMER.

<table>
<thead>
<tr>
<th>Time of Application</th>
<th>Material</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spur-burst and White-bud</td>
<td>1. Captan or 2. Captan plus Phenyl mercury compound. (Do not use on Josephine variety.)</td>
<td>1 1/2 lb. in 100 gals. 1 lb. in 100 gals. 1/4 normal strength.</td>
</tr>
<tr>
<td>Bloom‡</td>
<td>Captan</td>
<td>1 1/2 lb. in 100 gals.</td>
</tr>
<tr>
<td>Petal-fall</td>
<td>1. Captan or 2. Captan plus Phenyl mercury compound</td>
<td>1 1/2 lb. in 100 gals. 1 lb. in 100 gals. 1/4 normal strength.</td>
</tr>
<tr>
<td>After Petal-fall at 12-14 day intervals depending on weather conditions</td>
<td>Captan</td>
<td>1 1/2 lb. in 100 gals.</td>
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</table>

**NOTE.—**

1. Because of risk of spray injury the phenyl mercury compounds should **not** be used on the Josephine variety and no later than petal-fall on all other varieties.

2. The amount of phenyl mercury compound (chloride or nitrate) to be used in the spray mixture containing captan will depend on the brand used, but is approximately three-quarters the normal concentration.

3. Captan can be safely applied during the blossoming period to prevent infection occurring at that time. This spray would be of value for varieties in which the interval between the white-bud and petal-fall stages exceeds 14 days.

B.—AUTUMN.

<table>
<thead>
<tr>
<th>Time of Application</th>
<th>Material</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>After harvest but before leaf fall. Avoid spraying during high temperature periods</td>
<td>Phenyl mercury chloride</td>
<td>0.1% active ingredient.</td>
</tr>
</tbody>
</table>

**NOTE.—** At present this autumn spray is considered only as a supplement to the normal spring spray programme. Complete eradication of pear scab can only be expected if the orchard is well isolated from neighbouring orchards or if all orchards in an isolated district are treated. It is important to spray...
thoroughly all leaves on the trees and also any leaves which have fallen to the ground.

At current prices 100 gallons of 0.1 per cent, phenyl mercury chloride spray would cost £9 10s. However tests are proceeding with weaker strength PMC sprays to ascertain if costs can be reduced.

ACKNOWLEDGMENTS
Appreciation is expressed for the assistance given by Messrs. Mayor and Brindle, Parkerville, L. W. Wheatley, Bridgetown, T. W. Stewart, Dwellingup and G. Casotti, Karragullen, in making their orchards available for the spray trials. The help of Horticultural Field Instructors in conducting the experiments is also acknowledged.

REFERENCES

MURESK AGRICULTURAL COLLEGE
(Department of Agriculture)

Parents are reminded that applications for 1960 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1960 entrants is made after the Junior results are available early in 1959.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1959.

Before the course can be commenced students must have attained:
(a) Sub-Leaving Standard in English, Maths, A, Chemistry and Physics (including Magnetism and Electricity).
(b) Junior standard Bookkeeping.

Should places still exist for 1960 commencement after the preliminary selection early in 1959, they are filled in order of application during 1959, by qualified applicants.

Some places still exist for 1959 commencement and are now being filled by qualified applicants, i.e., those who have or are now taking the correct course at Sub-Leaving or higher standard.

Duration of Course.—Two years.
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