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Cover Page Footnote
Grateful appreciation is expressed for the assistance given by Messrs. A. Brimson, Horticultural Instructor, and W. Pickering, Field Technician, in conducting spray trials at Manjimup.

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POWDERY MILDEW OF APPLES

— Results of recent spray trials

By R. F. DOEPEL, B.Sc. (Agric.), Plant Pathologist, and S. E. HARDISTY, B.Sc. (Agric.), Horticultural Adviser

Powdery mildew of apples is found in orchard districts throughout the South-West. In recent years a rapid build-up of the disease has occurred in some plantings as a result of changes in orchard practice. Satisfactory control can be achieved by pruning out infected shoots and spraying with Karathane or Morocide.

Powdery mildew of apples has been present in Western Australia for many years and is troublesome in some districts. The disease markedly affects the growth and vigour of such susceptible varieties as Jonathan and Cleopatra whilst Yates and Granny Smith are affected to a lesser degree.

The situation of some orchards renders them more liable to severe mildew attack and in such cases growers are often not aware of the resulting depletion in tree vigour.

HOW TO RECOGNISE POWDERY MILDEW

Powdery mildew of apples is caused by the fungus Podosphaera leucotricha. It affects shoots, leaves, flowers and fruit.

On the Shoots

Infected shoots resulting from severe mildew attack during the previous growing season, are readily recognised on the dormant tree in early winter. Such shoots are white or silvered in appearance (Fig. 1.)

On closer examination the buds on these shoots appear pinched and smaller than healthy buds. Mildew-affected buds are often killed and consequently new growth can only develop from unaffected buds further down the shoot (Fig. 2.)

On the Leaves

The disease becomes obvious after bud burst as white powdery patches on the underside of the young leaves.

Infected leaves curl inwards and are narrower than normal (Fig. 3). The fungus grows down the leaf stalks, attacks the developing buds and extends along the shoot as a white coating. Later in the
Fig. 1.—Powdery mildew occurring as a white covering on dormant apple shoots

summer the mildewed leaves may develop purplish-red markings and become scorched.

On the susceptible varieties and also on Granny Smith infection shows as a yellowish-green mottle with slight puckering of the leaf.

On the Flowers
Infected fruit buds give rise to flower clusters covered with the white powdery
growth of the mildew fungus. Such infected clusters fail to develop normally (Fig. 4) and rarely set fruit.

On the Fruit
A net-like russeting is occasionally noticed on maturing fruit and results from severe mildew attack after petal fall. Jonathan appears to be the main variety affected in this manner (Fig. 5). Such russeting results in the downgrading of fancy grade fruit.

SURVIVAL AND SPREAD OF THE FUNGUS
The mildew fungus survives the winter as fungal strands (mycelium) in dormant buds on spurs and laterals infected during the previous season. At bud burst the mycelium grows actively onto the developing leaves and flowers to form white patches of mildew. Enormous numbers of tiny fungal seeds (spores) are produced by the mycelium in these patches and are blown by wind onto the new growth.

Fig. 2.—Effect of severe powdery mildew attack the previous season. Terminal and axillary buds have been killed and new growth can only develop from unaffected buds further down the shoot.
The axillary buds remain susceptible to mildew attack for about four weeks after their formation. Once the scales become tightly closed such buds are resistant to invasion by the fungus. As the shoot continues to grow each newly formed bud in turn passes through this susceptible stage.

The terminal buds on lateral shoots are prone to infection, both in the spring and again in the late summer when further shoot extension occurs. Such late-infected buds may not show any obvious mildew symptoms.

**REASONS FOR MILDEW INCREASE**

With the adoption, in recent years, of a much lighter pruning system very little cutting of leaders, laterals and spurs is practised by growers. As a result many infected shoots are left on the trees and serve to spread the disease the following season.

Furthermore, fungicidal spraying of orchards is not common practice as apple scab is not established* in Western Australia. In addition lime sulphur, which was formerly applied for insect control and also checked mildew, has been replaced by organic insecticides.

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* Isolated outbreaks of apple scab occurred in 1930, 1936, 1937, 1939, 1940 and 1947 but were eradicated.
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compared with wettable sulphur in an un-replicated block trial. On this property the mildew had also spread to adjacent Granny Smith trees, a less susceptible variety not normally attacked.

The treatments and spray schedule are outlined in Table 1.

A suitable spreader was added to all sprays to ensure adequate wetting of mildew and foliage. Selected trees in each of the experimental blocks were severely pruned during the winter to remove all obviously mildewed shoots.

Results over the two year test period indicated that a combination treatment of winter pruning and spraying with any of the fungicides Karathane, Morocide or Bayer 4964* gave effective control of powdery mildew. Wettable sulphur, although affording a moderate degree of protection, was less effective than the other test fungicides in preventing infection of healthy foliage.

RECOMMENDED CONTROL MEASURES

Where mildew has reached serious proportions, spraying alone will not achieve effective control. Any schedule adopted must be combined with appropriate pruning to prevent carry-over of the fungus.

Once the disease has been reduced to a low level the adoption of a routine spray schedule will give economic control.

1. — Pruning

All silvered shoots (refer Fig. 1) should be cut out during the winter pruning operations. Where practicable the laterals should also be tipped to remove diseased buds. This applies particularly to the Jonathan variety if severely mildewed.

TABLE 1—FUNGICIDES USED IN SPRAY TRIAL AT MANJIMUP—1961-63

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Application rate per 100 gallons water</th>
<th>Spray schedule (all treatments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wettable Sulphur</td>
<td>3 lb.</td>
<td>1. Pink bud.</td>
</tr>
<tr>
<td>Karathane</td>
<td>3 lb.</td>
<td>2. Petal fall.</td>
</tr>
<tr>
<td>Morocide</td>
<td>2 lb.</td>
<td>3. Cover spray 14 days later.</td>
</tr>
<tr>
<td>Bayer 4964*</td>
<td>6 oz.</td>
<td>4. An additional two cover sprays 14 days apart (in first year only of trial).</td>
</tr>
</tbody>
</table>

* Not available commercially.

Fig. 5.—Net-like russetting on Jonathan fruit associated with severe powdery mildew infection

Because current orchard practices no longer limit the disease it has rapidly built up to serious proportions in a number of plantings.

RECENT SPRAY TRIALS

Because of the recent build up of powdery mildew in some orchards, the opportunity was taken to test several newer fungicides against the standard sulphur spray.

Karathane, at 3 lb. in 100 gallons of water, was tested initially at Manjimup, Bridgetown and Pickering Brook in 1955 but did not prove superior to wettable sulphur in controlling mildew.

In 1961-63 in a severely affected commercial planting of Jonathan trees at Manjimup, the performance of Karathane and two other organic fungicides was
Trees should also be inspected at the pink bud stage when mildew becomes obvious on the terminal shoots and fruit spurs (refer Figs. 3 and 4). Any infected blossom and leaf clusters should be removed and burnt.

2.—Spraying

Karathane—\(\frac{1}{4}\) lb. in 100 gallons water or
Morocide—2 lb. in 100 gallons water should be applied at
(a) Pink bud.
(b) Petal fall.
(c) 14 days after petal fall.

Further cover sprays at 14-day intervals are required only if the orchard is severely affected by mildew.

Thorough spraying at high pressure is necessary and a suitable wetting agent, such as Agral, B.A.S.F., Triton, etc., should be added to the spray vat.

Avoid applying the fungicides when shade temperatures exceed 90° F. otherwise scorching of foliage and russetting of fruit may result.

Wettable sulphur (3 lb. per 100 gallons) can be substituted for Karathane or Morocide in the above schedule but comparable control of mildew may not be obtained. Sulphur sprays are also more likely to cause burning of foliage in hot weather.

ACKNOWLEDGMENTS

Grateful appreciation is expressed for the assistance given by Messrs. A. Brimson, Horticultural Instructor, and W. Pickering, Field Technician, in conducting spray trials at Manjimup.
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<th>Steel Ring</th>
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