Fungi and Shell Bark of Lemon

complex disorder of bearing lemon trees studied to establish role of fungi and control of the disease

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The best and cheapest shell-bark control—the only real control—is the use of resistant lemon selections on good root-stocks.

Control or prevention of small shell-bark lesions by fungicidal treatment is probably impossible because of the fact that many such lesions develop in the absence of fungi.

A detailed examination of many trees revealed that shell-bark lesions followed the appearance of small spots of dead tissue in the middle bark. Microscopic examination and approximately 1,000 attempts to culture fungi from these internal lesions showed no fungi present in them.

In direct contrast, large external lesions were full of fungi. Advancing margins of shell-bark lesions in orchards were sampled and placed in culture dishes or tubes to determine the fungi most commonly present. The results of fungus isolations from three orchards in three climatic situations—Riverside, Corona, Ventura—are shown in the table on this page.

Inoculation Tests

Many observations and data suggested that several fungi might be important in the enlargement of shell-bark lesions when the environment and bark condition favor fungus development. Consequently, in April 1952, inoculations in bark wounds on the trunks of 17-year-old Eureka lemon trees were made with four of the strongest decay fungi taken from shell-bark lesions. This experiment was located about four miles from the coast, near Oxnard. All except one of the inoculated trees had some shell bark at the time of inoculation. This one exception developed natural lesions at uninoculated spots within two months after treatment.

Forty-one trees were inoculated with each of the four fungi, Botrytis cinerea, Diplodia natalensis, Dothiorella gregaria, and Phomopsis citri. The fungi were inserted into chisel cuts about half-way through the bark. Lesions enlarged rapidly through July, then more slowly. Many lesions ceased growing by late summer. This deceleration of growth was especially apparent in the largest lesions. Largest lesions were produced by Botrytis. Next largest were certain ones with Phomopsis, although the average size of Dothiorella lesions was slightly in excess of Phomopsis lesions. Fungi used in the inoculations were easily recovered in July. Considerable gummosis occurred near some of the lesions, especially some of those containing Botrytis or Dothiorella. A portion of the gum remained in the young wood and inner bark and hardened. Check wounds, except a few accidentally infected, soon healed or produced only small spots of dead bark.

One year after inoculation the depth of bark killing 1" from each remaining inoculation wound was determined. The average bark thickness was 0.15", but in
BIURET
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leaves, and at higher concentrations the chlorosis increased.
The toxicity of biuret was also tested on the growth of rooted leafy-twig
Zutano—Mexican—avocado cuttings grown in two-gallon-capacity soil cul-
tures. These cultures received Hoagland’s complete nutrient solution from
time to time and on March 9, 1954, each culture received two liters of the nutrient
containing: 0, 50, 100, 150, or 200 ppm of biuret. Within a few days, wherever
immature leaves occurred, the symptoms of biuret toxicity were present, mature
leaves requiring a somewhat longer period in which to show the symptoms.
On April 9, 1954, the effects were severe, and a few of the cultures were
photographed. Many of the immature
affected leaves, even at the 50 ppm con-
centration, were shed. The initial effects
were practically all confined to the im-
mature leaves of the culture with biuret.

Chlorosis of immature leaves of large and
previously healthy avocado seedlings brought
about within a few days by the addition of
50 ppm of biuret in a single application of two
liters of nutrient to the soil cultures.

Comparison of Cultures Obtained from
Small Shell Bark Lesions with Those Grown from Dead Areas Adjacent
to Small Scratches on Trees with Shell Bark.

<table>
<thead>
<tr>
<th>Organism</th>
<th>New S.B. lesions</th>
<th>Dead spots by scratches</th>
</tr>
</thead>
<tbody>
<tr>
<td>No growth</td>
<td>38</td>
<td>12</td>
</tr>
<tr>
<td>Bacteria</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Pyrenochaeta</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Alternaria</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Diplodiella</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Cladosporium</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>Colletotrichum</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Dothiorella</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Phomopsis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other fungi</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

* Total samplings: 76 shell bark lesions, 34 dead spots near scratches.

resistance, which seems to involve the
maintenance of a good wound-healing
potential by the outer bark.
All old-line true Eureka selections are
moderately to extremely susceptible to
shell bark. Most open-type Lisbons are
no better. Carefully chosen seedling-
line—nucellar—selections from Eureka
lemons are somewhat more resistant to
shell bark than old-line Eurekas and
should be used when Eureka lemons are
propagated. Certain vigorous Lisbon or
Lisbon-type trees—especially Monroe
and Prior—have very high resistance to
shell bark. Propagation stock should be
carefully chosen from virus-free sources.

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