ROLE OF SURFACE WAX OF CHILLI FRUITS
IN INDUCING RESISTANCE TO FRUIT ROT
PATHOGENS COLLETOTRICHUM CAPSICI
AND HELMINTHOSPORIUM ROSTRATUM

V. PRAKASAM* and R. JEYARAJAN
Department of Plant Pathology, Tamil Nadu Agricultural
University, Coimbatore 641 003, India
*Present address: Department of Plant Pathology, Horticultural
Research Station, Yercaud 635 602, India

FRUIT rot of chilli (Capsicum annuum) is one of the
important diseases that affects red ripe fruits. The
pathogens Colletotrichum capsici and Helminthosporium
rostratum were isolated from the majority of
fruit samples showing fruit rot. The role of surface
wax in the resistance of green fruits to fungal
infection was studied. Surface wax was found to
confer resistance to Gloeosporium limetticola in
Citrus aurantifolia1,2 and to Erysiphe polygoni f. sp.
hordei in barley3.

Healthy fruits of three different ages, viz. 5, 15 and
25 days, free from visible injury, and uncontaminated
by spray chemicals were taken from plants.
Surface wax was extracted from 5 g of fruit skin and
estimated following the procedure of Martin and
Batt2. The fruit skins were dipped in ether and
gently agitated for 15–30 sec. This was repeated in
four successive beakers containing ether. The ether
extracts were made up to 25 ml. The volume of ether
extract was reduced to 10 ml and the wax present in
the ether extract was precipitated by adding excess of
acetone. The solvents were then allowed to
evaporate and the precipitate dried. The difference
between the final and initial weight of the beakers
gave the wax content of fruits. It was expressed as
mg/g fresh weight and mg/g dry weight. Seven
samples were used for each age group.

The surface wax extracted from the fruits was
coated on a glass slide by a method slightly modified
from Blakeman and Sztejnberg4. The wax (2 mg)
from each fruit sample was dissolved in 10 ml of
acetone and the solution was covered with a plastic
cover. A wick of cotton thread was placed in contact
with the wax solution. The other end of the wick
was passed through a glass tube placed over the
plastic cover and then allowed to touch a cavity
slide. The wax solution rose through the wick and
got deposited uniformly inside the cavity slide. This
process was allowed for 48 h and the cavity slide was
removed and placed in a ventilated container for
seven days. To this cavity slide, 0.1 ml of spore
suspension (~10^6/ml) of C. capsici and H. rostratum
containing the wetting agent Tween-20 was added.
The slide was incubated in a moist chamber for 8 h
and the number of germinating spores was counted.
One hundred spores were examined per sample and
four samples were used for the study. Spores placed
in a drop of water served as control.

Entry of fungi into fruits of different ages was
studied by the method of Shipton and Brown5.
Chilli fruits of different ages, viz. 5, 15 and 25 days,
were surface-sterilized with 0.1% mercuric chloride,
washed repeatedly in sterile water, sprayed with
spore suspension (~10^6/ml), and incubated in a
moist chamber for 48 h. The skin of the fruits was
then cut into bits and immersed immediately in 10–
15 ml of alcoholic cotton blue. They were boiled for
90 sec and then allowed to remain in the stain for
48 h at room temperature (28 ± 2°C). After rinsing
with water, they were placed in chloral hydrate
solution for 30 min, mounted in 50% glycerine, and
examined under an oil immersion lens for conidial
germination and entry.

Surface wax content of chilli fruits of different ages
is presented in table 1. An interesting trend was
noticed when the quantity of surface wax was
expressed on the basis of two factors. While there
was no significant difference between fruits of the
three ages when wax content was expressed on fresh
weight basis, it was highest in 5-day-old fruits when
expressed on the basis of the dry weight of the fruits.
In the experiment to study the possible role of wax
in inhibiting spore germination, no significant
difference was seen in the germination of spores in
the presence of surface wax extracted from fruits of
different ages (table 2). The tissue clearing technique
revealed that the germination of spores and formation
of appressoria were noted in fruits of all the ages.
However, when sections were examined, entry of
genus was seen only in 25-day-old red ripe fruits.

Table 1 Surface wax content of chilli fruits at
different ages

<table>
<thead>
<tr>
<th>Age of fruits (days)</th>
<th>Surface wax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(mg/g fresh weight)</td>
</tr>
<tr>
<td>5</td>
<td>2.90</td>
</tr>
<tr>
<td>15</td>
<td>3.00</td>
</tr>
<tr>
<td>25</td>
<td>3.40</td>
</tr>
<tr>
<td>C.D. (P = 0.05)</td>
<td>NS</td>
</tr>
</tbody>
</table>

*For correspondence
Table 2  Effect of surface wax on germination of spores of Colletotrichum capsici and Helminthosporium rostratum

<table>
<thead>
<tr>
<th>Treatment</th>
<th>C. capsici (% germination)</th>
<th>H. rostratum (% germination)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-Day old fruit wax</td>
<td>93.63 (80.02)</td>
<td>96.63 (79.73)</td>
</tr>
<tr>
<td>15-Day-old fruit wax</td>
<td>94.50 (76.73)</td>
<td>95.00 (77.77)</td>
</tr>
<tr>
<td>25-Day old fruit wax</td>
<td>96.25 (79.57)</td>
<td>95.75 (79.74)</td>
</tr>
<tr>
<td>Control (sterile water)</td>
<td>99.13 (87.27)</td>
<td>99.76 (88.57)</td>
</tr>
</tbody>
</table>

Figures in parentheses are transformed values.

C.D. ($P=0.05$)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fungus</th>
<th>Treatment</th>
<th>Fungus x treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungus</td>
<td>NS</td>
<td>4.55</td>
<td>NS</td>
</tr>
</tbody>
</table>

In the present study, the amount of wax was higher in resistant green fruits than in susceptible ripe fruits, when expressed on dry weight basis. The chief components of cuticle are cutin and wax. Cutin forms the framework of the cuticular membrane which carries the wax on its surface and embedded within it. A difference in quantity of wax between susceptible and resistant tissues has been reported in leaves of Citrus aurantifolia with reference to infection by Gloeosporium limetticola

Dickinson discussed the possibility that the waxy surface may present the first barrier by repelling the water film required by the pathogen for germination. Nutman and Roberts ascribed differences in susceptibility of coffee varieties to berry disease caused by Colletotrichum coffeum to some physico-chemical differences in the cuticle, which made penetration of the resistant variety more difficult.

The possible mechanisms of interrupting infection are: (i) thickness of natural waxy layer in barley against Erysiphe polygoni f. sp. hordei, (ii) repelling of film of water on the leaf surface in sorghum against Peronosclerospora sorghi, and (iii) chemical substance in the cuticle of chrysanthemum against Botrytis cinerea. After a critical examination of the role of wax in disease resistance, Royle suggested that there was some evidence that cuticle provided protection against pathogens.

21 October 1988; Revised 14 February 1989


MANGIFERINE-INDUCED CHROMOSOME ABERRATION IN ROOT-TIP CELLS OF SOLANUM INCANUM L.

G. KUMAR
Department of Botany, Banaras Hindu University, Varanasi 221 005, India

ROOT-TIPS from mangiferine-treated seeds of Solanum incanum showed several kinds of chromosome aberrations. The frequency of aberration increased with concentration of mangiferine. These observations are suggestive of its mutagenic property. The correlation coefficient between the aberrations and concentration is significant at the 1% level.

Mangiferine, a naturally occurring glucosylvanine, is widely distributed in higher plants such as in the members of the families Gentianaceae and Anacardiaceae. It has been found to work as an antimitotic and antifertility agent in animals, particularly mammals. These effects had not been known in plants. If this drug can cause antifertility in plants, it may be of use in plant breeding programmes, specially in those cases where fruits and seeds are not required. The present paper reports some initial observations on mitotic chromosome