A leaf spot disease of brassicas caused by Xanthomonas campestris pv. raphani

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Leaf-spot disease of Brassicaceae crops and other hosts

- Attributed to either X. campestris pv. armoraciae (McCulloch) Dye or X. campestris pv. raphani (White) Dye
- Other pathogens of X. campestris including X. campestris pv. campestris, the cause of black rot, can produce leaf spots, but the host range of this disease is narrower and the symptoms are distinct
- X. campestris leaf-spot isolates are sometimes obtained from commercial brassica seed
- The aim of this study was to clarify the nomenclature of X. campestris leaf spot isolates

Pathogenicity

- Inoculation methods:
  1. spray inoculation of bacterial suspension followed by 24-48h high humidity
  2. pin inoculation using entomopathological pin charged with bacterial growth
- Results recorded after one and two weeks
- Isolates received as either X. campestris pv. raphani and pv. armoraciae that caused leaf spots and dark sunken lesions in the middle vein, petiole and/or stem when spray and pin inoculated into a susceptible B. oleracea cultivar (Wirosa F1) were selected
- Twenty-five leaf-spot isolates were inoculated into a range of hosts

Examples of reactions of plant accessions to Xanthomonas campestris pv. raphani

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Hosts</th>
<th>Cultivarline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very susceptible to all races</td>
<td>Savoy cabbage (B. oleracea var. sabauda), Brussels sprout (B. oleracea var. capitata), Broccoli (B. oleracea var. italica)</td>
<td>Wirosa F1; Selection of FR isolate</td>
</tr>
<tr>
<td>Susceptible</td>
<td>Popular (B. oleracea var. capitata)</td>
<td>Telegraph Improved; White Beauty</td>
</tr>
<tr>
<td>Nearly susceptible</td>
<td>Hawaiian (Brassica rapa var. rapa)</td>
<td></td>
</tr>
<tr>
<td>Resistant to race 1</td>
<td>Glazed rape (B. rapa var. glabra), Mustard (B. juncea), Nasturtium (Tropaeolum majus)</td>
<td>Aurora; Bush Broad Leaf; Long Island Cheek of Gold</td>
</tr>
<tr>
<td>Resistant to race 2</td>
<td>Cauliflower (B. oleracea var. botrytis), Pepper (Capsicum annuum)</td>
<td>Mosaic F1; French Breakfast 2; Winterladle</td>
</tr>
<tr>
<td>Resistant to all races</td>
<td>Stocks (Malcolm)</td>
<td>Polo Green</td>
</tr>
</tbody>
</table>

Comparison with other pathovars

- Causes a non-vascular disease
- Has a wide host range including most brassicas, ornamental crucifers, radish and tomato
- Causes leaf spots and dark sunken lesions as described by White (1930)
- X. campestris pv. campestris, X. axonopodis pv. vesicatoria and X. vesicatoria (syn. X. campestris pv. vesicatoria) have narrower host ranges
- X. campestris pv. armoraciae symptoms include leaf spots, but no sunken lesions and is strongly pathogenic on horseradish and only weakly pathogenic on some brassicas (McCulloch, 1929)

References:
White H.E. (1930) Phytopathology 20: 653-662

Identification of races

<table>
<thead>
<tr>
<th>Race type</th>
<th>Host of origin (number of isolates)</th>
<th>Geographical origin (number of isolates)</th>
<th>Total number of isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brassica oleracea (2)</td>
<td>France (3)</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>B. rapa (5)</td>
<td>USA (1)</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>B. rapa (5)</td>
<td>Japan (1)</td>
<td>11</td>
</tr>
</tbody>
</table>

rep-PCR fingerprinting

- High variability between X. campestris pv. raphani isolates even within the same race
- But X. campestris pv. raphani isolates clustered separately from pv. campestris

Reactions recorded after one and two weeks

<table>
<thead>
<tr>
<th>Inoculation methods</th>
<th>Host (Resistance genes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray</td>
<td>Wirasa Calia ((R3))</td>
</tr>
<tr>
<td>Pin</td>
<td>Miracle ((R2))</td>
</tr>
</tbody>
</table>

Comparison with other pathovars

Dendrogram of genetic similarity of Xanthomonas campestris pv. raphani and other Xanthomonas isolates. Similarities were calculated from the combined data of REP, ERIC and BOX primer sets using Dice's coefficient. The dendrogram was obtained using the UPGMA method.

Conclusions

The X. campestris leaf-spot isolates studied here were identified as pv. raphani and not pv. armoraciae

A new type-strain (HRI 6519) and race-type-strains (HRI 6490, 8305, 6519) were assigned for X. campestris pv. raphani

Acknowledgements

This work was funded by the UK Defra.
We thank the following researchers for supplying some of their isolates: Margreet Asma, Hacène Bouzar, Diane A. Cuppels, John P. Damicone and Katsunori Tamura. We also thank Bio-Rad Laboratories Ltd for the use of FingerprintingTM II.