Late blight in Vietnam; pathogen population, host specificity and control

Vinh Hong Le¹, Xuyen Thi Ngo², Tung Xuan Pham³ & Arne Hermansen¹

¹ Norwegian Institute for Agricultural and Environmental Research
² Hanoi Agricultural University, Vietnam
³ Potato, Vegetable and Flower Research Center in Dalat, Vietnam.
Content

- Late blight in Vietnam
- Late blight population studies
- Field experiments with IPM strategies
- Growth chamber experiments on aggressiveness
Late blight in Vietnam

- Winter season (November-March) in the North
- All the year around in Lam Dong province in the South
- Fungicide application; up to daily if rain, longer interval in the north
- Crop losses variate between 0-100%
- Isolates collected in 2002-2003 (590 isolates): Vietnam still have the ”old” population of *P. infestans* which was distributed worldwide outside central Mexico before 1970’s; mating type A1 and mtDNA haplotype Ib
Population change

✓ Isolates were collected from potato and tomato fields in 2007

✓ Tested isolates (31) was paired with 2 standard isolates of A1 and A2

Mating type of 31 tested isolates from 2007

- Potato (North n=13): 0% A1, 0% A2
- Tomato (South n=18): 100% A1, 67% A2
Aggressiveness test in growth chamber

Test the hypotheses:

- Isolates from tomato or potato in Vietnam are most aggressive on the host plant they are isolated from

Isolates of *P. infestans* collected from potato and tomato from North and South Vietnam were tested for aggressiveness on leaflets and leaf discs of susceptible cultivars of potato and tomato.

Optimal humidity, 18°C and 12 hours dark/light in 7 days

- Latency period (LP)
- Lesion growth rate (LGR)
- Sporulation capacity (SC)
- Frequency of infectious sporangia (FIS)
Aggressiveness test in growth chamber

<table>
<thead>
<tr>
<th>Location</th>
<th>Isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tomato</td>
</tr>
<tr>
<td>North</td>
<td>19</td>
</tr>
<tr>
<td>South</td>
<td>14</td>
</tr>
</tbody>
</table>

- Total 53 isolates tested
- 795 leaflets were tested per host
- 7950 leafdiscs were tested per host
Results

Frequency of sporulation on leaflets during the test

<table>
<thead>
<tr>
<th>Region x Org. host</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. isolates from North</td>
<td>0.7</td>
</tr>
<tr>
<td>P. isolates from North</td>
<td>0.5</td>
</tr>
<tr>
<td>T. isolates from South</td>
<td>0.6</td>
</tr>
<tr>
<td>P. isolates from South</td>
<td>0.5</td>
</tr>
<tr>
<td>North isolates on T.</td>
<td>0.8</td>
</tr>
<tr>
<td>North isolates on P.</td>
<td>0.2</td>
</tr>
<tr>
<td>South isolates on T.</td>
<td>0.7</td>
</tr>
<tr>
<td>South isolates on P.</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Tomato isolates from north and south

Frequency of infectious sporangia (FIS)

No. of leafdiscs

Region | Test host | Region x Test host* | Test host x Spores/unit
North isolates | South isolates | Tomato | Potato | North isolates | South isolates | Tomato isolates | South isolates | 0.4 sp/unit | 1.6 sp/unit | 6.2 sp/unit | 25 sp/unit | 100 sp/unit |

No. of sporulated leafdiscs
Potato and tomato isolates from the South of Vietnam

Latency period (LP)

<table>
<thead>
<tr>
<th>No. of hours</th>
<th>Tomato</th>
<th>Potato</th>
<th>Tomato</th>
<th>Potato</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP (hours)</td>
<td>108</td>
<td>97</td>
<td>91</td>
<td>113</td>
</tr>
</tbody>
</table>
Short conclusion from Aggressiveness test

☑ Few isolates sampled from tomato infected potato leaves

☑ Most isolates sampled from potato infected both tomato and potato leaves, but were more aggressive on tomato

☑ Practical conclusion; more risky to plant tomato close to an late blight infected field of potato than the opposite
IPM field experiments

✓ Potato: in the South
✓ Tomato: in the North and South
✓ Experimental design: Randomized Complete Block
✓ Cultivars: 3 (different level of late blight resistance)
✓ Fungicide treatments:

1. Control
2. Fungicide 1/1 dose - 7 days int.
3. Fungicide ½ dose - 7 days int.
4. Fungicide 1/1 dose - 1 misty day or 25mm rain
5. Fungicide 1/1 dose - 2 misty days or 50mm rain
Tomato fields in Lam Dong

IPM

Farmers spray practice

✓ Fungicide; Mancozeb (2kg/ha= 1/1dose)
✓ One trial in dry season 2005-2006
✓ Two trials in rainy season (one in 2005 and one in 2006)
✓ All three trials died early caused by heavy infection of late blight
Tomato fields in the North

☑ Total 6 field trials carried out in the North, in the winter seasons 2005-2008

☑ No fields had natural infection of late blight

☑ 2 field trials were artificially infected by late blight and are still under harvest
Potato experiments (4 trials in Lam Dong)

Chemical used

Fungicide; Fluazinam (300ml/ha) = 1/1dose
Potato experiments (4 trials in Lam Dong)

Late blight in the foliage (RAUDPC) and tuber blight (g/10 per plot)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>RAUDPC</th>
<th>Tuber blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK-158</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Red skin 07</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>CFK 69.1</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Late blight in the foliage (RAUDPC) and tuber blight (g/10 per plot)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>RAUDPC</th>
<th>Tuber blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>15</td>
</tr>
</tbody>
</table>
Conclusion of field trials

- Tomato; weekly sprays with mancozeb 1/1 dose could not control late blight in the South
- Late blight was a minor problem on tomato in the North

- Potato; weekly sprays with fluazinam ½ dose showed good control of late blight. Use of 25mm rain or 1 misty day as spray trigger for 1/1 dose fluazinam was effective but resulted in more fungicide use

- Potato; the same strategies seems not to be effective against late blight when mancozeb is used (data are still in progress)
This work was a part of the project ”NORAD RAS 2016 – Integrated Pest Management (IPM) – Vietnam” which was supported by grants from The Norwegian Agency for Development Cooperation (Norad)