VARIATION IN PHYTOPHTHORA PALMIVORA ON COCOA IN PAPUA NEW GUINEA

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Proportion of Merchandise exports for 2008 in Millions of Kina

Total = K15,442 million Kina*

*K1 = $0.40
Proportion of export values for Agric. and Marine Products for 2008

Total Exports = K2,558.6 million Kina*

K1 = $A0.40*
Cocoa
Cocoa

Drying Cocoa Beans

Bagged PNG Cocoa for Export
P. Palmivora Diseases

- Black Pod
- Stem Canker
- Leaf Blight
Hypotheses

- *P. palmivora* is the sole species causing disease on cocoa in PNG.

- There is variation between *P. palmivora* populations on cocoa from different locations in PNG.
Methods
Morphology

- Colony morphology
- Sporangioaphore branching
- Sporangia morphology
Stellate/Striate colony morphology at 4 days
Sporangiophore Branching
Sporangia Morphology
Physiological & Biological Tests

- Physiological
  - Growth Rates on Carrot Agar

- Biological
  - Compatibility Test on Kidney Bean Agar
Colony measurements on 4-day-old cultures
Variation in lesions on pods, colony morphology and growth rate

ENB 42

ENB 45
Variation in sporangia morphology

ENB 42

ENB 45
Compatibility Studies
Mycelial Growth

DNA Extraction

RAMS Analysis
Mycelial Growth & Storage
Frequency of sporanagium length (µm) of *P. palmivora* isolates from PNG cocoa.
Frequency distribution of sporangia breadth (µm) for *P. palmivora* isolates from PNG cocoa.
Frequency distribution of sporangia pedicel length (µm) of *P. palmivora* isolates from PNG cocoa.
Frequency of Sporangia length/breadth ratio of *P. palmivora* isolates from PNG cocoa.
### Comparison of *Phytophthora* species implicated to cause disease on cocoa in PNG

<table>
<thead>
<tr>
<th>Species</th>
<th>Colony Morphology</th>
<th>Sphorangiophore Branching</th>
<th>Caducity</th>
<th>Sporangia pedicel length (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. arecae</em> (= <em>palmivora</em>)</td>
<td>Radiant, abundant aerial mycelia</td>
<td>Simple sympodium</td>
<td>Yes</td>
<td>1 – 6</td>
</tr>
<tr>
<td><em>P. palmivora</em></td>
<td>Stellate, striate</td>
<td>Simple sympodium</td>
<td>Yes</td>
<td>&lt; 5</td>
</tr>
<tr>
<td><em>P. megakarya</em></td>
<td>Cottony aerial mycelia</td>
<td>Simple sympodium</td>
<td>Yes</td>
<td>10 – 30</td>
</tr>
<tr>
<td><em>P. nicotianae</em></td>
<td>Stoloniferous/web-like</td>
<td>Loose sympodium Unbranched</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td><em>P. citrophthora</em></td>
<td>Petaloid</td>
<td>Irregular branching</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>Isolates from current study</td>
<td>Radiant., stellate, striate</td>
<td>Simple sympodium</td>
<td>Yes</td>
<td>1 – 7</td>
</tr>
</tbody>
</table>
Mating Types (A1:A2)
Randomly Amplified Microsatellite Primer CA
Randomly Amplified Microsatellite primer CGA
UPGMA dendrogram of *P. palmivora* isolates on cocoa from PNG
Conclusion

- *Phytophthora palmivora* is the sole *Phytophthora* species causing disease on cocoa in PNG.

- Variation in sporangia morphology between isolates within a farm is very high.

- There is genetic variation between isolates in PNG.
Implications of Disease Control

- *P. palmivora* population in PNG has a potential to evolve and adapt to changes.

- Presence of one large continuous population therefore breeding in one location acceptable.

- Deploy mixed cocoa cultivars and promote Integrated Disease Management.
Future Studies

- Pathogenicity tests using representative isolates on a range of cocoa clones.
- Genetic variation studies using other RAMS primers.
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