WIND SPREAD OF PLANT VIRAL PATHOGENS INTO NORTHERN AUSTRALIA

By Solomon Maina (MSc.)
ARC CoE Plant Energy Biology and School of Chemistry and Biochemistry, UWA, and CRC for Plant Biosecurity

Co-authors: Laura Boykin, Monica Kehoe, Brenda Coutts Owain Edwards, Luis Almeida, Ian Small, and Roger Jones
Main goal: Determine the risk of damaging plant viruses spreading from Southeast Asia into northern Australia
Hypothesis

The **hypothesis** being tested is that **economically important viral pathogens of agricultural and horticultural crops** are arriving in Australia via wind-borne insects virus vectors blown across the sea from Indonesia/East Timor and Papua New Guinea by prevailing wind currents.

Existing evidence for hypothesis:

**CP nucleotide analysis** of *Zucchini yellow mosaic virus* (ZYMV) isolates revealed that that the ORD river Irrigation Area is the **only place in** Australia where the **virulent south east Asian strain occurs** (Coutts et al. 2011)
Aims

1. Investigate the connectivity between viruses found in East Timor and Indonesia, and those found in northern Australia.

1. Establish whether wind-borne vectors blown from nearby countries are introducing viruses into northern Australia.

2. Identify damaging insect vectored crop viruses in East Timor and Indonesia that pose a potential threat to northern Australian crops.

1. Obtain data that establishes the likely economic impact of viruses found to have already reached northern Australia.
### Principal target virus groups and crops

**Virus groups:**
- Begomovirus
- Luteovirus
- Mastevirus
- Potyvirus
- Tospovirus

**Crops:**
- Banana
- Capsicum
- Cucurbits
- Maize/Sorghum
- Sugar Cane
- Sweet potato
- Tomato
Experimental flow for virus genome comparisons

Sample Collections
- East Timor: 106 samples (FTA Cards)
- ORIA: 62 samples
- Broome: sample in 2015
- Katherine & Darwin: sample in 2016
- QLD: sample in 2016?
- Indonesia: sample in 2016

Processing samples
- Sample collections
- Host inoculations
- Nucleic acid extractions
- PCR/RT-PCR
- Library preparations
- Genome Sequencing

Illumina sequencing

Lab activities
- Supercomputing-Magnus
- Trinity
- CLC genomics
Field symptoms in ORIA collected samples from 2015

Sweet potato

Sorghum

Cucurbits

Common bean

Capsicum

Cucurbits
Indicator plants used in biological virus characterisation
East Timor sampling sites
Tape Station Library QC

Truseq stranded Ribozero libraries for East Timor samples
On board cycle quality
sweet potato feathery mottle virus (spfmv)

1_(paired)_trimmed_(paired)_con-

Genome Assemblies
## Assemble whole genome blast results

<table>
<thead>
<tr>
<th>Sample</th>
<th>Virus</th>
<th>E. Value</th>
<th>% identity</th>
</tr>
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<tbody>
<tr>
<td>L1_</td>
<td><strong>Zucchini yellow mosaic virus</strong></td>
<td>0.00</td>
<td>&gt; 94%</td>
</tr>
<tr>
<td>L2_</td>
<td><strong>Aphid lethal paralysis virus</strong></td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>L3_</td>
<td><strong>Maize stripe virus</strong></td>
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<td></td>
</tr>
<tr>
<td>L4_</td>
<td><strong>Papaya ringspot virus</strong></td>
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<td></td>
</tr>
<tr>
<td>L5_</td>
<td><strong>Papaya ringspot virus</strong></td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>L6_</td>
<td><strong>Sweet potato virus C</strong></td>
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</tr>
<tr>
<td>L11_</td>
<td><strong>Suakwa aphid-borne yellows virus</strong></td>
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</tr>
<tr>
<td>L12_</td>
<td><strong>Sweet potato feathery mottle virus</strong></td>
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</table>
Conclusions from preliminary work done so far

- **RT-PCR** reveals **potyvirus and tospovirus** genera in **East Timor**
- **ORIA surveys** and preliminary assays **demonstrate virus occurrence in several crops**
- **Initial genome sequencing** found **8 whole genomes** of different viruses
- **RNA < RIN 2** used **successfully** for virus **genomics diagnostics**
Future research

• Collect more samples in Northern Australia and neighbouring countries
• Deep sequencing of more samples to establish virus genome connectivities
• Study the impact of selected Australian viruses to obtain biological, biomass and seed yield loss data.
Implications of project findings for Australian quarantine

Quarantine departments in airports

Quarantine departments in ports

Surveillance team
Acknowledgments

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CSIRO: Operational expenses

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Seeds of Light project in East Timor: Sample collection
Thank you.