Ministry for Primary Industries
Manatū Ahu Matua

The Impact of NGS in New Zealand Biosecurity

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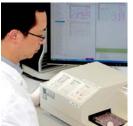
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Growing and Protecting New Zealand

Plant Health and Environment Laboratory

- Entomology: Insects, mites, and molluscs

- Bacteriology: Bacteria

- Mycology: Fungi

- Virology: Viruses, viroids, and phytoplasmas

- Nematology and Botany contracted out

Virology – *current application* (1)

- Only used for difficult diagnosis cases

- 20+ species tested   7 new viruses

  – Crops: aubergine, avocado, grapevine, kiwifruit, potato, stonefruits, strawberry, tomato

  – Herbs: lavender, Vietnamese mint

  – Ornamentals: bellflower, bromeliads, camellia, clematis, coprosma, daphne, daylily, honeysuckle, kawakawa, melicytus, pittosporum, rose, tulip

Virology – *current application* (2)

Prunus persica

Lavendula x intermedia 'Grosso'

x Electron microscopy
x 10-20 PCR

√ Herbaceous indexing

N. Benthamiana (ex. Prunus)

C. Quinoa (ex. Lavender)

? NGS

√ NGS: *Strawberry ringspot virus* (new isolate)

! PCR generic or specific primers

√ NGS: *Raspberry ringspot virus Phlox mosaic virus*

Symptoms caused by fungi

Part 1: Application of NGS in a Plant Health Lab

Virology – *current application* (3)

- Side-by-side testing of PEQ materials
  - Illumina sequencing on small RNA to test for the presence of viruses and viroids
  - Current PEQ testing methods
  - Hosts: Citrus (11), Prunus (6), Fragaria (2), Rubus (1)

- Initial results:
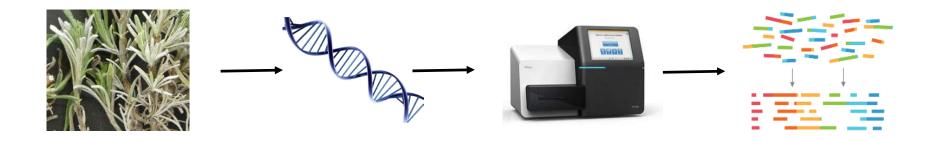 - Strong correlation between the two approaches
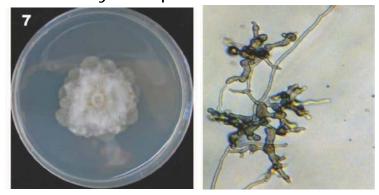
Virology – *future application*

- Continue using NGS for solving difficult cases

- More side-by-side testing of PEQ materials

- Use NGS routinely
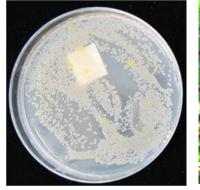
Mycology & Bacteriology – *current application*

House-keeping genes

qPCR

Ceratocystis sp.

Pseudomonas syringae pv. *actinidae*

Abad et al. 2014. Mycologia 106: 431-447

Mycology & Bacteriology – *future application* (1)

Full genome sequencing

Response
Myrtle rust

Import requirement
Ceratocystis fimbriata

Prunus sp.

Predict Biosecurity risks

- Sequencing of high profile taxa from authentically identified specimens

- Predict viability of *Phytophthora* sp. and other oomycetes by sequencing eRNA

- Identify genetic signatures of variants of key bacterial pathogens from plant tissues

- Develop a platform for biosecurity detections through eDNA sequencing

Mycology & Bacteriology – *future application* (2)

- Continue using NGS for solving difficult cases

- Side-by-side testing of PEQ materials

- Use NGS routinely

Part 1: Application of NGS in a Plant Health Lab

Entomology – *current application*

- Only used when morphological identification is difficult or for confirmation

Queensland Fruit fly
(*Bactrocera tryoni*)

Entomology – *future application* (1)

- Determining insect species composition from surveillance programme
    - at any stages of their life cycles AND
    - in large bulk insect trap samples

Biting midges (*Culicoides*)

Saltmarch mosquito

(*Aedes taeniorhynchus*)

Entomology – *future application* (2)

- Geographical origin tracing of exotic pests

Queensland Fruit fly
(*Bactrocera tryoni*)

Brown marmorated stink bug
(*Halyomorpha halys*)

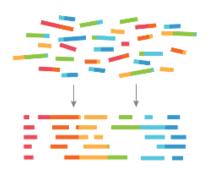IF YOU FIND ONE OF THESE:

**CATCH IT.
CALL US.**

EXOTIC PEST & DISEASE
HOTLINE 0800 80 99 66

Exotic pests like the brown marmorated stink bug are a threat to our primary industries and environment. If you've been overseas, or received parcels/ shipments from overseas, check your luggage or parcels indoors for insects.

New Zealand Government

Ministry for Primary Industries

Main challenges

$$$$$

If 6 samples per NGS run
√ Virology
√ Bacteriology
x Entomology
x Mycology

Nucleotide BLAST
nucleotide ▶ nucleotide

Bioinformatic skills

Validation

Future

- Routinely used for general diagnosis
- Replace current PEQ testing requirements