Understanding and controlling flower blights in macadamia orchards

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FABI, University of Pretoria

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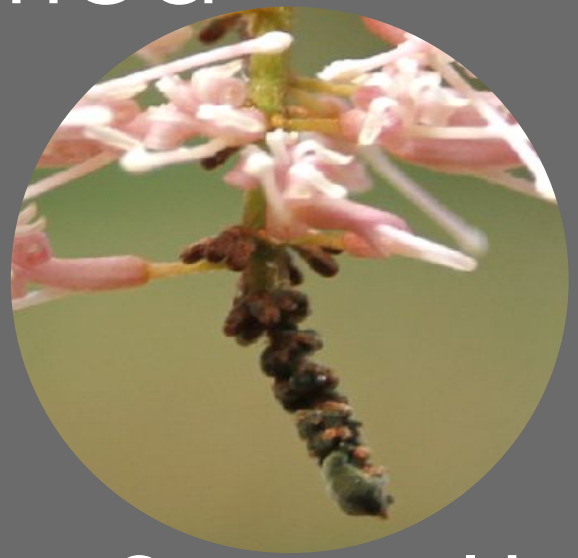
Macadamia flower blight disease complex in South Africa

Dry flower disease

- *Pestalotiopsis* spp.
- *Neopestalotiopsis* spp.



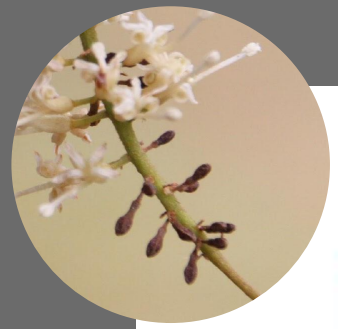
Green mould

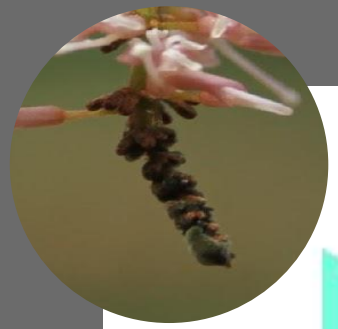
- *Cladosporium* spp.

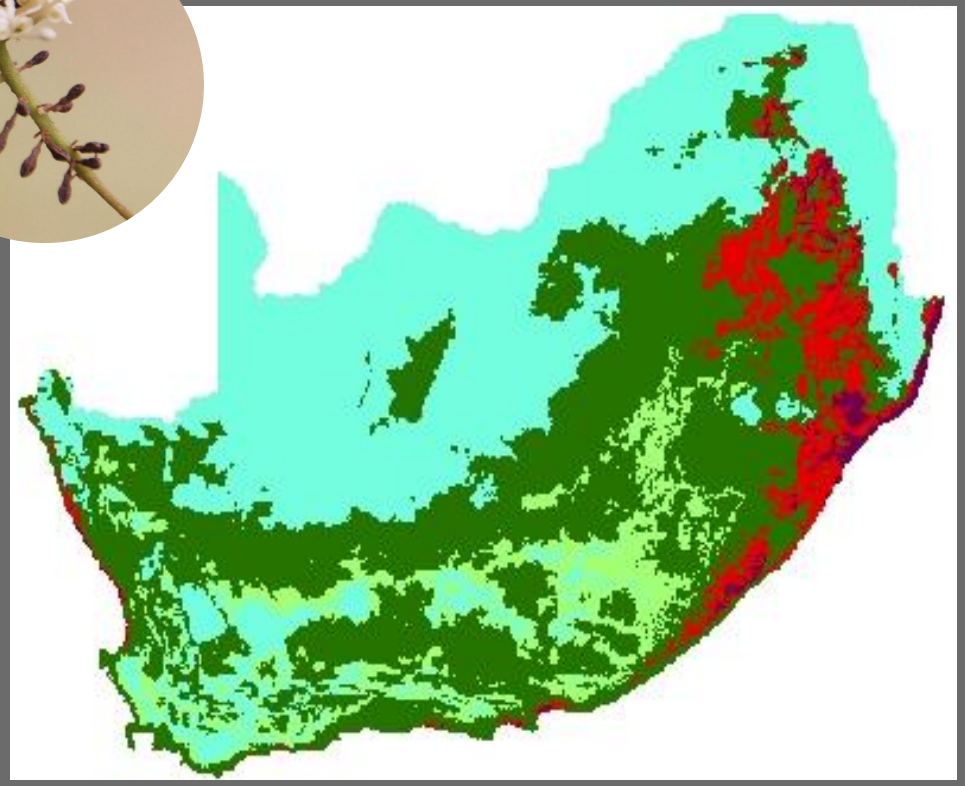
Grey mould

- *Botrytis* spp.

Flower blight risk maps







Severe risk
Moderate high
Low risk
High risk
Moderate low

(Dr Ilaria Germishuizen)

Dry flower disease of macadamia

Symptoms:

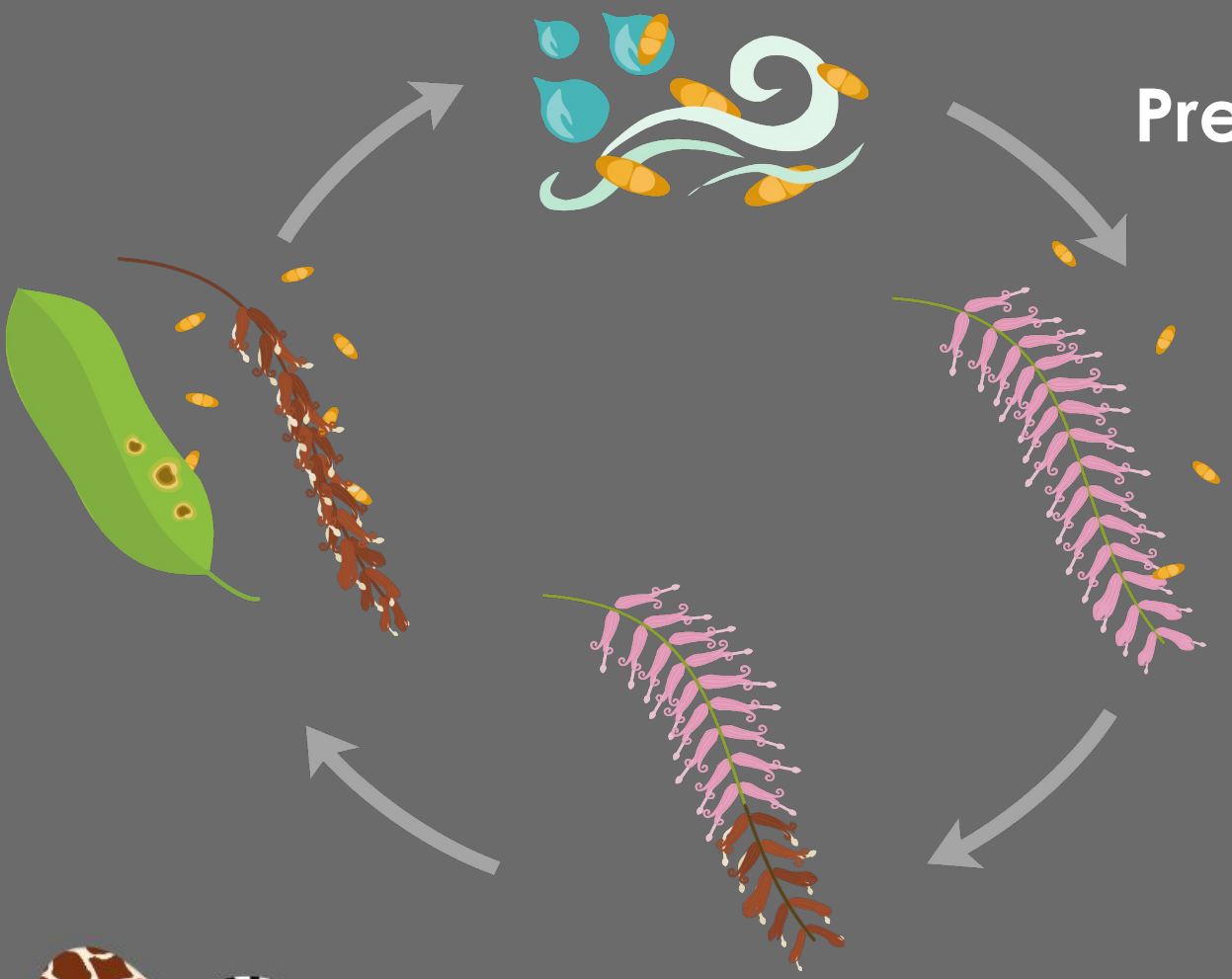
- Flower blight, necrosis and dieback
- Dry appearance of flowers and raceme

Causative agents:

- Two *Pestalotiopsis* species
- Six *Neopestalotiopsis* species

 The most prevalent species found in surveys conducted in Australia and South Africa

Dry flower disease of macadamia



Presence of *Neopestalotiopsis* species

- Healthy and diseased flowers
- Different stages of flowering
- Potential sources of inoculum

Dry flower pathogen presence

MACADAMIA protection programme

DNA metabarcoding

Simultaneous identification of many taxa within the same sample

DNA based ID

N. macadamiae

N. drenthii

N. olumideae

N. zakeelii

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Dry flower pathogen presence

DNA metabarcoding

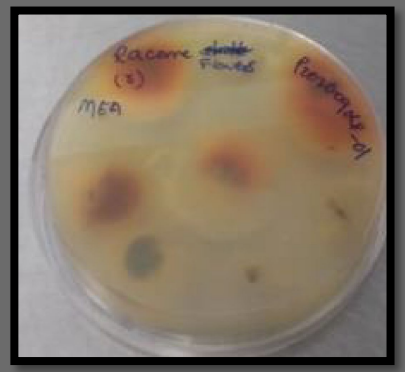
Simultaneous identification of many taxa within the same sample

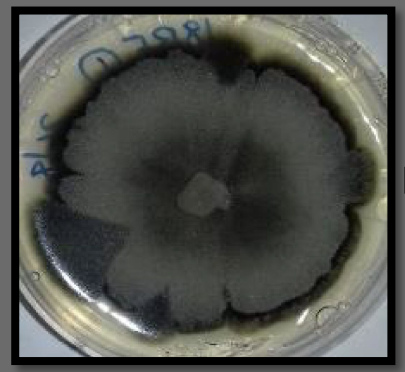
Quantitative PCR

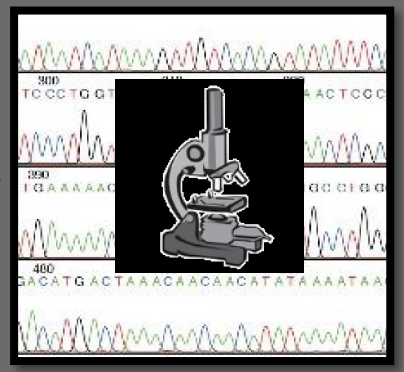
Measures the amount of inoculum present

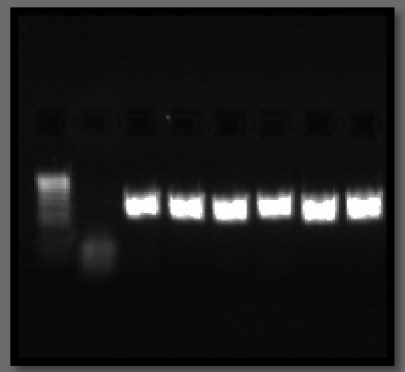
Rapid diagnostics

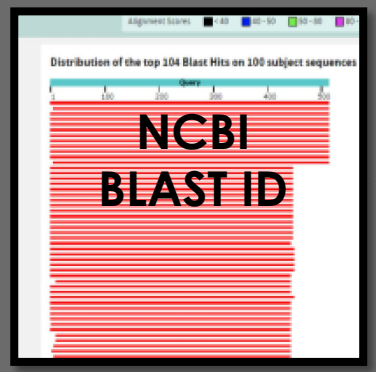
Rapid diagnostic tool to streamline traditional identification











Rapid diagnostics

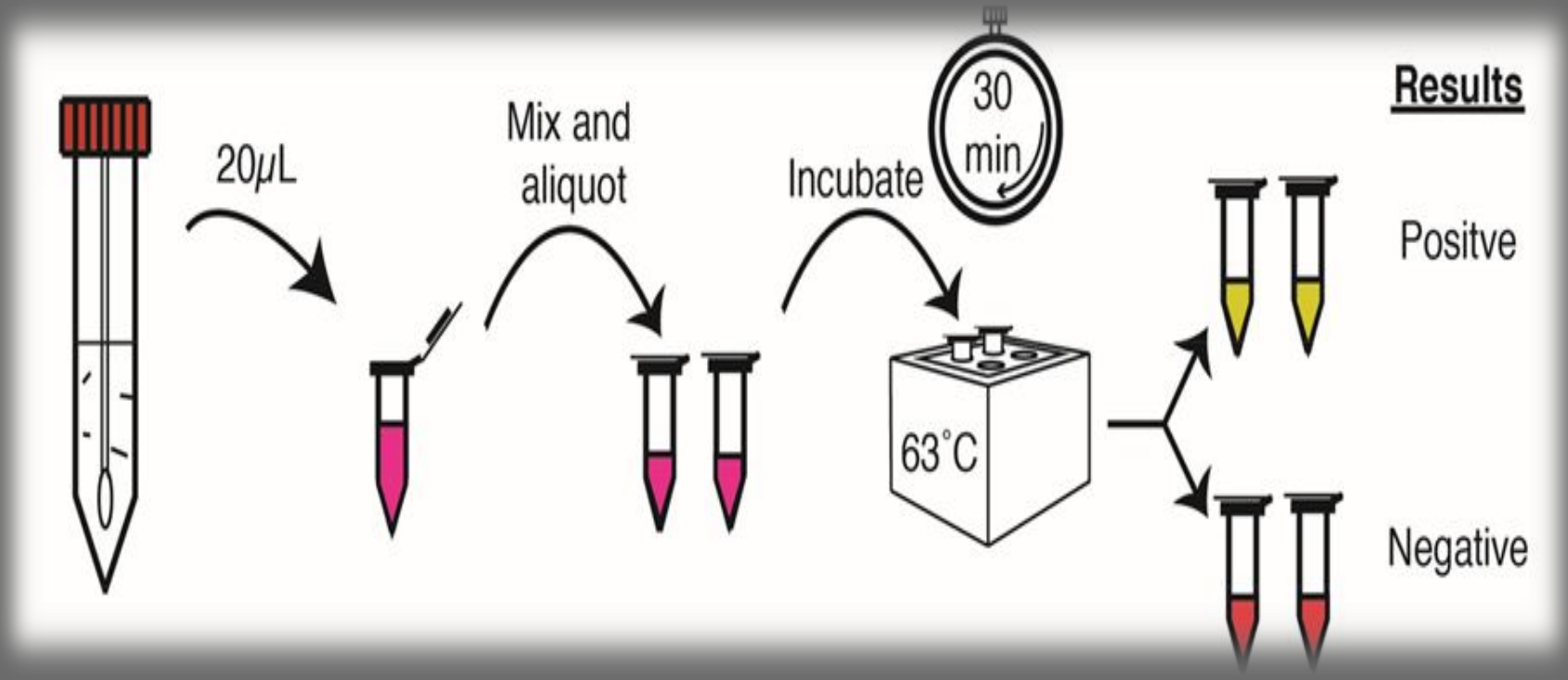
Thrip damage vs. dry flower symptoms

Thrips tenellus

Scirtothrips aurantii (citrus thrips)

Photo credits: M. Kibor, E. Joubert

Rapid diagnostics



LAMP assay – targets unique region in genome

Genomes to understand fungal biology

Mating type strategies

- Recombination potential and sexual state
- Fungicide resistance

Virulence factors

- Pathogenicity – related genes

Trophic lifestyles

Genome sequencing dry flower pathogens

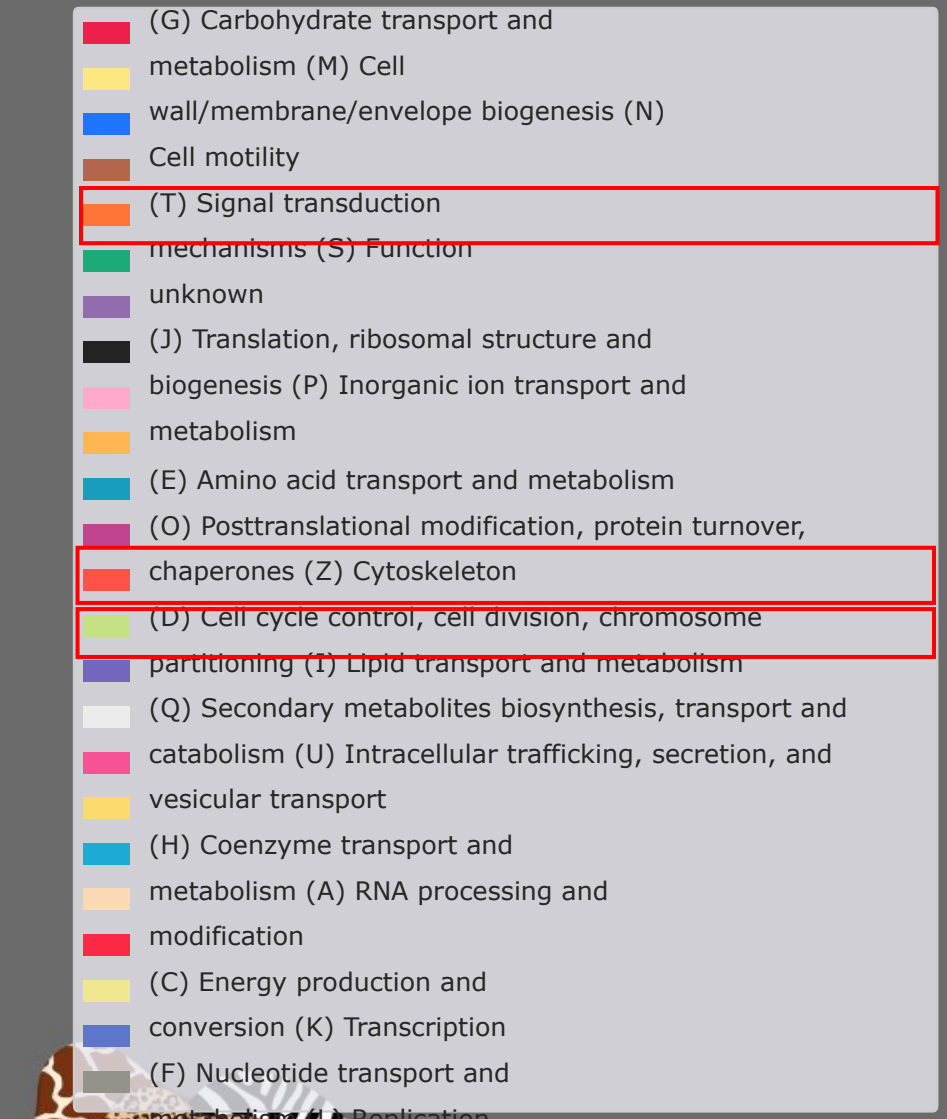
- *Neopestalotiopsis macadamiae*
- *Neopestalotiopsis drenthii*
- *Neopestalotiopsis olumideae*
- *Neopestalotiopsis zakeelii*

Genome sequencing dry flower pathogens

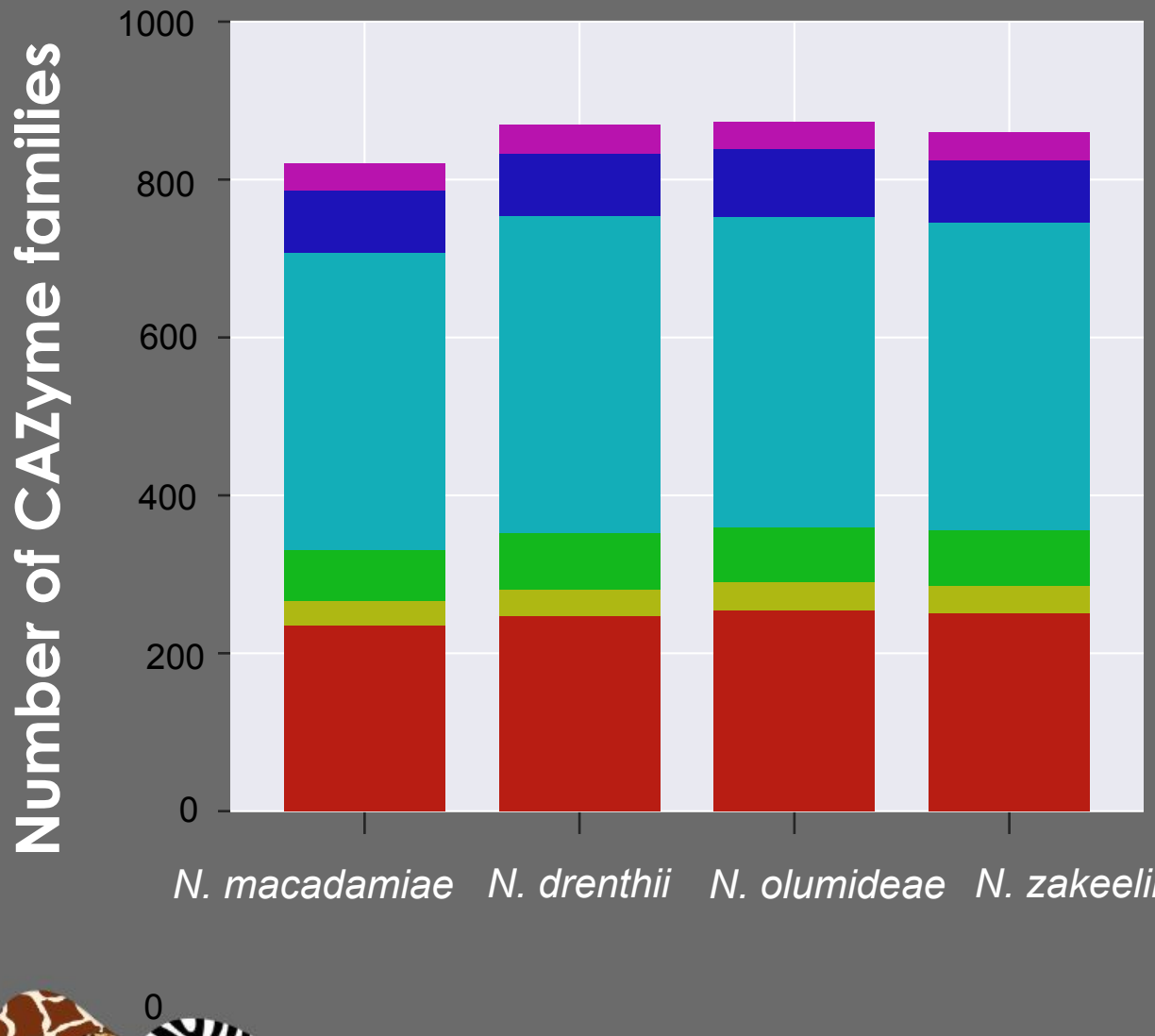
Species	# of genes	# of proteins
N. macadamiae	14 221	14 012
N. drenthii	14 838	14 604
N. olumideae	14 933	14 678
N. zakeelii	14 560	14 330

Genomics

"Housekeeping" genes



Genomics

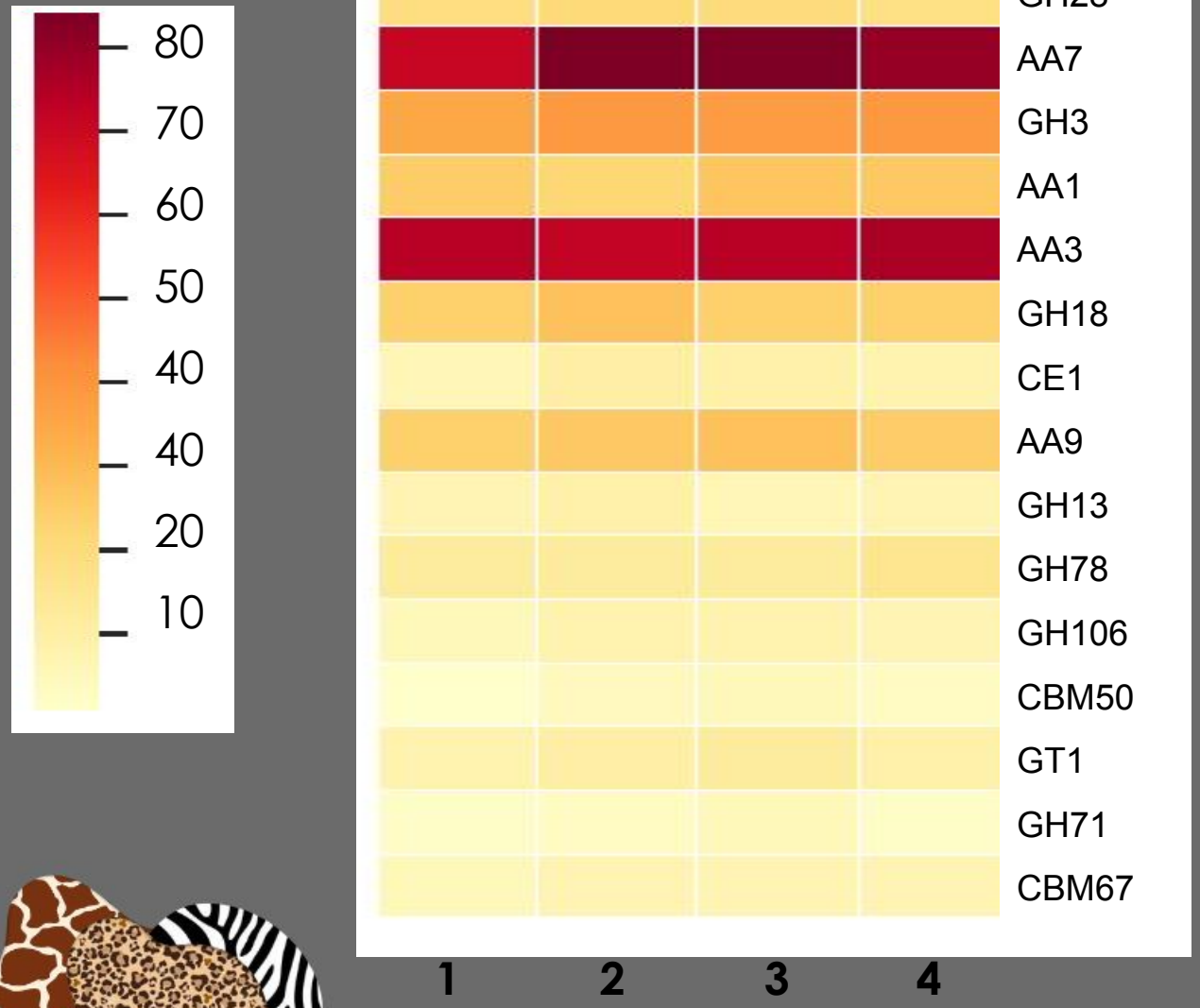


Carbohydrate Active Enzymes

AA and **GH**:
Plant cell wall degradation

- AA: Auxillary activities
- CBM: Carbohydrate-binding module
- CE: Carbohydrate esterase
- GH: Glycoside hydrolase
- GT: Glycosyltransferase
- PL: Polysaccharide lyase

CAZymes



1. *Neopestalotiopsis macadamiae*
2. *Neopestalotiopsis drenthii*
3. *Neopestalotiopsis olumideae*
4. *Neopestalotiopsis zakeelii*

Trophic classification of dry flower pathogens

MACADAMIA protection programme

Necrotroph

Kill host plant cells for nutrients

Botrytis cinerea

Vasculartroph

Wilts, anthracnoses and rots

Fusarium solani

Mesotroph

Appressorial feeding structure

Colletotrichum spp.

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Take-home message

- Improved understanding the biology of dry flower pathogens will contribute to improved management practices
- Rapid diagnostic tool will allow for accurate and streamlined identification of dry flower pathogens
- Improved timing of fungicide application

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Acknowledgements

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