





Sentinel plant research and monitoring PSHB

Mesfin Gossa & Trudy Paap

Beetle Workshop FABI, University of Pretoria

01 November 2019

Invasive insects and pathogens pose major threats



Dutch elm disease Scolytus multistriatus Ophiostoma novo-ulmi



Laurel Wilt *Xyleborus glabratus Raffaelea lauricola*



PSB Euwallacea fornicatus Fusarium euwallaceae



The emerald ash borer, *Agrilus planipennis*



Asian longhorn beetle, Anoplophora glapripennis



The European gypsy moth *Lymantria dispar*

A combination of lines of defense required

- Many damaging pests and pests are unknown to science prior to their arrival in a new environment
- **Biosecurity** remains the first line of defense
 - a series of measures against the entry and spread of pests and diseases (ISPM, regulations on exchange of plant and wood material, quarantine,.....)
- **Early detection** can be considered a second line of defense important for eradication, containment, control/management intervention



A move towards the use of sentinel plants/plantings

- Sentinel plants: plants present in the vicinity of high-risk sites or in urban areas that are inspected at regular interval for signs and symptoms of pest attack
- Sentinel plantings: are located in the country of origin of pests
- botanic gardens and arboreta present a unique opportunity
- over 3,000 botanic gardens with a wide geographical distribution
- house an estimated 30-40% of known plant species



Map of known botanic gardens courtesy of BGCI's GardenSearch database - http://www.bgci.org/garden_search.php

'Sentinel plant research'

- serve as an early warning system to identify new and emerging pest and pathogen threats (new pest-host associations)
- requires global coordination
- International Plant Sentinel Network (IPSN) <u>www.plantsentinel.org</u>
 - provides platform to coordinate information exchange between botanic gardens



SANBI funded postdoc project

- initiated in 2016 under the framework of IPSN
- focuses on monitoring plant health in botanic gardens and arboreta
- First term: Mid 2016 to end 2018 Trudy Paap PSHB was detected
- Second term: 2019 and 2020 Mesfin Gossa



Project aim

Improve surveillance and identification of new and emerging pest and pathogen risks by using botanical gardens and arboreta as sentinel sites for plant health monitoring in South Africa

Key tasks

- Interact with botanical garden staff to build capacity to detect and manage tree pests and pathogens
- Provide a status report on pests and pathogens in the gardens
- Assist with consolidating quarantine lists of pests and pathogens

Process involved

- Pest surveillance and detection active + passive surveillance
- Pest identification morphological + molecular
- Pest characterization
- Pest risk analysis
- Evaluating pest management options



Target locations for pest surveillance

Borders

- involves inspecting goods arriving in a country for signs and symptoms of pests
- only small proportions of goods can be inspected

Post-border areas

- targeted surveillance at high risk areas (seaports, airports, botanic gardens)
- can be done using traps, sentinel plants and intensive surveys

Plantations, natural forests and urban <u>forests</u>

 carried to assess forest health and to detect outbreaks of endemic or new pests



Aloe weevils







Control and management

- Control often difficult
- hand picking of the adults
- removing the rotting crown leaves and hand picking the grubs
- apply insecticides in the crown
- cultivate aloes in suitable habitat

Aloe scale, Duplachionaspis sp.



Control and management

- Natural enemies (parasitic wasps and predatory beetles) keep the population under control: *Aphytis griseus*, *Zaomma cestus*, various species of ladybird beetles
- Insecticidal control is an option sometimes when infestations go out of hand

Cypress aphid, Cinara cupressi



A serious invasive aphid in East and Southern Africa threatening *Juniperus*, *Cupressus*, *Widdringtonia* trees

Control and Management

- host plant resistance for example *Cupressus torulosa*, *C. funebris* and *C. arizonica*
- a biological control agent, *Pauesia juniperorum* was
 imported from Europe to
 Malawi and found effective
- chemical control is not practical since the aphids live deep inside the canopy

Cycad aulocaspis scale, Aulacaspis yasumatsui



Control and management

- an invasive insect that kills susceptible cycad (Cycas revolute)
- control often difficult
- repeated treatment with horticultural oils
- approved systemic insecticides
- wash plants with a vigorous spray of water

Aspidiotus? capensis on an endemic cycad Encephalartos senticosus





Only known from South Africa and very little known about this insect

African citrus psyllid, Trioza erytreae on Clausena anisata and Zanthoxylum davyi



Trioza erytreae – a vector of the serious Citrus Greening Disease (Huanglongbing)

Phytophthora root and collar rot





Phytophthora root and collar rot

Loss of fine roots

Ganoderma (multiple species)

*G. australe G. destructans G. enigmaticum G. gibbosum G. resinaceum

Armillaria mellia and gallica

Brabejum stellatifolium Olea cupensis subsp. cupensis







Polyphagous shot hole borer (*Euwallacea fornicatus*) and Fusarium euwallaceae

2017 KZN National Botanical Gardens Pietermaritzburg



(Platanus x acerifolia)





Monitoring PSHB in botanic gardens and arboreta

• Regular tree health surveys in the gardens

- helps to understand host range and distribution of PSHB

	Garden	Category	Province
1	Pretoria NBG	SANBI	Gauteng
2	Pretoria NZG	SANBI	Gauteng
3	Walter Sisulu NBG	SANBI	Gauteng
4	KwaZulu Natal NBG	SANBI	KZN
5	Durban BG	Non-SANBI	KZN
6	Kirstenbosch NBG	SANBI	Western Cape
7	Arderne Gardens	Non-SANBI	Western Cape
8	Harold Porter NBG	SANBI	Western Cape
9	Garden Route	Non-SANBI	Western Cape
10	Karoo Desert NBG	SANBI	Western Cape
11	Free State NBG	SANBI	Free State
12	Lowveldt NBG	SANBI	Mpumalanga
13	Kwelera NBG	SANBI	Eastern Cape
14	Thohoyando NBG	SANBI	Limpopo





Monitoring PSHB

- First record of PSHB in Pretoria National Zoological Garden
 - -175 trees assessed (57 tree species), 33 trees infested (11 tree species), 20% infestation

	Tree species	Common name
1	Acacia galpinii	Monkey thorn
2	Acer negundo	Box elder
3	Brachychiton discolor	Pink flame tree
4	Dombeya rotundifolia	wild pear
5	Erythrina lysistemol	Coral tree
6	<i>Erythrina</i> sp.	Coral tree
7	Platanus x acerifolia	London Plane
8	Quercus kellogii	Californian black oak
9	Searsia lancea	karee
10	Liquidambar styraciflua	Liquid ambar
11	Unknown tree species	



Capacity building of garden staff to detect and manage tree pests and pathogens, including PSHB















Acknowledgements

- Mike Wingfield
- Bernard Slippers
- Brett Hurley

- John Wilson
- Wilhelm de Beer
- Staff of Botanic Gardens



South African National Biodiversity Institute

