

Report on tree health at Walter Sisulu National Botanical Gardens

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Two surveys assessing tree health have been conducted within the Walter Sisulu NBG, the first in May 2017, the second March 2018. A number of issues that present a serious threat to the health of the trees in the garden have been detected and diagnosed. These are presented here, together with management recommendations.

Ganoderma

Decay of dead wood is an important natural process and is required for the recycling of nutrients and organic materials, as well as hollow creation which provides animal habitat. Many natural decay fungi are saprophytes, breaking down dead wood. When decay fungi attack living wood tissues, they are considered pathogens. This attack can make trees vulnerable to breakage and uprooting.

The genus *Ganoderma* (Polyporales: Ganodermataceae) includes important pathogens that cause root and basal rots. Several species are known to occur in South Africa including *austroafricanum*, *destructans*, *enigmaticum*, *gibbosum* and *resinaceum*. Of these species, *G. destructans* is likely to be having the biggest impact in the Walter Sisulu NBG. First described from root and basal rot of *Jacaranda mimosifolia* in Pretoria (Coetzee et al., 2015), this fungus appears to have been building up inoculum levels in the gardens and has been observed fruiting on several tree species including *Dombeya cymosa* (Fig 1), *Combretum* spp. and *Celtis africana*. Additional susceptible host trees have been recorded in the Pretoria NBG including *Acacia xanthophloea* and *Searsia* spp. and it is highly probable that the host range is wider than currently recorded.



Fig 1. *Ganoderma* fruiting at base of *Dombeya cymosa*

Fig 2. Tree failure resulting from root rot

There are no known treatment options for this root rot disease. Infection by this fungus leads to a decline in health and dieback of the tree, and can ultimately lead to tree death. Further, root rot destabilises the trees making them more vulnerable to wind throw (Fig 2). Environmental stress will

likely contribute to disease development therefore it is important to minimise damage to trees and their roots. Alleviation of soil compaction and water logging issues (which are frequently experienced by trees in turf environments) can reduce tree stress. Where possible as much stump and root material should be removed in instances where trees have died as a result of *Ganoderma* root rot, in an effort to reduce inoculum loads. The use of infected chipped material should be avoided (unless well composted) as the fungus will persist and can establish in new areas of the garden through the application of infested mulch to new beds.

Recommendations

Given there are currently no known treatments, management of *Ganoderma* root rot is primarily a matter of prevention

- Avoid excavation work and other activities in close proximity to trees to reduce risk of mechanical damage to roots and base
- Use good pruning techniques to facilitate wound closure
- Reduce environmental stress resulting from soil compaction and water logging
- Avoid the use of chipped wood unless well composted ie. do not use green mulch
- Where trees show symptoms of decay, assessment is recommended as trees that are severely decayed can present a hazard to people and property
- Remove dead and decaying stumps to reduce inoculum load

Tree maintenance

Managing trees in a garden environment is not without challenges, however, a number of avoidable issues have been observed in Walter Sisulu NGB, the correction of which would greatly benefit overall tree health and vigour.

Pruning is an essential component in tree maintenance to improve form, remove dangerous or defective branches, or to provide clearance between a tree and a structure. Small wounds on young vigorous trees heal much more rapidly than large wounds on old trees, therefore formative pruning should take place when trees are young, and large limbs should only be removed if they are dead or dangerous. When pruning, it is essential to minimise the impact of wounds. This is aided by choosing the appropriate tool for the job, keeping tools sharp, disinfecting tools between trees and taking care to avoid rip cuts, stub cuts and flush cuts. Good pruning favours fast wound closure and limits decay, while poor pruning is detrimental to recovery, leaving trees vulnerable to decay fungi.

Trees are long lived and bear the legacy of bad maintenance. It takes time and energy for a tree to recover from pruning that results in damage. This leaves trees stressed and more vulnerable to pest attack and decay. Fig 3 shows examples from the gardens where pruning has been carried out with tools not appropriate for the task, producing a result far from the desired clean cut in the correct location. In addition stubs have been left and rip tears have resulted.



Fig 3. Examples of damage in WSNBG resulting from the use of inappropriate tool for the sized branch, and poor pruning technique resulting in stub cuts and rips

Managing trees in turf is not an easy combination. Mechanical damage to the base of trees frequently occurs as a result of impact from mowers and trimmer line. Soil compaction, soil moisture fluctuations and lawn fertiliser regimes can all lead to tree stress. The elimination of turf from the base of trees by mulch circles (Fig 4) is one technique that can be employed to alleviate some of these impacts. This can assist in soil moisture retention, moderating soil temperatures, improving soil structure, increasing the presence of beneficial soil microbes and reducing 'mower blight'. However, care should be taken to avoid direct contact of mulch against the tree base, and the use of uncomposted/green mulch should be avoided.



Fig 4. Elimination of turf from tree base by mulch circles

Recommendations

- Remediation of previous poor pruning
- Adequate training for staff carrying out pruning tasks
- Disinfest tools between jobs
- Consider elimination of grass around tree base by creation of mulch circles, but avoid direct contact with trunk and the use of uncomposted/green mulch

Polyphagous Shot Hole Borer

In 2017 an invasive ambrosia beetle, the polyphagous shot hole borer (pshb) *Euwallacea* sp. nr. *forficatus* (Fig 5), was detected together with its fungal symbiont *Fusarium euwallaceae* causing Fusarium dieback on the lane of plane trees (*Platanus x acerifolia*) in the KwaZulu-Natal National Botanical Gardens (Fig 6) (Paap et al., 2018). Native to southeast Asia, the pshb has caused serious damage to trees in California and Israel, where it has also established in recent years.

In January this year, the presence of the beetle was confirmed in Sandton, Johannesburg. This pest and associated fungus present a worrying threat to the health of South African trees. The trees affected in the Sandton area include the non-native ornamentals Japanese maple, London plane, kapok and Liquidambar.



Fig 5. Adult female polyphagous shot hole borer, about 2mm long



Fig 6. External symptoms on plane tree, removal of bark exposing symptoms caused by fungal colonisation

A growing list of indigenous host trees also appear susceptible, including *Acacia sieberiana* var. *woodii*, *Harpephyllum caffrum*, *Erythrina* spp., *Combretum* spp. and *Diospyros lyciodes*. Symptoms vary on different tree species (PSHB symptom bulletin), however, the fungus leads to branch dieback and ultimately death of susceptible beetle infested trees (Fig 7).



Fig 7. Branch dieback on *Acacia sieberiana* var. *woodii* and *Harpophyllum caffra*

During an assessment of tree health undertaken in the WSNBG on 27th March 2018, symptoms of ambrosia beetle attack were observed on four tree species: *Acacia sieberiana* var. *woodii*, *Cordia caffra*, *Erythrina lysistemon* and *E. abyssinnica* (Fig 8).



Fig 8. Early stages of pshb attack on *Acacia sieberiana* var. *woodii* (left) and *Erythrina lysistemon* (right)

Very few beetle 'hits' were observed and there was little evidence of colonisation by the fungal pathogen *Fusarium euwallaceae*, suggesting the beetle has only recently arrived and may be in the process of establishing in the garden. Nevertheless, isolates resembling *F. euwallaceae* were recovered from sampled material. This identification is based on culture and spore morphology, and will be confirmed by DNA sequencing. The arrival of this pest presents a major threat to the health of trees in WSNBG.

While chipping infested wood may kill the majority of beetles present, it is estimated that a small percentage (3-5%) will survive this process. Given the extent of pshb infestation in the Sandton area and the current lack of a designated dumping site for dead and dying branches and trees, there is a risk associated with bringing green mulch into the gardens from outside sources. It is strongly recommended that this is avoided. Composted mulch would provide a safe alternative, as temperatures reached during the composting process will kill beetles and larvae that have survived chipping.

Control options are currently very limited. Chemical treatment trials have been initiated in California, with combined insecticide and fungicide applications showing some promise when trees are treated during early stages of attack (Eatough Jones & Paine, 2017). There are plans to establish similar treatment trials in infested stands of trees in Sandton in the near future to determine the efficacy of chemical treatments in reducing beetle attack and the development of fungal infection.

Recommendations

- Continue monitoring to determine possible susceptible tree species within WSNBG
- Do not bring green mulch into the garden from outside sources
- Do not move plant material with signs of beetle infestation off site, infested branches should be chipped, sealed in plastic and kept in direct sunlight to kill beetles and larvae. Alternatively, wood should be burnt on site

References

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