Report on Plant Health at Kirstenbosch National Botanical Garden

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A survey was conducted in Kirstenbosch National Botanical Garden (KNBG) on the 3rd and 4th of June 2019 with the objective of identifying major plant health problems in the garden. Assessments were made in various parts of the garden. Samples were collected from damaged plant parts and plant showing signs and symptoms of pest attack. Insect samples previously collected by Adam Harrower, a horticulturalist at the garden were also obtained. Samples were diagnosed using morphological and molecular techniques and the results are presented as follows with some management options.

1. Cypress aphid, *Cinara cupressi* sensu lato (Hemiptera: Aphididae)

Cinara cupressi belongs to the sub-genus *Cinara (cupressobium)* and is native to North America although there are some indications that it could be native to Syria. It was reported from Europe (Belgium, Bulgaria, France, Italy and Portugal), the Middle East (Israel, Jordan and Yemen), Africa (Burundi, Democratic Republic of Congo, Ethiopia, Kenya, Libya, Malawi, Mauritius, Morocco, Rwanda, South Africa Tanzania, Uganda and Zimbabwe) and South America (Argentina, Brazil, Chile and Colombia). *Cinara cupressi* has seriously damaged trees belonging to *Cupressus*, *Juniperus*, *Widdringitonia* and other Cupressaceae in various parts of its invasive range. For example, it has caused severe damage to stands of indigenous Cupressaceae such as *Juniperus procera* and *Cupresses lustanica* in East Africa and *Widdringtonia* species in Malawi. The loss of trees due to damage by cypress aphid in commercial plantations and native forests had significantly reduced wood supply in eastern and southern Africa. A total of US$27.5 million worth of cypress trees were killed in 1991 alone. It has also damaged infrastructures such as hedges and fences which were made of living trees. In the current survey, this aphid was detected on *W. nodiflora* (Figure 1). In South Africa, invasion by this aphid is likely to threaten the already endangered indigenous trees species such as *W. wallichii* and *W. nodiflora*.

Management options

In general, management of these aphids is not easy as they camouflage the trunk and hide in the tree canopy, produce several generation every year and in regions with colder winter they

develop sexual females and winged males, and overwinter as eggs. In particular, the camouflaging and hiding behaviour of these aphids makes the use of insecticidal control challenging. Interestingly, a biological control agent, *Pauesia juniperorum* (Hymenoptera: Braconidae) from Europe was introduced to different countries and found effective in reducing the impact of *C. cupressi* in Malawi, Kenya and Uganda.

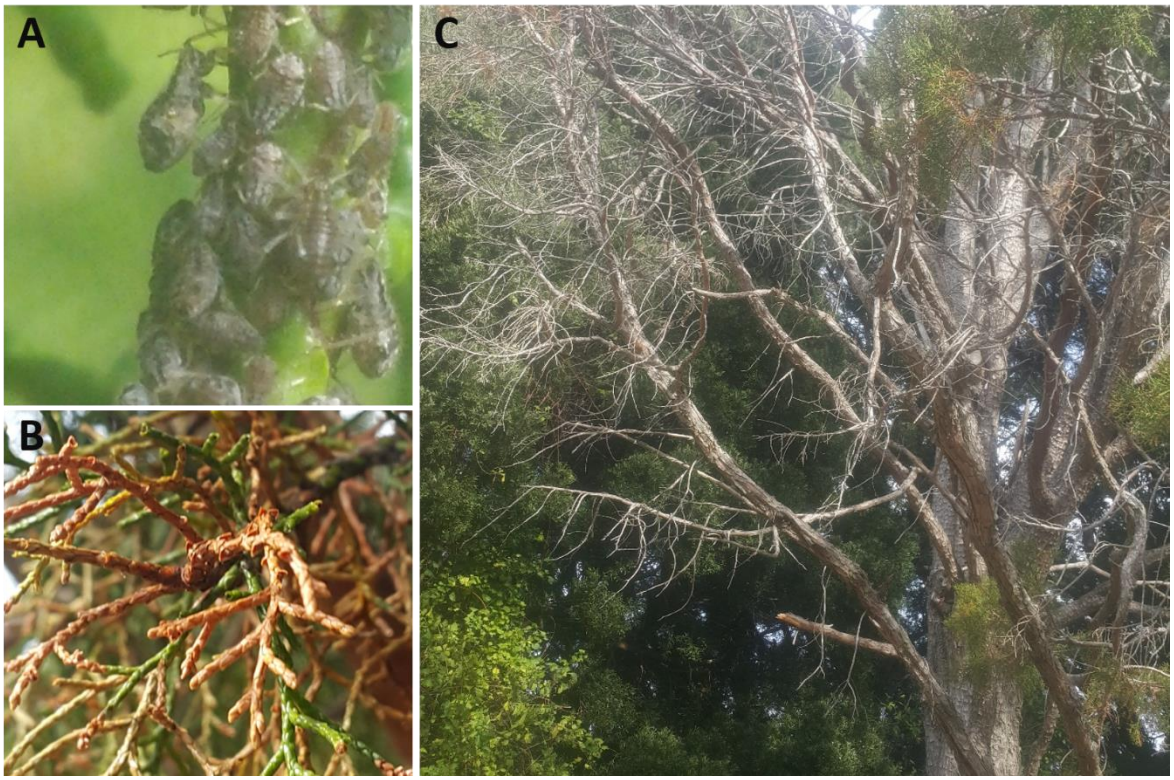

Figure 1. Cypress aphid infestation on a *Widdringtonia* tree: (A) aphids camouflaging the trunk and hiding in the canopy, (B) aphid infested foliage turning reddish-brown, and (C) progressive dieback from the outer edge of the canopy of infested trees.

2. Cycad stem borers, *Phacecorynes* spp. (Coleoptera: Curculionidae)

Phacecorynes weevils are known to bore deep into stems of *Encephalartos* cycad. In a survey conducted in KNBG two species, namely Large cycad stem borer, *P. sommeri* and Ace-of-spades cycad stem borer, *P. variegatus* were found attacking *Encephalartos* cycad (Figure 2). These species occur on a wide range of species within the genus *Ecephalartos*. Both of these species have been recorded primarily from Eastern Cape, KwaZulu-Natal and Mpumalanga from wild cycad population. It is likely that these weevils were transported to the Western Cape together with cycad stems. Under natural condition, these weevils exclusively attack sick, dying, dead or rotting trunk. However, in human made environments such as botanical gardens all transplanted plants and plants subject to other stresses (drought, overwintering,

fertilizers, etc.) are vulnerable. Under garden conditions, the death rate of infested cycads is very high. Detection of these weevils is very difficult as they develop within the cycad stem tissue. They are often found after the plant has shown damage symptoms or already dead.

Figure 2. Adults of Cycad stem borers: (A) *Phacecorines sommeri*, (B) *P. variegatus* (Photo: Adam Harrower).

Management options

No natural enemies or biological control agents are known to control the population of these stem borers. Considering the fact that these weevils are attracted to only weakened plants, management in the gardens should focus on protecting cycad plants from any form of stress or at least minimizing stresses that could result from transplanting, fertilization, drought and other garden practices. In infested plants, cutting away damaged crown to a level where there is healthy stem tissue may save the plant. Application of preventative insecticides could be an option only if there use is limited to highly valuable or recently transplanted plants.

3. Aloe snout beetles, *Brachycerus tauriculus* and *Rhadinomerus illictus* (Coleoptera: Curculionidae)

Two aloe snout beetles, namely Greater aloe snout beetle, *Brachycerus tauriculus* and Lesser aloe snout beetle, *Rhadinomerus illictus* were confirmed present in KNBG. Both of this species are native to Southern Africa. *Rhadinomerus illictus* is a wide spread and common aloe pest, causing considerable damage to a variety of cultivated garden aloes. It is the only member of the genus that is associated with aloes. The adult female lays the eggs between the bases of

leaves. The newly hatched grubs bore into the stem beneath the crown of the leaves where they feed. Pupation may probably take place in the soil. The adults feed on the leaves, causing typical circular scares with a centrally placed rupture of the epidermis (Figure 3). The larvae feed in the crown, causing the crown leaves and upper part of the stem to rot. Very little is known about the biology of *B. tauriculus*. The adult lays the eggs in the leaves near the center of the rosette and the newly hatched larvae bore into the crown and the upper part of the stem. As in *R. illictus*, pupation may take place in the soil. The adults feed on the edges of the aloe leaves, whereas the larvae feed in the crown, gradually causing the crown leaves and upper part of the stem to rot (Figure 4). This weevil occurs sporadically on cultivated aloes.

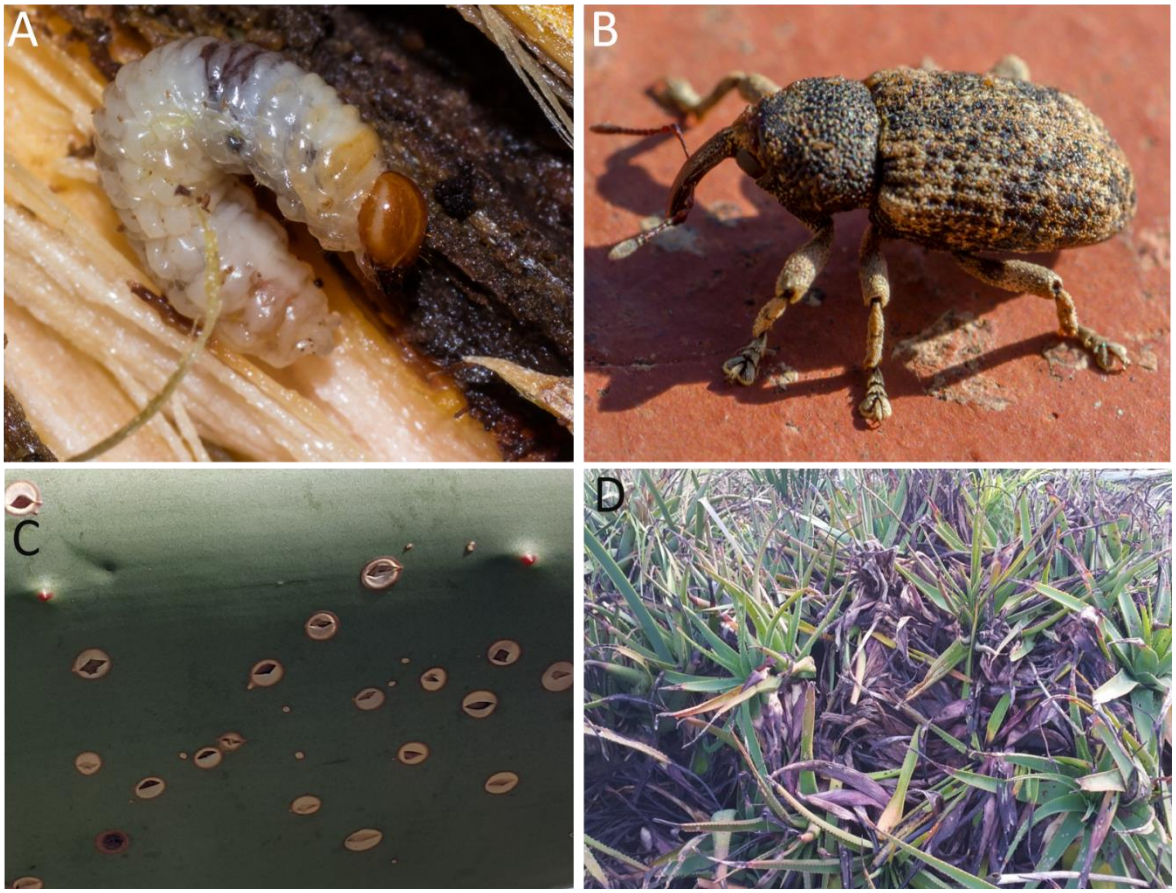

Figure 3. *Rhadinomerus illictus* and its feeding damage: (A) larva inside the stem, (B) adult weevil, (C) circular scars on aloe leaf caused by adult feeding, (D) rotting of upper part of the stems of aloe plants caused by *R. illictus* damage (Photo A and B: Adam Harrower).

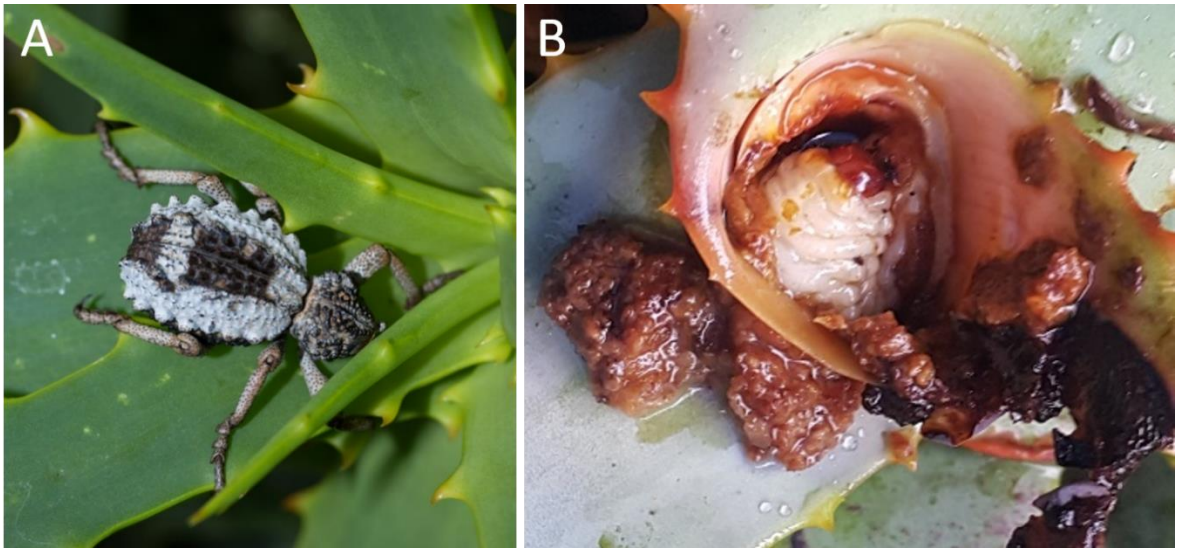

Figure 4. *Brachycerus tauriculus* and its feeding damage on aloes: (A) an adult weevil feeding on leaves, (B) a larva feeding inside the crown caused the crown leaves to rot (Photo A: Adam Harrower).

Management options

Control of both *B. tauriculus* and *R. illictus* is difficult because damage to the crown and stem has usually been done by the time symptoms are observed. Yet, handpicking of the adults and the grubs from the rotting crown leaves and upper stem is helpful. Aloe growers apply insecticides to the crown though it is not recommended in light of environmental protection. Cultivation of aloes in suitable habitats is recommended as this will reduce stress to the plants and making them less vulnerable to pest attack.

4. *Sciobius tottus*

Sciobius tottus was found feeding on *Clivia* and *Melianthus* plants in KNBG (Figure 5). The weevil genus *Sciobius* is native to Southern Africa, including Eswatini, Lesotho and South Africa. In South Africa, *S. tottus* seems to be common in the Eastern Cape, coastal regions of the southern Cape, and the south-western Western Cape. The biology of *Sciobius* species is poorly known, except for two pestiferous species, one on citrus and the other on potato. All immature stages of *Sciobius* are probably found in the soil. All *Sciobius* adults are flightless and feed on above-ground parts of plants (Figure 5). *Sciobius tottus* is polyphagous, with many recorded host plants, including *Myrsine, Searsia*, *Buddleja, Podocarpus* and *Pinus* species. So, it is not strange that *S. tottus* was found feeding on *Clivia* and *Melianthus*. In the late

1990s, this weevil species was found to cause considerable damage to the leaves, buds and blossoms of some deciduous fruit trees in the south-western Cape, leading to serious crop losses. Its population size and damage in orchards have subsequently decreased significantly due to unknown reason.

Figure 5. Adults of *Sciobius tottus* (A), and their feeding damage on *Clivia miniata* (B) (Photo A: Adam Harrower).

Management options

Currently, there is no known management option available for this weevil. Proper species-site matching and implementation of best garden practices would help in reducing the susceptibility of plants. Entomopathogenic nematodes would be the best candidates to test in the future as all immature stages of *S. tottus* are probably found in the soil.

5. Banded Fruit Weevil, *Phlyctinus callosus*

Phlyctinus callosus which is also commonly known as Banded Snout Beetle or Grapevine Beetle is naturally restricted to the Western Cape province of South Africa. It was collected from different succulent plants in KNBG (Figure 6). This is a polyphagous species which has become important pest of numerous crops, including apples, grapes/vine and nectarines. It is a serious quarantine pest on fruits exported from South Africa. For example, it is a major reason why South African table grapes are disqualified from entry to the USA. The adults lay the eggs in loose organic litter and the hatching larvae immediately bore into the soil and feed on the roots of plants. The larvae pupate in the soil and the emerging adult feeds on the host

(Figure 6) during the night and hide during the day under rough bark or under clods of earth and rough organic material on the ground around the hots. This species has become established in Australia and New Zealand, causing serious negative impacts there.

Management options

Good management of weeds can help reduce *P. callosus* population as a number of weed species are hosts of this insect. This weeds can act as oviposition sites. Soil disturbance and inter-row hoeing helps to destroy immature stages of *P. callosus*. Biological control agents such as the nematode *Heterorhabditis bacteriophora* and the fungus *Beauvaria bassiana* have shown great potential of controlling *P. callosus* under laboratory condition. Insecticides such as pyrethroid fenvalerate and lambda-cyhalothrin were proved effective in controlling *P. callosus.*

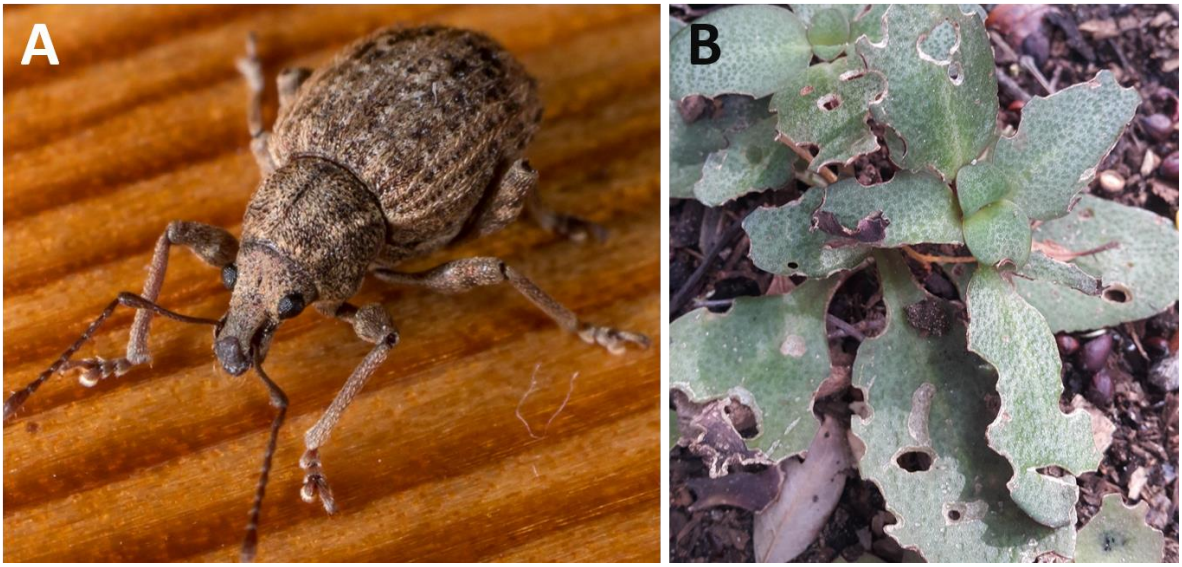

Figure 6. Adult *Phlyctinus callosus* (A), and its feeding damage on *Crassula multicavata* (B) (Photo A: Photo: Adam Harrower).

6. *Other insects identified from the garden*

A list of other insects identified from various plants in the garden is given below in Table 1. Under natural conditions, the majority of these insects are not known to cause significant damage. However, under human modified environments such as botanical gardens, some of these insects may cause sporadic damages because of all kinds of stresses the plants are exposed to. Such insects can be managed by implementing best garden practices (species-

site matching, cultivation, fertilization, watering, transplantation, pruning, mulching, composting, etc.) which would help to reduce stresses to the plants. It is always recommended to monitor such insects as some of these may become important pests when the optimal conditions are met.

Table 1. Other insects identified from Kirstenbosch National Botanical Garden from different host plants.

Scientific name	Common name	Order: Family	Native range	Collected from	Collection number
Acraea horta	Garden acraea butterfly	Lepidoptera: Nymphalidae	Southern Africa	*Kigellaria africana*	KR12
Aliteus reichei	Click beetle	Coleoptera: Elateridae	-	*Ecephalartos* cycad	87
Ellimenistes laesicollis	Gardenbane Weevil	Coleoptera: Curculionidae	South Africa		82
Sophronica carbonaria	-	Coleoptera: Cerambycidae	-		80
Trioza bullatae	-	Hemiptera: Psyllidae	Described from South Africa	*Ocotea bullata*	KR04

References

CABI. 2019. Invasive species compendium. *Cinara cupressi* sensu lato (Cypress aphid). https://www.cabi.org/isc/datasheet/13579.

CABI. 2019. Invasive species compendium. *Phlyctinus callosus* (vine calandra). https://www.cabi.org/isc/datasheet/40299.

Chilima CZ, Owour AL. 1992. A review of the natural enemies of *Eulachnus rileyi* (Williams), *Pineus pini* (L), *Cinara cupressi* (Buckton) and *Cinara cronartii* Tissot and Pepper in Africa. International Institute of Biological Control unpublished report.

Day RK, Kairo MTK, Abraham Y, Kfir R, Murphy ST, Mutitu KE, Chilima CZ. 2003. Biological control of homopteran pests of conifers in Africa. In Neuenschwander P, Borgemeister C, Langewald J, eds. Biological control in IPM systems in Africa. Wallingfold, UK: CAB International, 101-112.

Prinsloo G, Uys VM. 2015. Aloes. In G.L. Prinsloo GL, Uys V, eds. Insect pests of cultivated plants and Natural Pastures in Southern Africa.

Watson GW, Voegtlin DJ, Murphy ST, Foottit RG (1999) Biogeography of the *Cinara cupressi* complex (Hemiptera: Aphididae) on Cupressaceae, with description of a pest species introduced into Africa. Bulletin of Entomological Research 89: 271-283.