

The population structure and insect relationships of the fungal pathogen *Ceratocystis albifundus*

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Introduction

- *Ceratocystis albifundus* is a serious fungal pathogen of exotic *Acacia mearnsii* trees (Roux & Wingfield. 1997)
- First reported in the 1980's
- Only known from African continent
- Hypothesised to be native
 - Restricted occurrence on African continent
 - Population genetics (Roux *et al.* 1999, Barnes *et al.* 2005)
- Reported on 8 native host genera in 2004
- Currently known to occur on 11 native host genera
- Needs wounds to infect trees



Introduction

- The relationship that exists between insects and fungi have been known since 1878 (Hartig 1878)
- Some bark beetles are among the most economically important pests of the world (Wood & Bright 1992)
- Some fungal associates of bark beetles are forest pathogens (Harrington 1993, Wingfield 1993)
- Although the association between beetles and fungi have been recognised for more than a century, these relationships are still poorly understood (Kirisits 2004)

Introduction

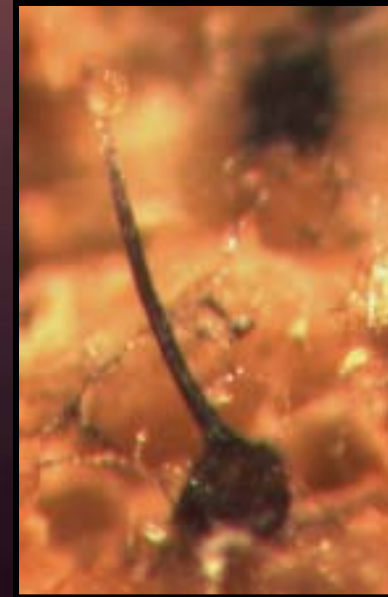
- There are 3 generally accepted forms of interaction between fungi and beetles:
 - Total dependence of the fungus on the beetle for dissemination
 - Obligatory dependence of the beetle on the fungus
 - Non-dependence (loose association) of the fungus on the beetle

Ceratocystis spp. & Bark beetles

- *C. fagacearum*
 - *Carpophilus brachypterus*
 - *C. dimidiatus*
 - *C. sayi*
 - *Epuraea labilis*
 - *E. peltoides* (Juzwik et al. 1983)
- *C. fimbriata* & *C. moniliformis*
 - *Carpophilus freemani*
 - *Chymomyza procnemoides* (Moller et al. 1968)

The fungal associates

- Adaptations by *Ceratocystis spp*:
 - Long ascomatal necks
 - Sticky ascospores and conidia
 - Aroma production



Aim

To investigate possible insect associations of the wilt pathogen *C. albifundus*

Why investigate the insect associations?

- *Ceratocystis* spp. require wounds for infection

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- Beetles are a cause of wounds



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Why investigate the insect associations?

- *Ceratocystis* spp. require wounds for infection
- Beetles are a cause of wounds
- Insects visit wounds made by other factors and could act as vectors of *C. albifundus* to these wounds
- Control the insects, control the pathogen



Materials and Methods

- Traps were placed at Leeuwfontein Collaborative Nature Reserve, Gauteng
- The traps were placed on native *Faurea saligna* trees
- Trapping started in July 2005

Preliminary trials:

- >Bait: >Fruits & fruit mixtures
 - > Dough
- > Trap : 3 designs

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Materials and Methods

- Pineapple was selected as bait
- Pitfall traps were used
- Bait was replaced and insects collected once a week
- Insects were:
 - Grouped based on morphology and counted
 - Most common groups of insects were identified
- Fungal isolations from insects:
 - Squashed on artificial growth medium
 - Carrot baiting

Materials and Methods

- Insect exoskeleton was studied for presence of fungal spores using Scanning Electron Microscopy (SEM)
- Daily weather data was obtained

Results

- Collected 4787 insects in total over 31 weeks
- 4 main morphological groups were identified

Results

- Insect identifications:

1.15%



9.94%



85.6%



3.3%



Brachypeplus sp.

Carpophilus spp.

Drosophila sp.



Results

- Insect identifications:



Carophilus hemipterus

Carophilus tersus

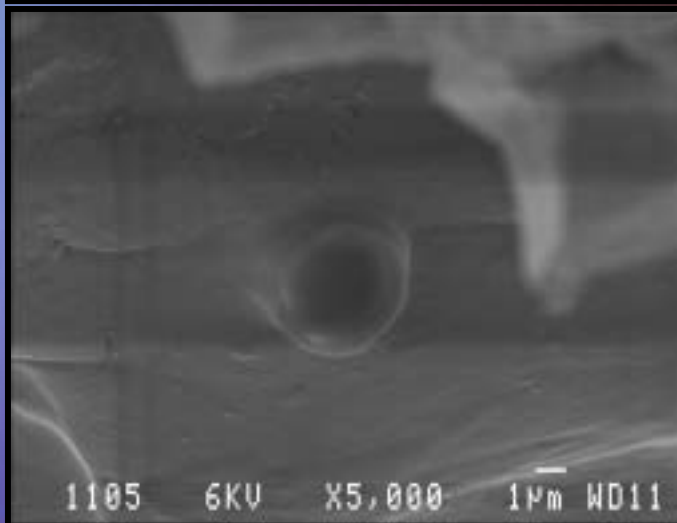
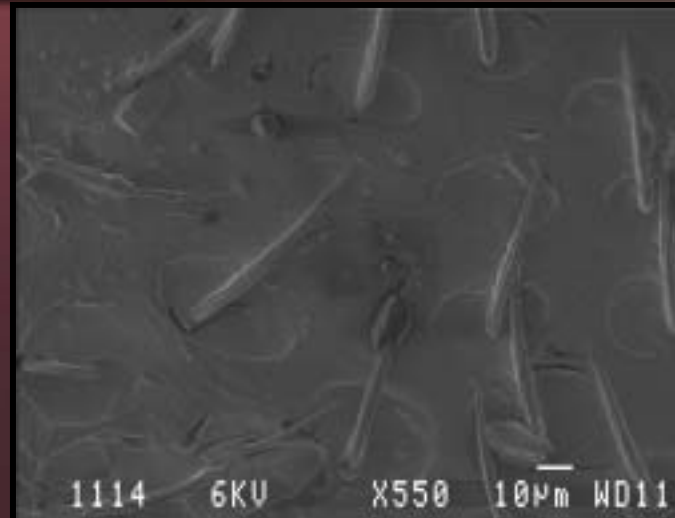
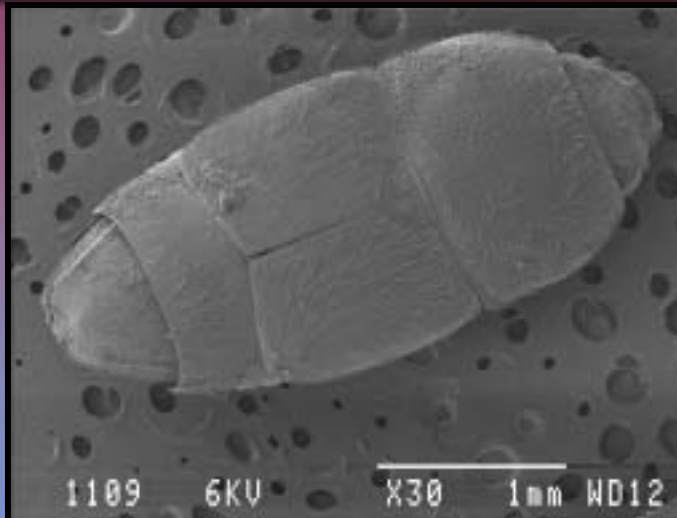
Carophilus bipustilatus

Results

- Fungal isolations:
 - *Ceratocystis albifundus*:
 - 2 from *Carpophilus*
 - 12 from *Brachypeplus*
 - *Ceratocystis* sp.:
 - 39 from *Carpophilus*
 - 7 from *Brachypeplus*



Results

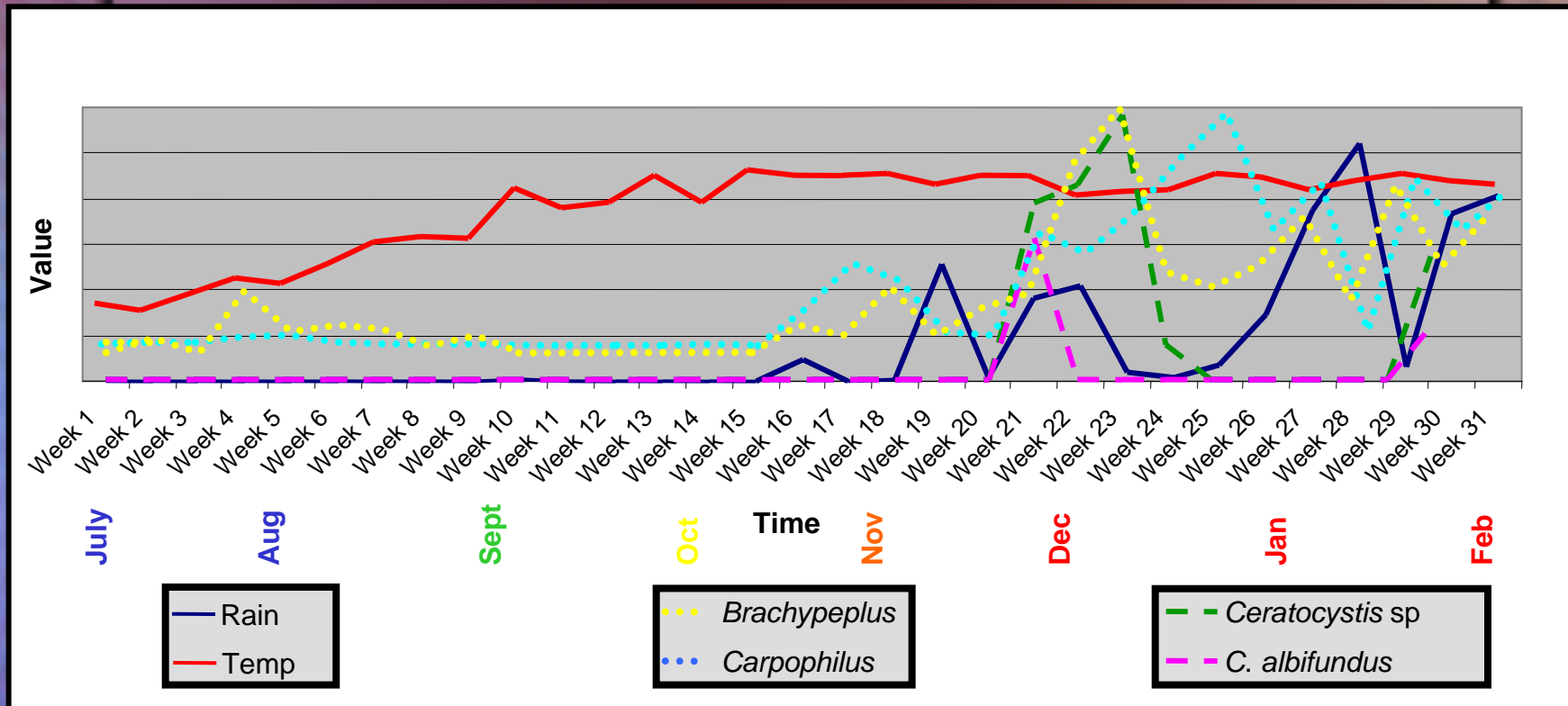


Discussion

- Two *Ceratocystis* spp. were isolated from four insect spp.:
- *Carpophilus* spp.
 - Extremely variable in form, structure & habitat
 - Known vectors of 3 *Ceratocystis* spp.
- *Brachypeplus* sp.
 - No known insect association
- There seems to be a correlation between temperature, rainfall and quantity of insects trapped and number of fungal isolates

Discussion

- Climate vs Insect nr vs fungal isolates



Discussion

- Low number of fungal isolates in relation to number of insects (1.17%) was expected
- This study confirms vectorship of two *Ceratocystis* spp. by insects in native vegetation
- Similar insects have been found on fresh wounds made by Elephants in KNP
- Interaction?

Elephants-insects-fungi-disease

Acknowledgements

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A photograph of an elephant in a savanna environment, reaching up to eat from a tree. The elephant's trunk is thick and wrinkled, and its head is partially obscured by the branches of the tree. The background shows a mix of green trees and a clear sky.

THANK YOU

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