

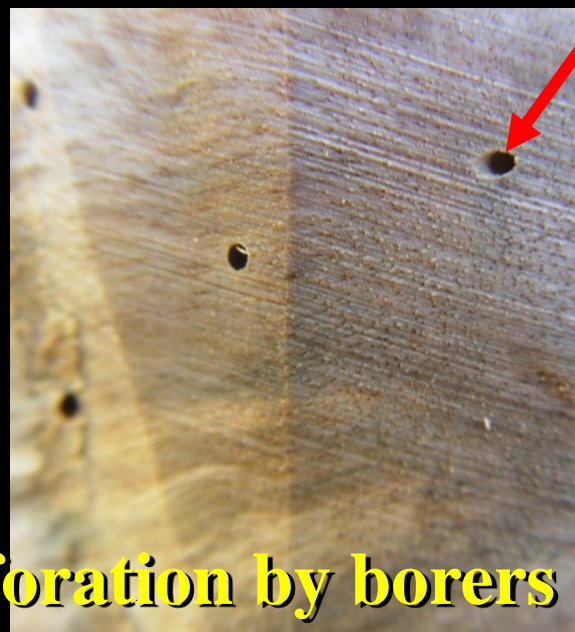


**Volume and pulp yield of healthy and infected trees of
Eucalyptus urophylla x *E. grandis* by *Ceratocystis*
*fimbriata***

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Tree wilt and xylem darkening



Perforation by borers

Eucalyptus: die-back and tree death



First reports of ceratocystis wilt world wide

- **Brazil – Ferreira et al. (1999)**
- **Uganda – Roux et al. (2001)**
- **Uruguay – Barnes et al. (2003)**
- **South Africa – Roux et al. (2004)**





Wide host range

- ☞ **Eucalyptus**
- ☞ **Mango**
- ☞ **Annona**
- ☞ **Gmelina**
- ☞ **Fig**
- ☞ **Crotalaria**
- ☞ **Coffee**
- ☞ **Yam**
- ☞ **Sweet potato**
- ☞ **Kiwi**

Gmelina

Only in Pará (Jarí)





Mango trees: São Paulo, Rio de Janeiro, Distrito Federal, Pernambuco, and Mato Grosso do Sul



Ficus (fig)
São Paulo



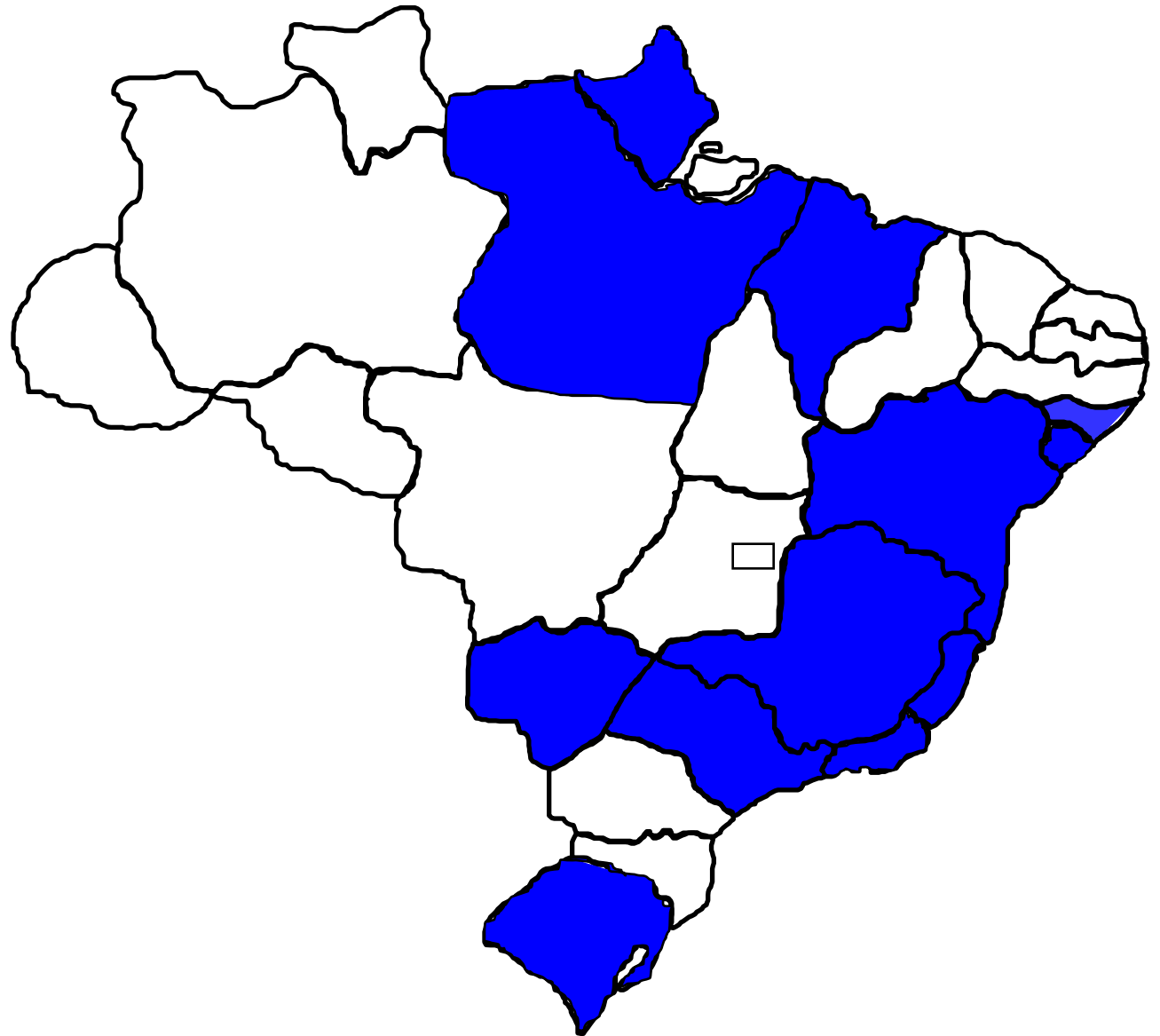
Colocasia (Yam)
São Paulo and Distrito
Federal





Kiwi in Rio Grande do Sul

Current records of *Ceratocystis fimbriata* in Brazil



Symptomatology

Wilt and die-back



Depression in the bark



Thickening at the base of the trunk (7y old trees)

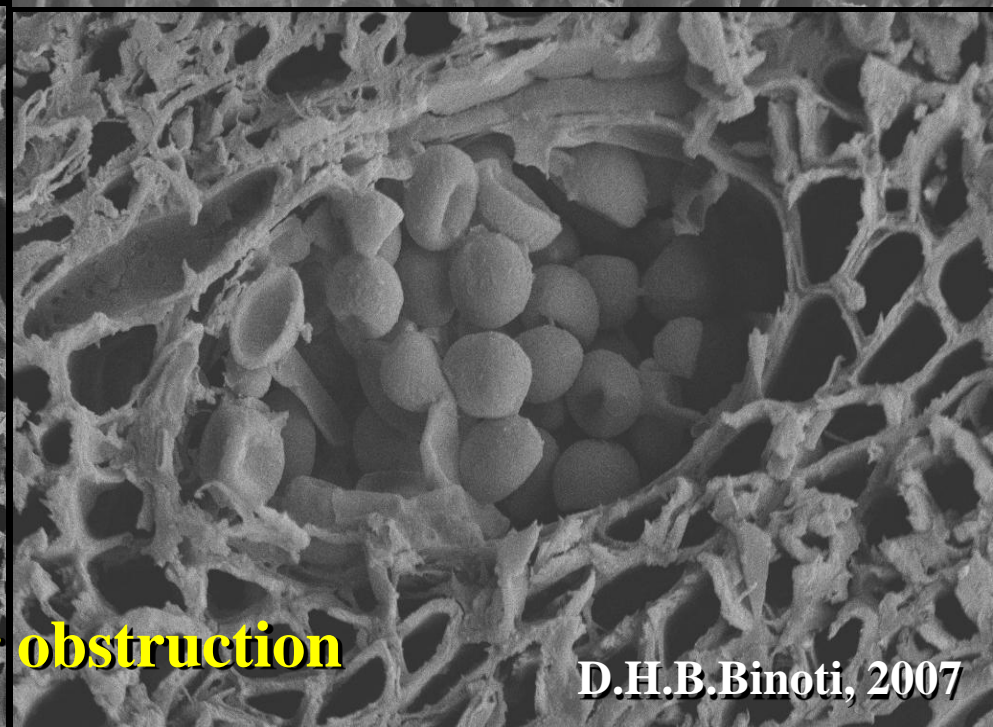
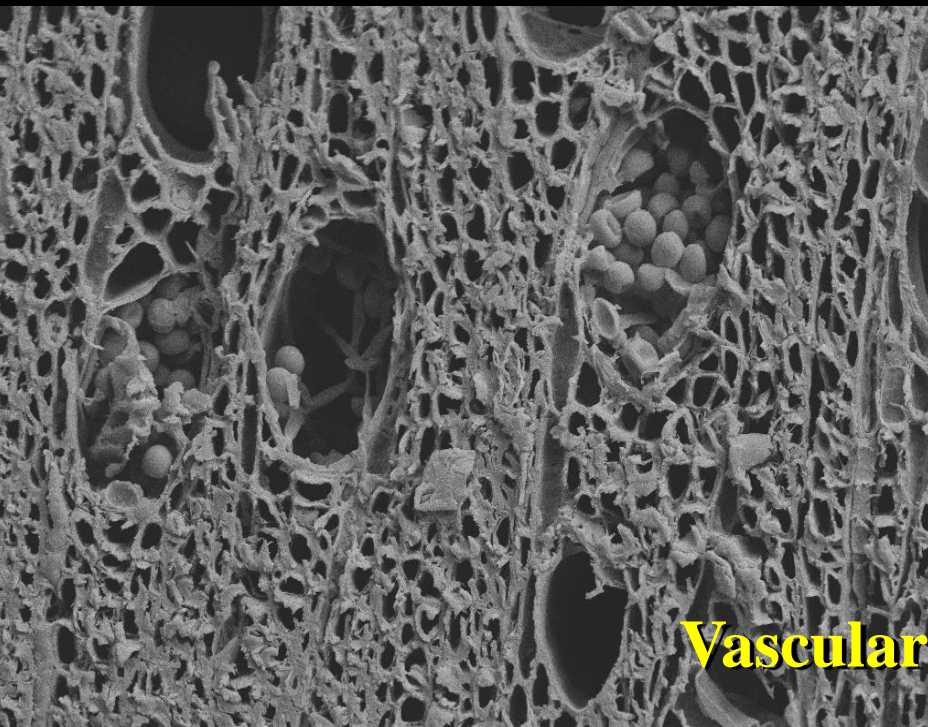
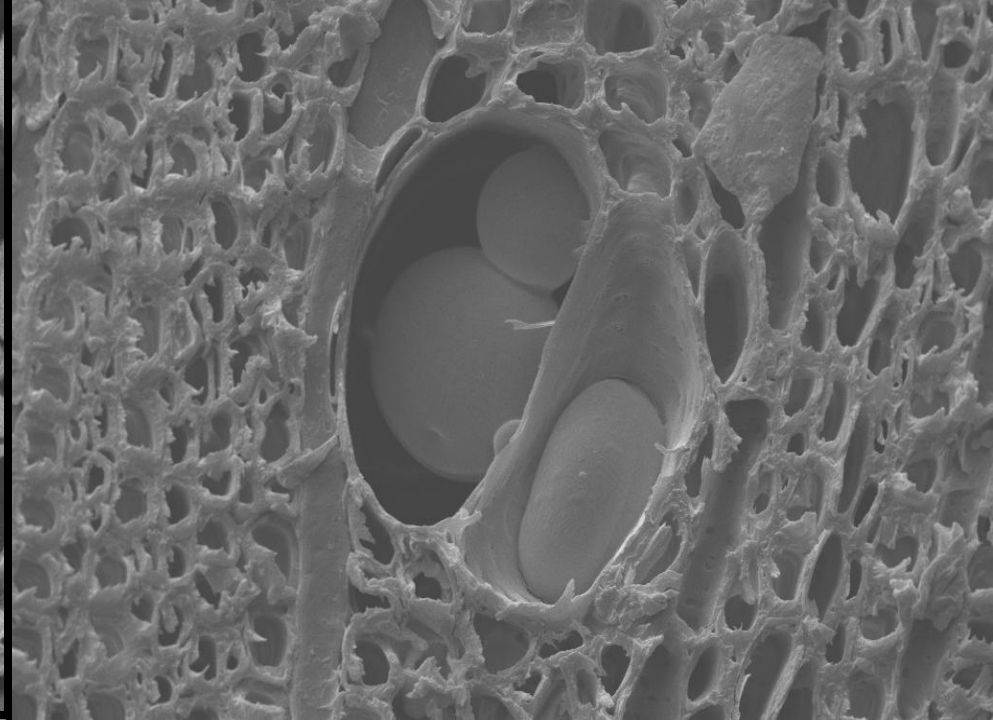
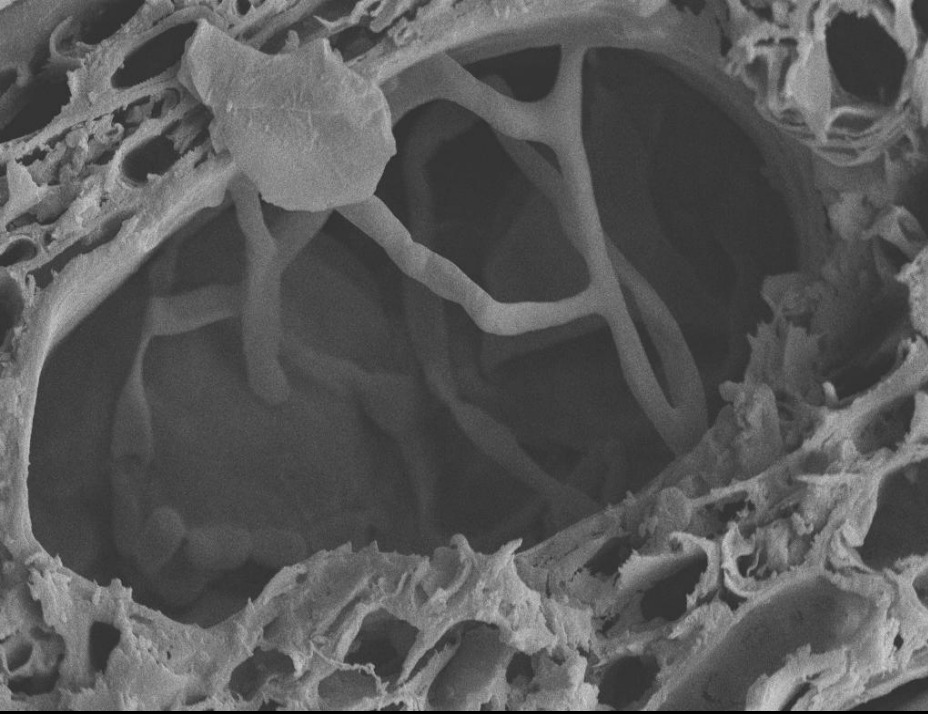


Wood darkening



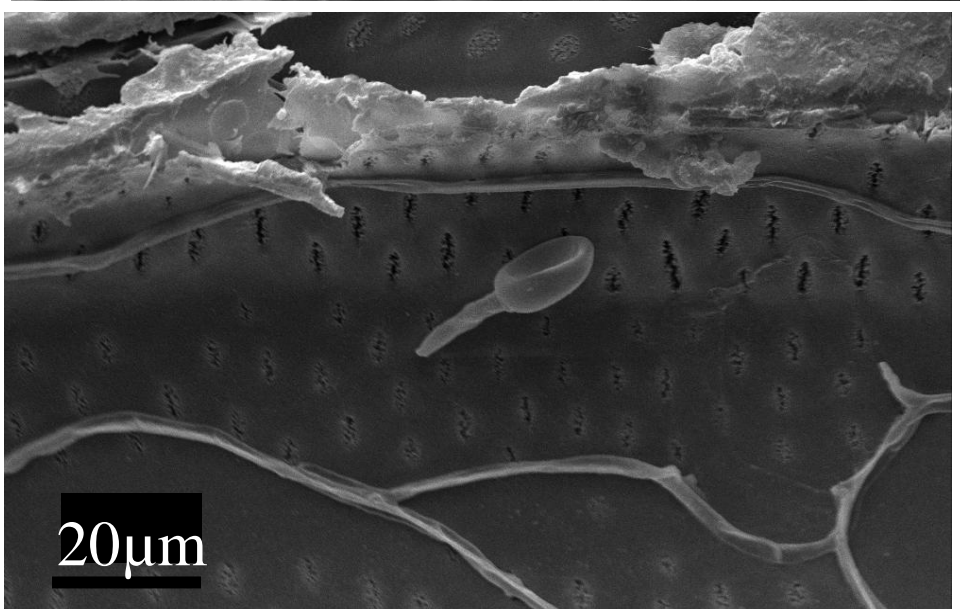
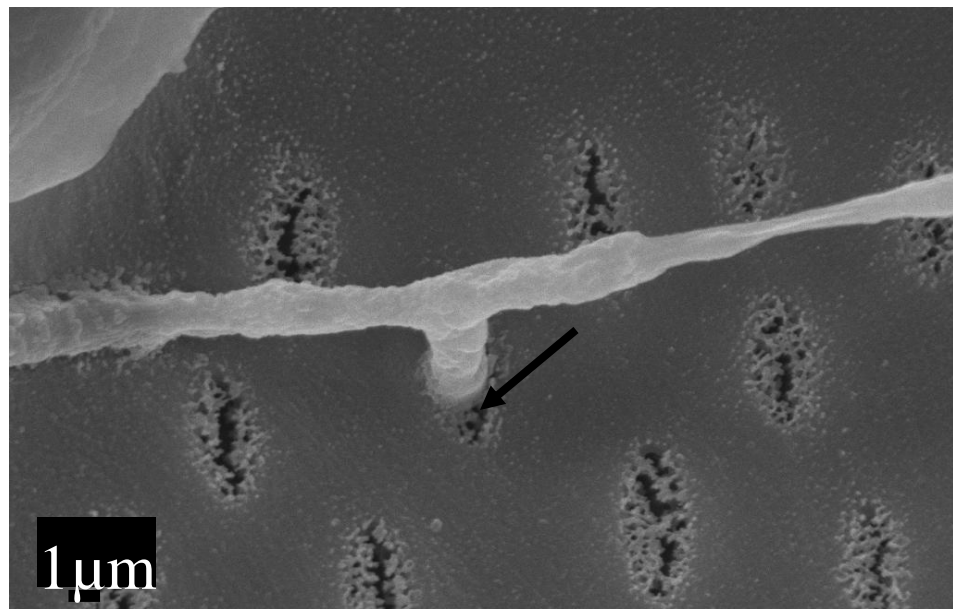
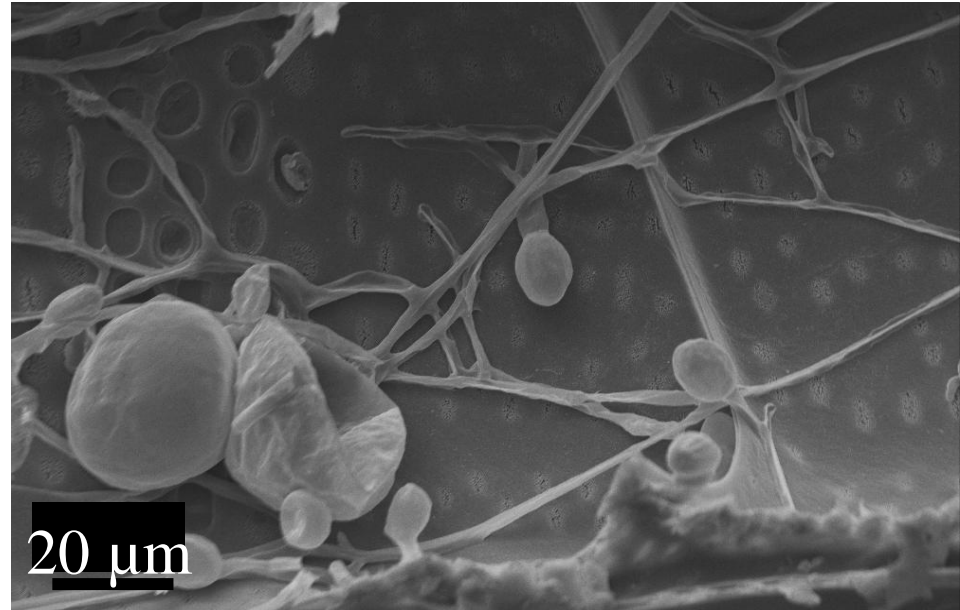
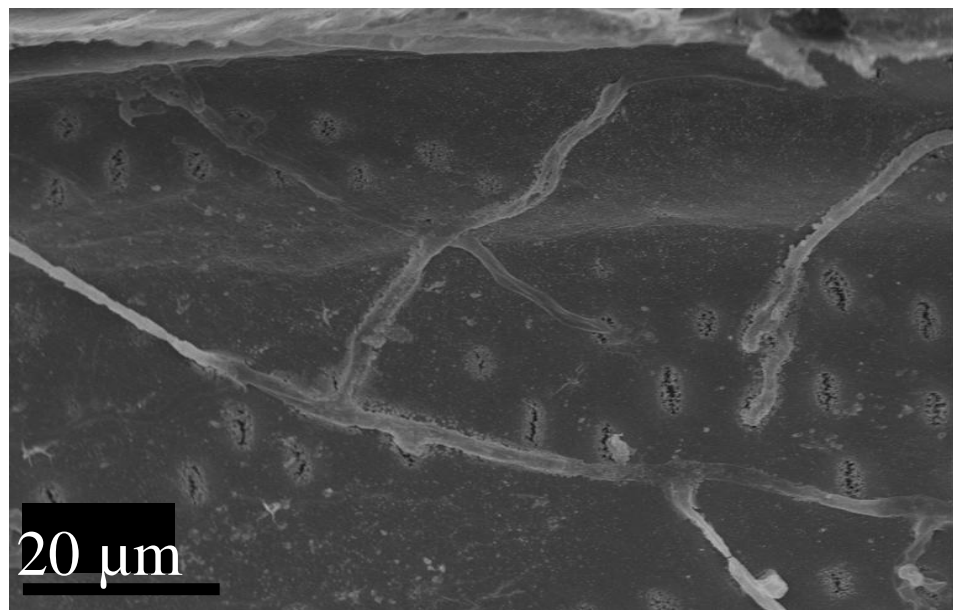
Wood infection and termite invasion



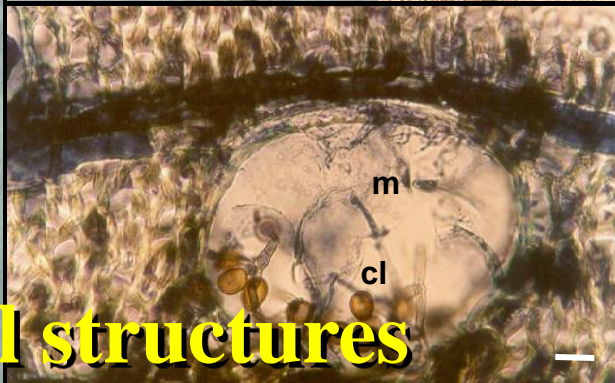
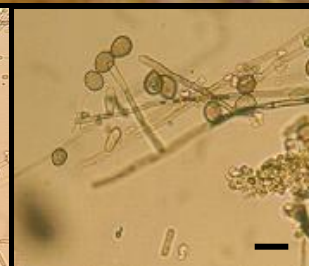
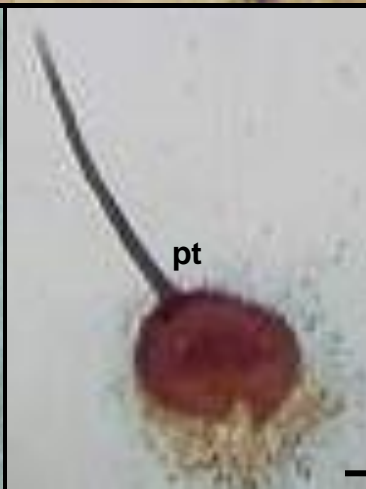
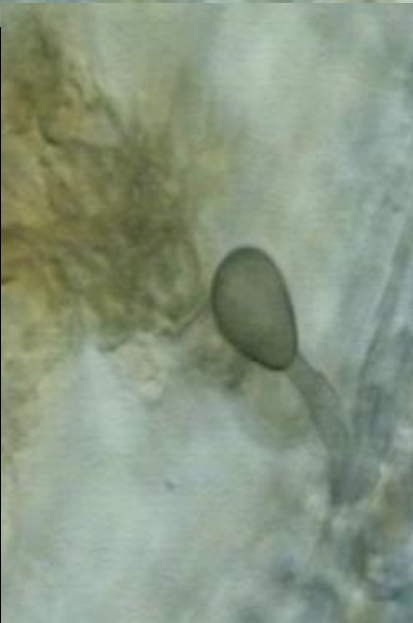
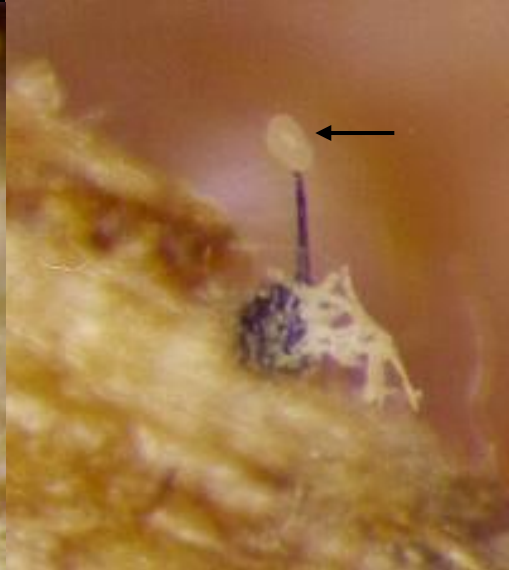
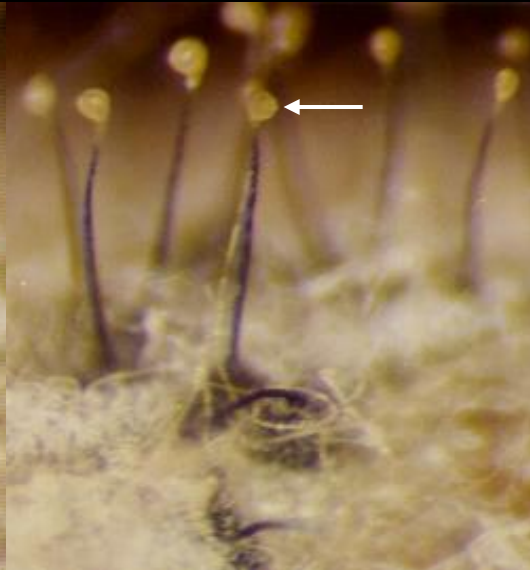
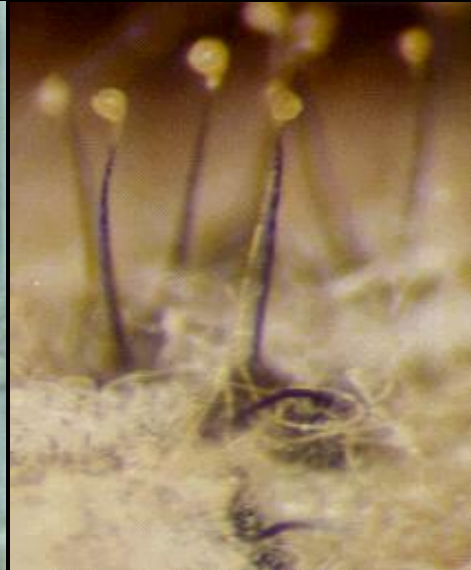
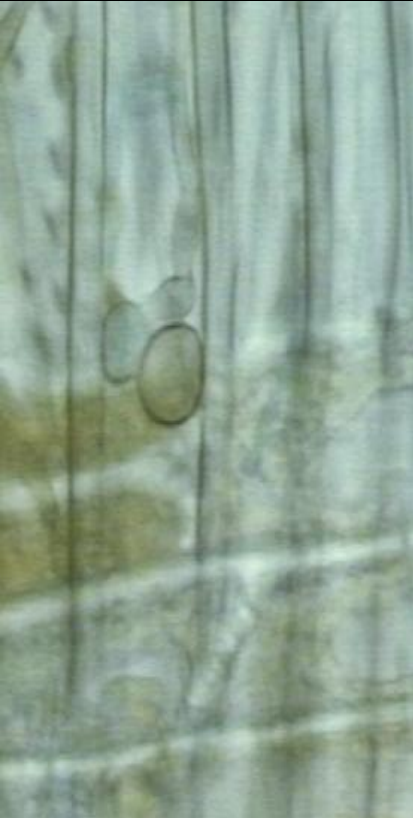


Vascular obstruction

D.H.B.Binoti, 2007



Penetration of hyphae through pits



Fungal structures



What are the main economic losses caused by *Ceratocystis*?

- ➡ **Tree death?**
- ➡ **Reduction of wood value for timber?**
- ➡ **Reduction of wood volume?**
- ➡ **Increase of alkali consumption and reduction of cellulose yield?**



Death of infected trees





Reduction in tree growth



**Objectives of the present study were
to estimate:**

- 1. Losses of wood volume**
- 2. Losses of pulp yield**

E. grandis x E. urophylla



Infected trees in plantation

Effect of Ceratocystis wilt on tree growth

DBH and H

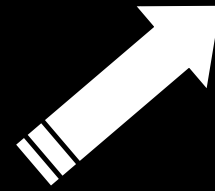




Tree harvest



Lesion size evaluation



**Coleta de uma
massa de
ascósporos de um
peritécio**



Confirmation by carrot slice



Volume estimation of trees according to the following classes of disease severity (m) (lesion length)

1- 0 m - healthy

2 - 0,1-2,8 m lesion size

3 - 2,9-5,6 m lesion size

4 - 5,7-8,4 m lesion size

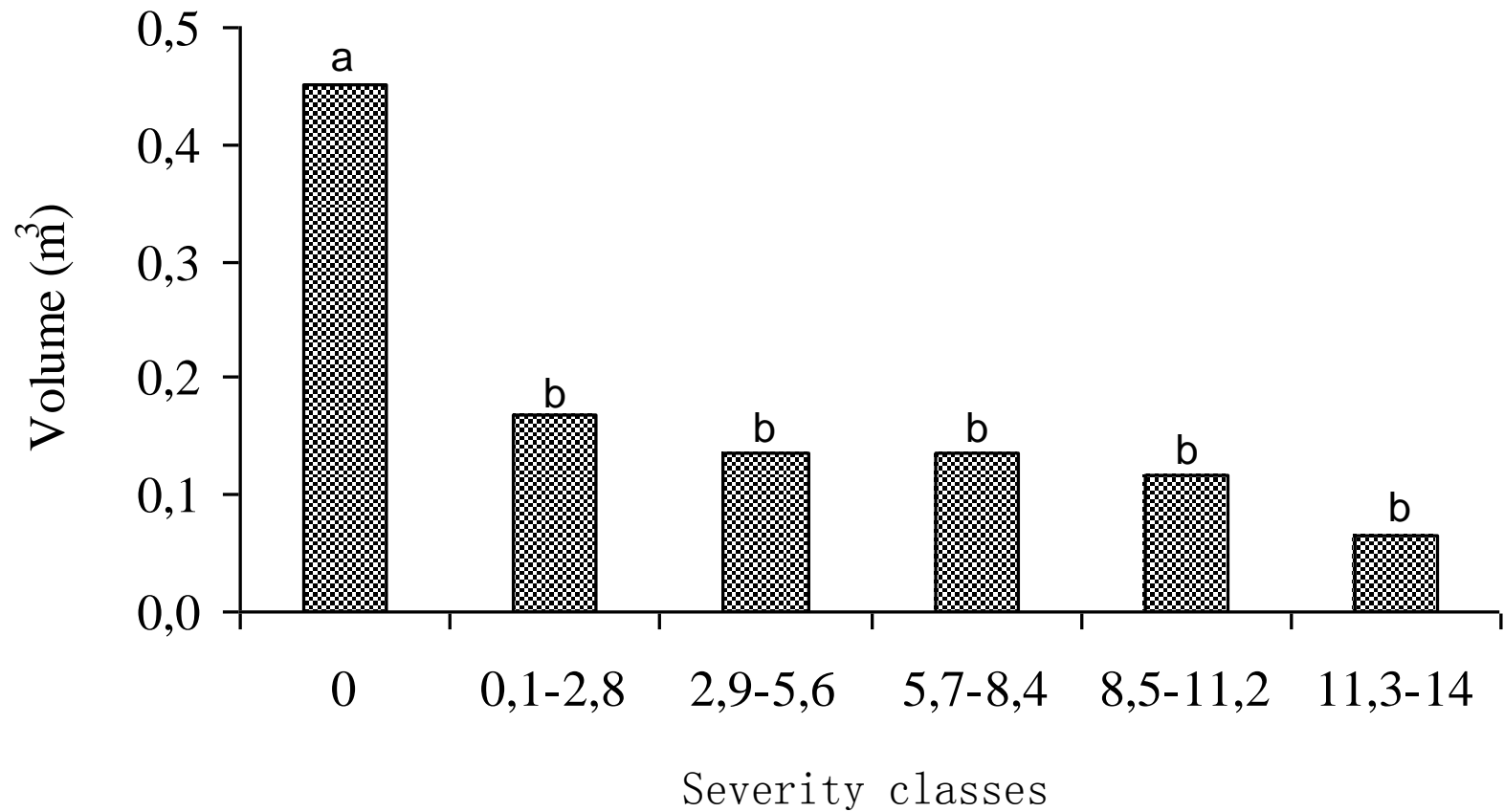
5 - 8,5-11,2 m lesion size

6 - 11,3-14,0 m lesion size

$$\mathbf{VIC = e^{(-10,992085 + 2,265092 * Ln(DAP) + 1,002495 * Ln(HT))}}$$

Growth of eucalyptus trees according to the severity of Ceratocystis wilt
Columns with the same letter do not differ statistically (Tukey, $p \leq 0,05$).

Severity classes	Lesion size		
	DBH (cm)	(m)	VCCC (m ³)
0	20,05 a	28,61 a	0,4512 a
0,1-2,8	14,05 b	22,10 b	0,1681 b
2,9-5,6	13,20 b	21,44 b	0,1350 b
5,7-8,4	13,10 b	20,30 b	0,1348 b
8,5-11,2	12,60 b	20,03 b	0,1163 b
11,3-14	10,52 b	17,57 b	0,0639 b



Disease severity classes with the same letter do not differ (Tukey, $p \leq 0,05$)



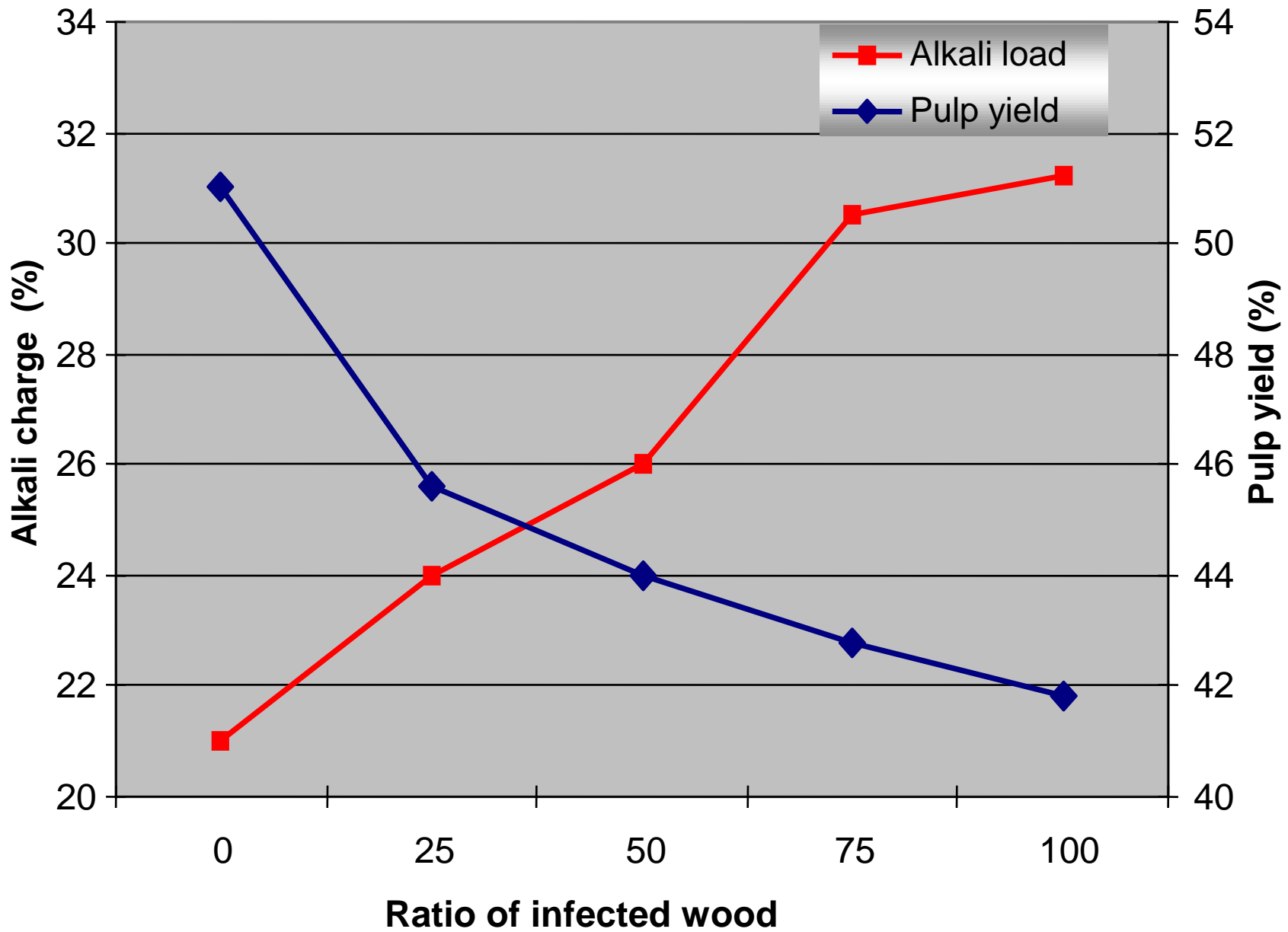
Effect of *Ceratocystis fimbriata* infection on pulp yield

Ratio of healthy/infected wood

100	00
75	25
50	50
25	75
00	100

- Cozimento dos cavacos Kappa 18





Chemical analysis of healthy and infected wood of two *Eucalyptus* hybrid clones

Clone1028							
Samples	Glycans	Xylans	Mannans	Insoluble lignin	Soluble lignin	Total lignin	Celullose
Healthy	45,49	12,60	0,78	26,29	4,27	30,56	44,72
Infected	41,71	13,68	0,65	30,31	4,23	34,53	41,06

Clone 1172							
Samples	Glycans	Xylans	Mannans	Insoluble lignin	Soluble lignin	Total lignin	Celullose
Healthy	47,79	11,82	1,06	28,00	3,64	31,28	46,73
Infected	40,68	13,71	0,71	30,93	4,02	33,59	39,97



Control of *Ceratocystis* wilt

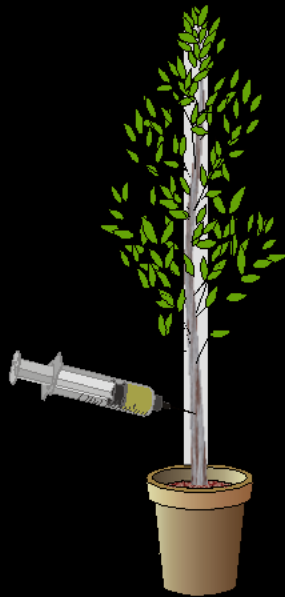
Planting of resistant genotypes



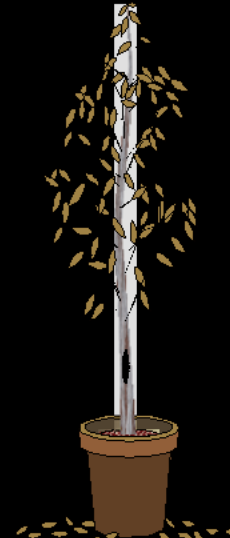
How to evaluate resistance?

Incidence

Inoculation



60 days

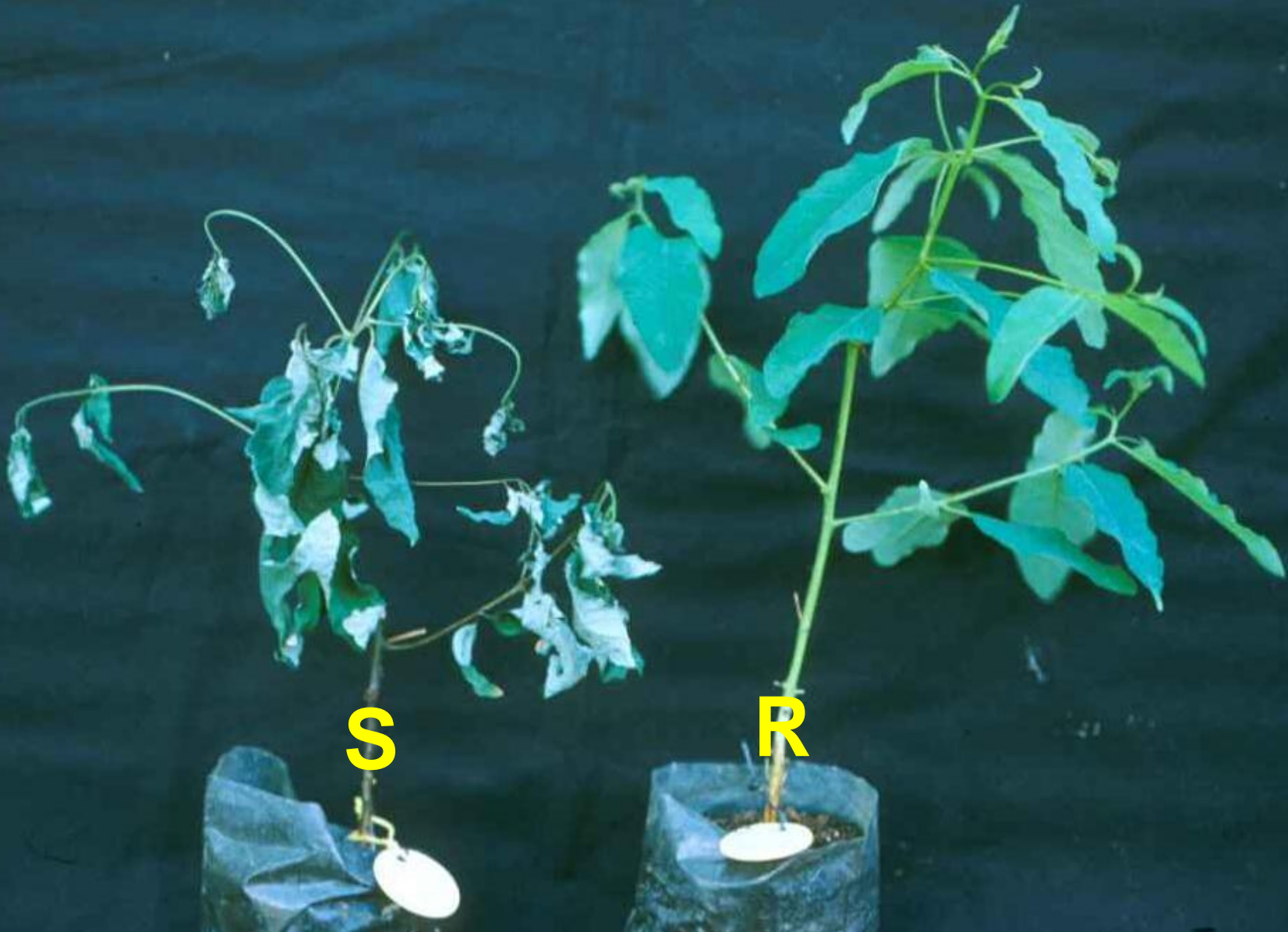


Lesion size



Evaluation of resistance





S

R



Resistant

Susceptible

Conclusions:



Ceratocystis infection may result in:

- 1. Losses in tree growth from 62-86%**
- 2. Losses in pulp yield nearly 14,0%**
- 3. Increase in alkali charge from 45 – 57%**
- 4. Increase in lignin and xylan content**
- 5. Reduction of glycans, mannans and cellulose content**
- 6. Control of the disease: selection and planting of resistant genotypes.**



Acknowledgments

FIBRIA
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Thank you!

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