Research Update on Pine Ghost Canker

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CFPC Annual Meeting -Davis, CA,

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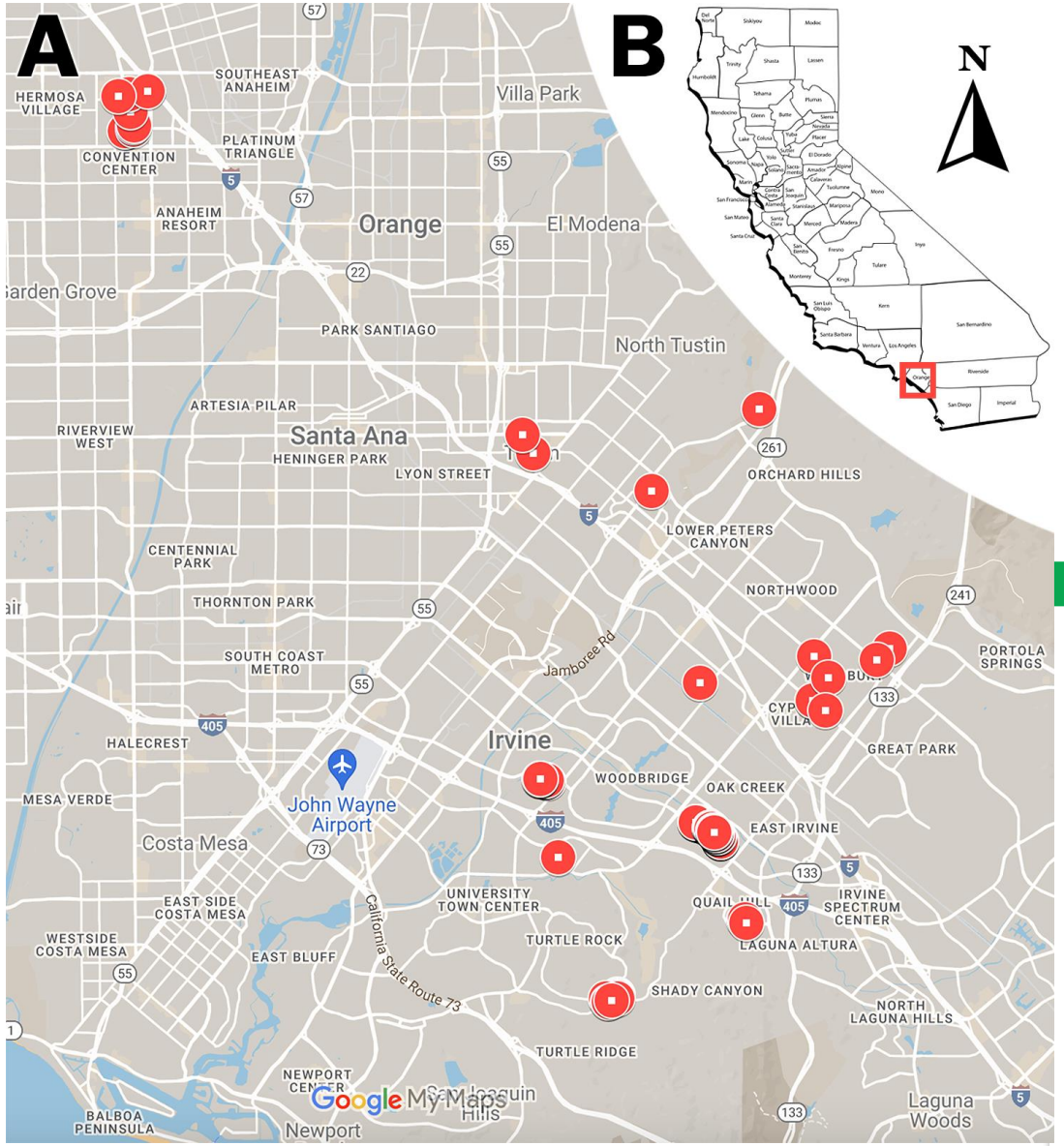
First detections and survey (2018-2023)



Monterey pine
(*Pinus radiata*)

Eldarica pine
(*Pinus eldarica*)

Black pine
(*Pinus nigra*)

Aleppo pine
(*Pinus halepensis*)

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DISEASE NOTE

OPEN

First Report of *Neofusicoccum mediterraneum* and *Neofusicoccum parvum* Causing Pine Ghost Canker on *Pinus* spp. in Southern California

M. I. Bustamante, S. C. Lynch, K. Elfar, J. Kabashima, R. Wood, H. F. Neault, M. B. Rauhe, J. Crain, J. A. Lopez, A. Penicks, H. Mojica, M. D. Atkinson, C. Shogren, M. Arreguin, C. F. Chiang, S. I. Wells, K. S. Alarcon, and A. Eskalen

Affiliations

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Pinus eldarica, *P. halepensis*, and *P. radiata* are important conifer species native to Mediterranean regions that are cultivated in the southwestern United States for

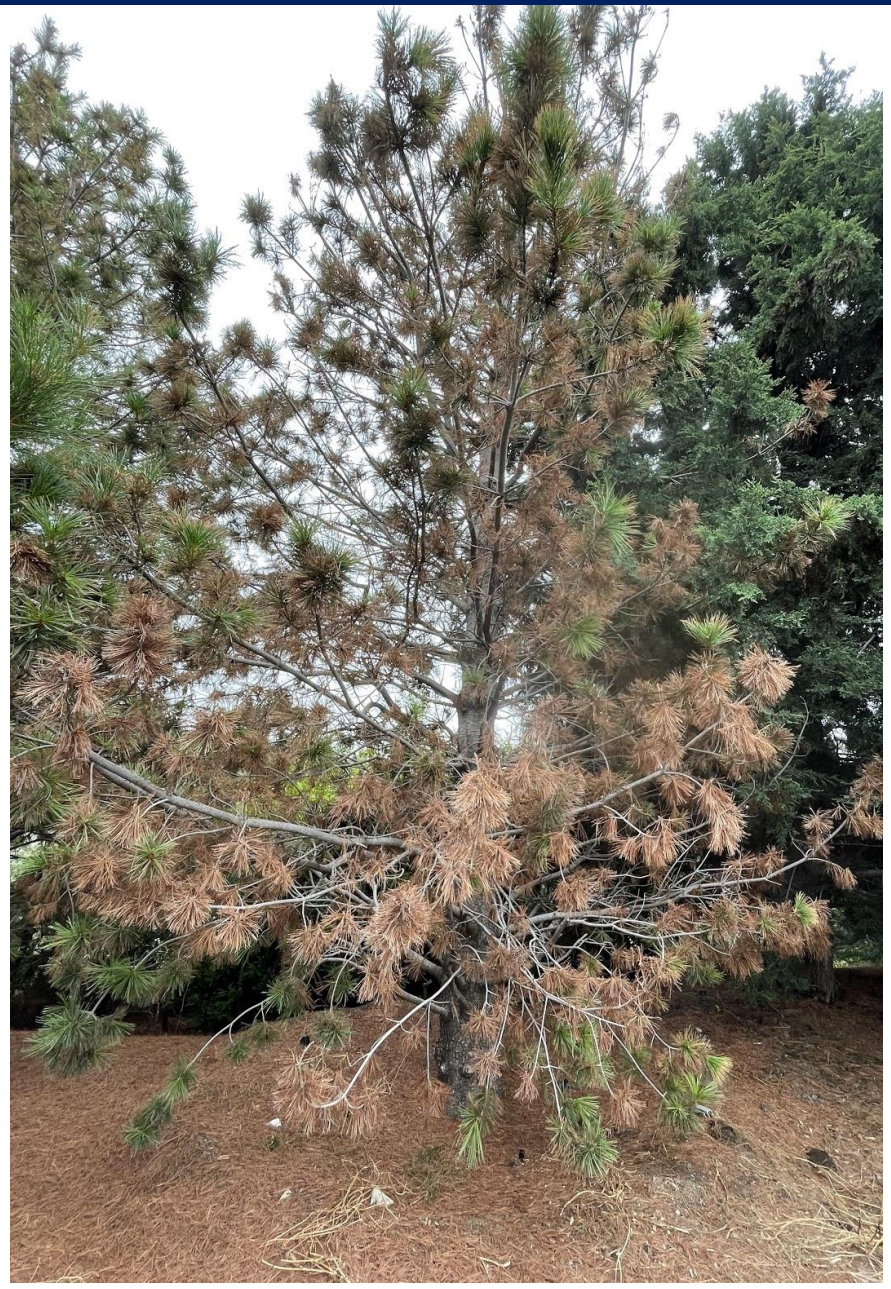
Importance of Monterey pine (*Pinus radiata*)

1. Native populations
   - Restricted distribution
   - Source of genetic diversity

2. Extensively planted for timber in other countries
   - Australia
   - Chile
   - New Zealand
   - Spain

Pine Ghost Canker Symptoms

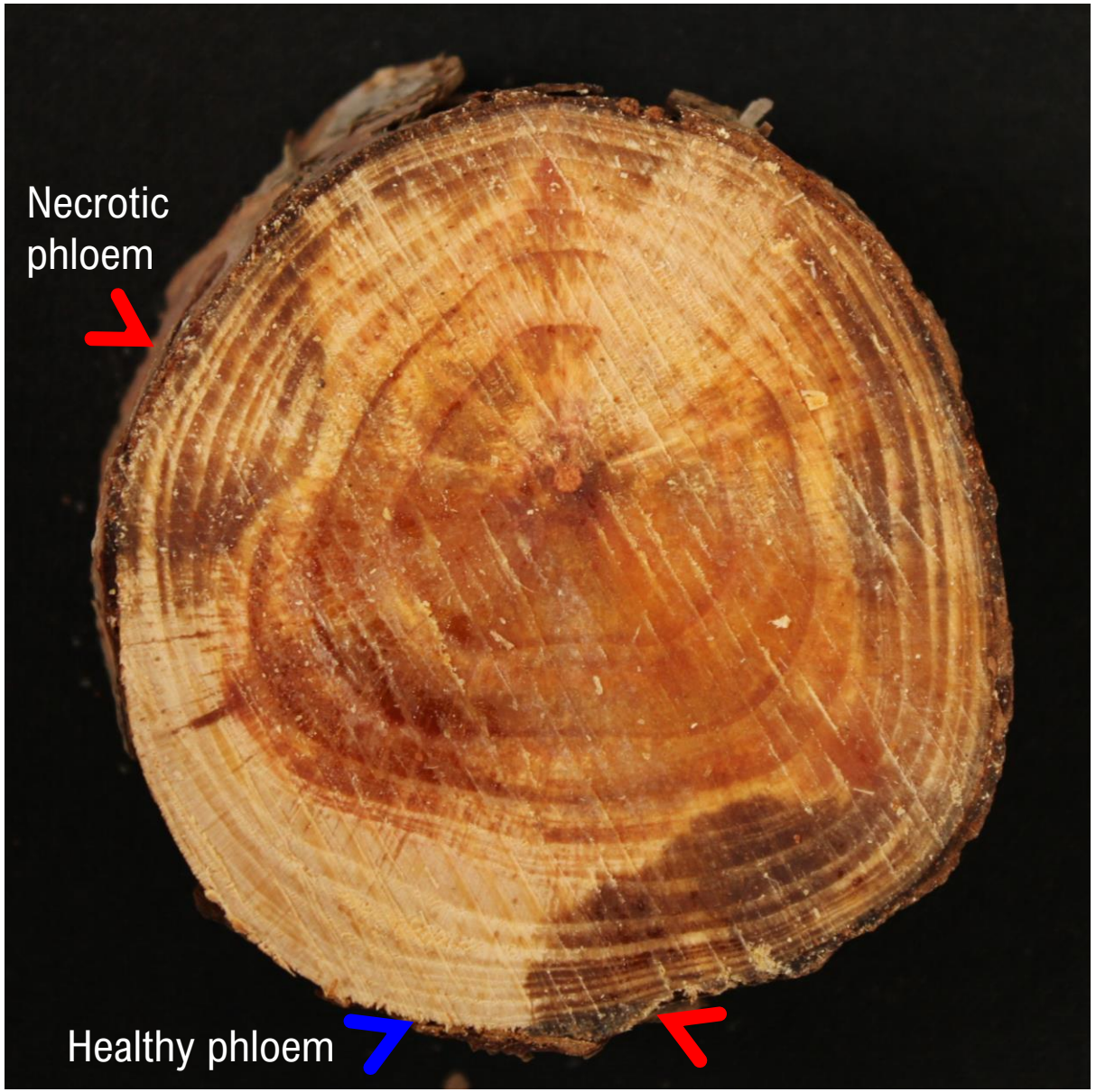
Cankers lead to severe dieback of pine trees



Cryptic discoloration of the cankers = Ghost canker




Phloem tissue is usually necrotic



Why “ghost” cankers?

Grapevine

Apple

Pear

Oak

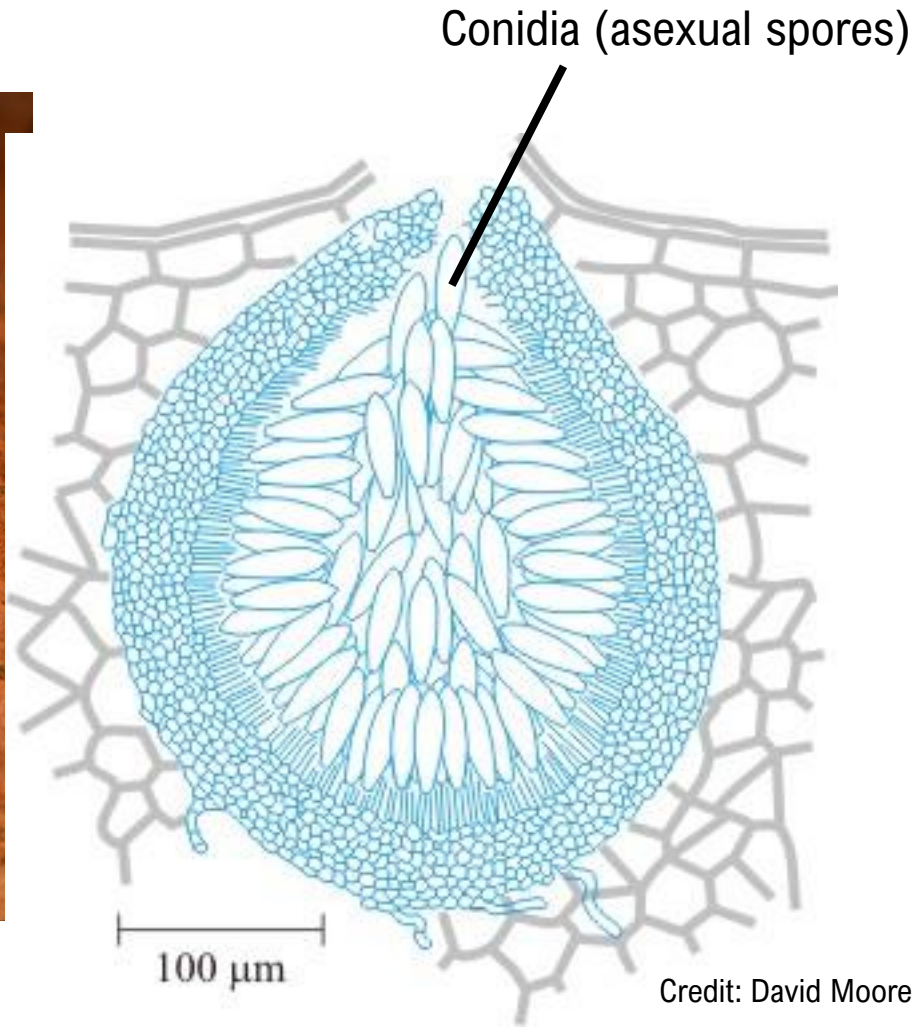
Citrus

Grapevine

Common wood canker symptoms plants
(grapevine and other fruit crops)

Pine ghost canker

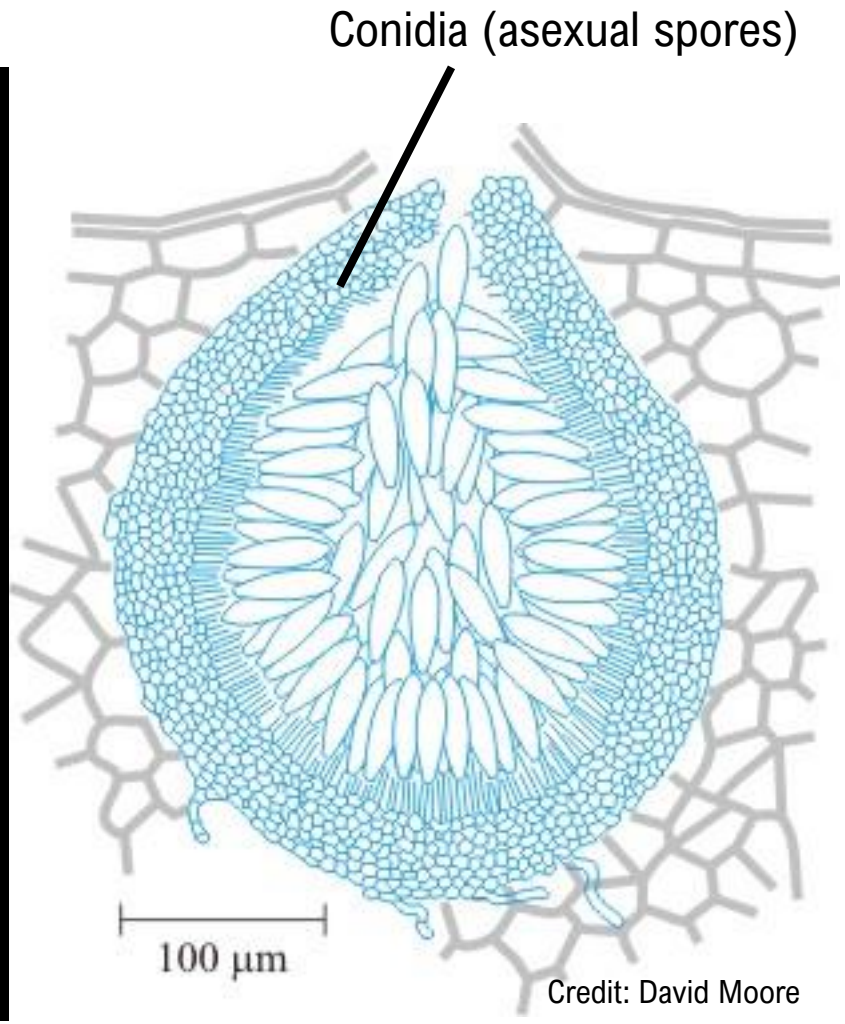
Severe infections show fungal fruiting bodies



Credit: David Moore

Pycnidium (pl. pycnidia)

Severe infections show fungal fruiting bodies



Credit: David Moore

Pycnidium (pl. pycnidia)

Isolations showed the occurrence of canker pathogens

Isolation on acidified potato dextrose agar (APDA)

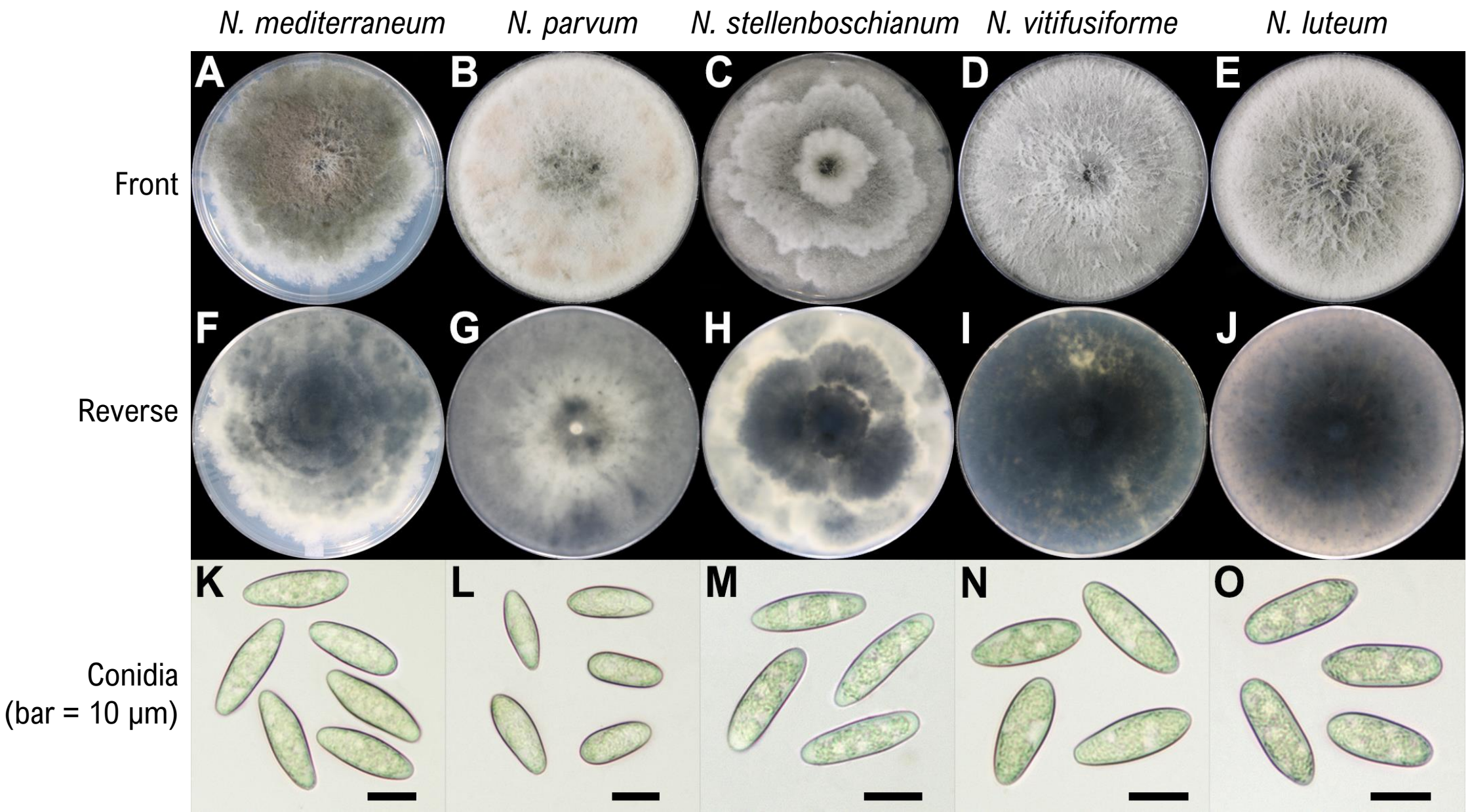
Morphological determinations

Botryosphaeriaceae (*n* = 44)

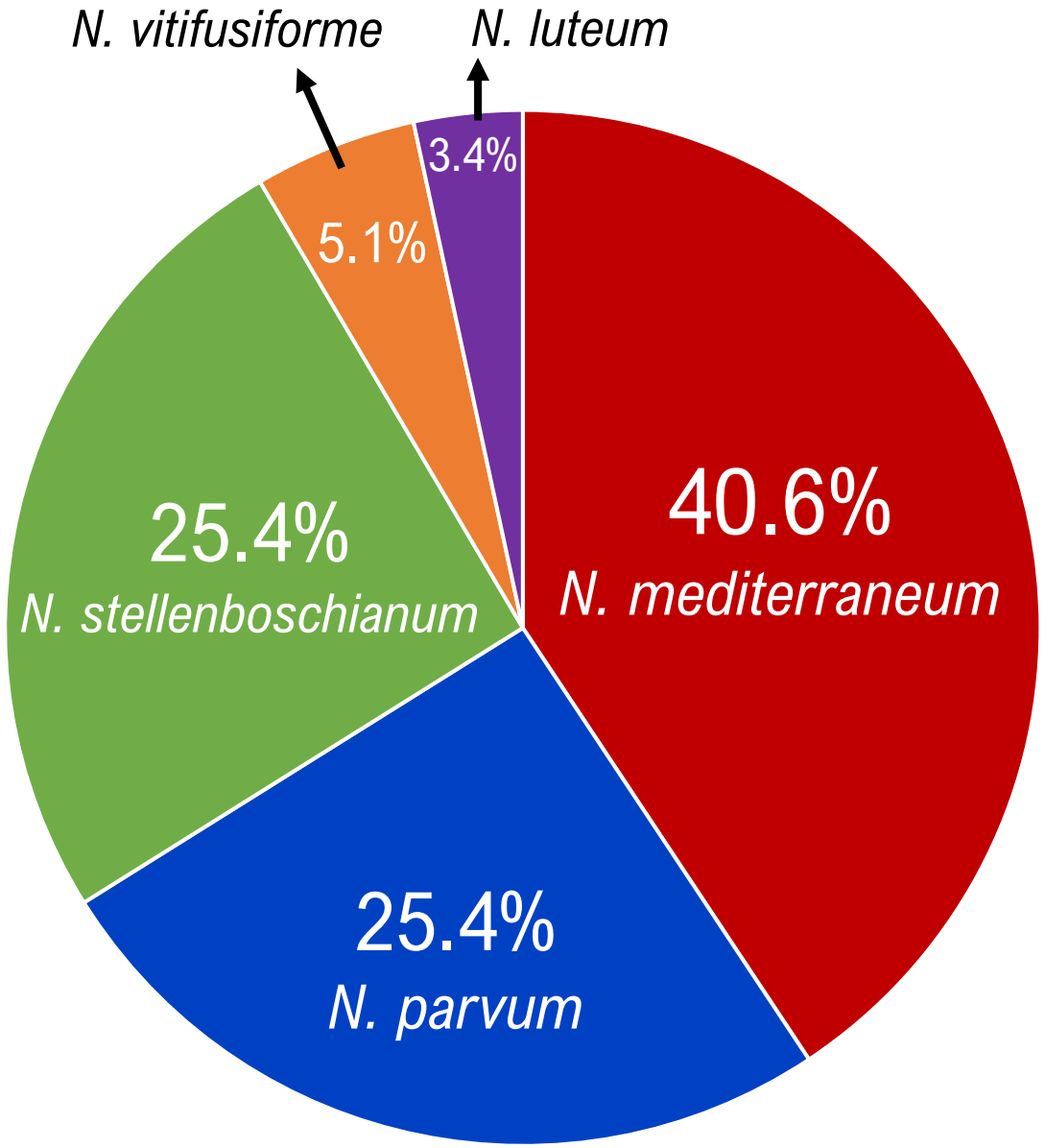
Sporocadaceae (*n* = 7)

Diaporthaceae (*n* = 4)

Neofusicoccum spp. showed distinct morphology



Recovery of fungal species associated with PGC



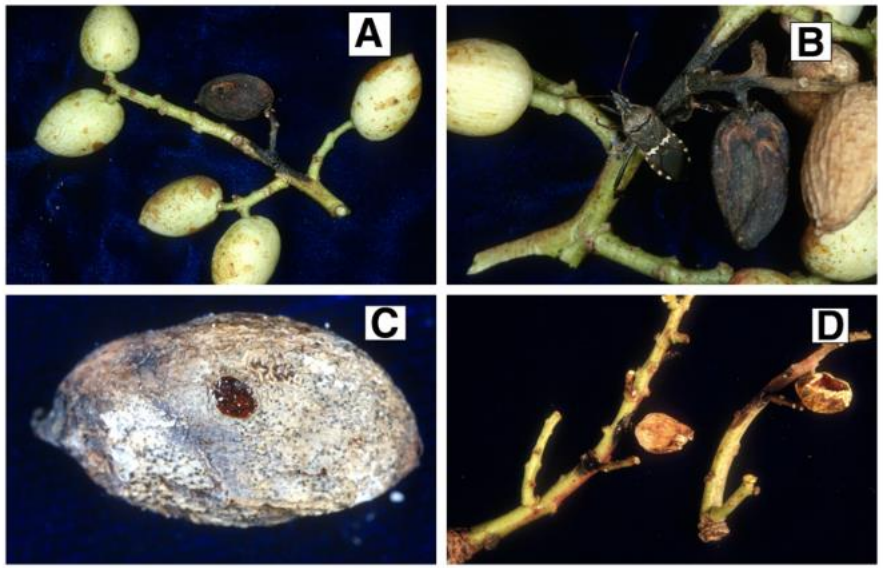
RESEARCH

Association of Botryosphaeria Panicle and Shoot Blight of Pistachio with Injuries of Fruit Caused by Hemiptera Insects and Birds

Themis J. Michailides and David P. Morgan

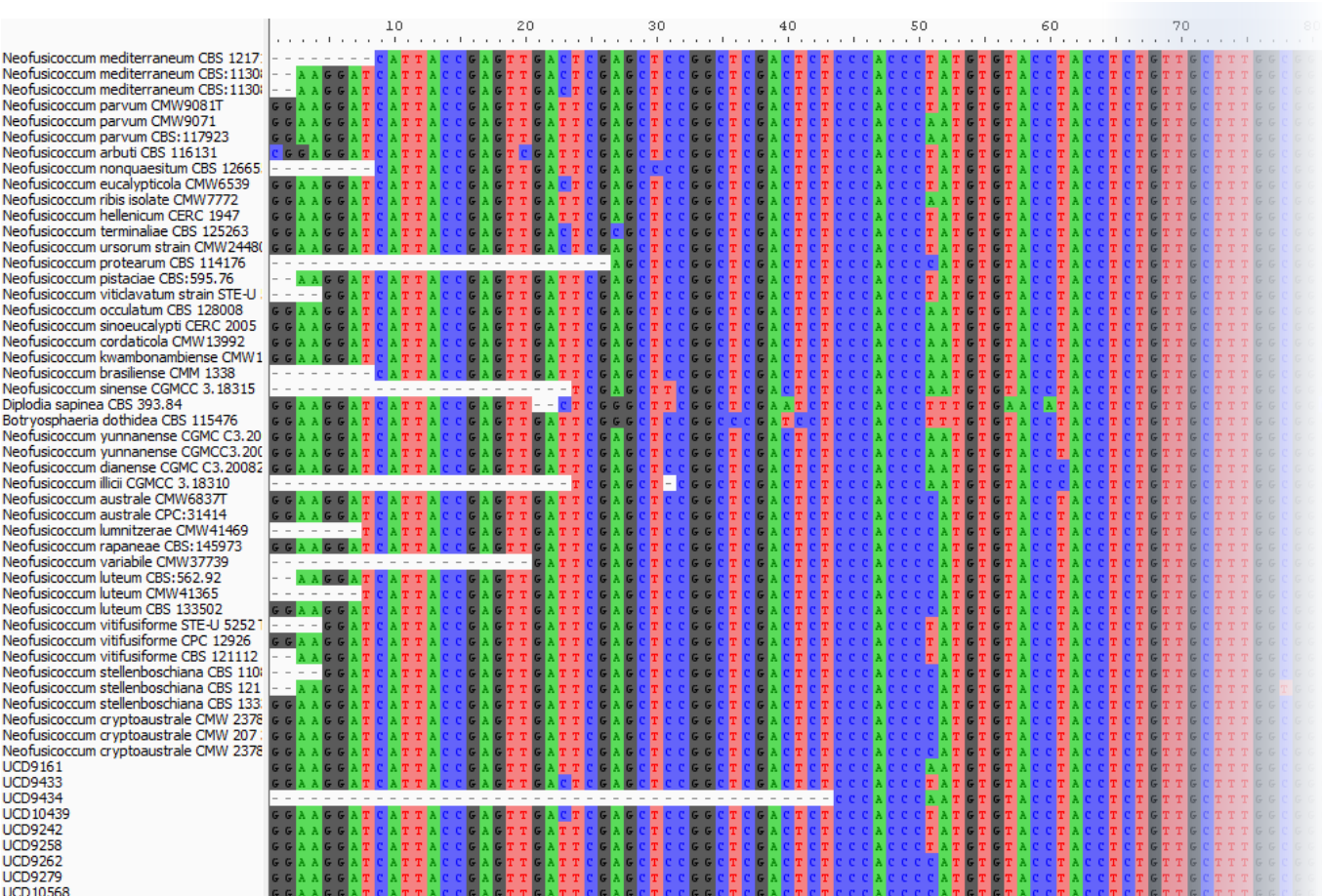
Affiliations

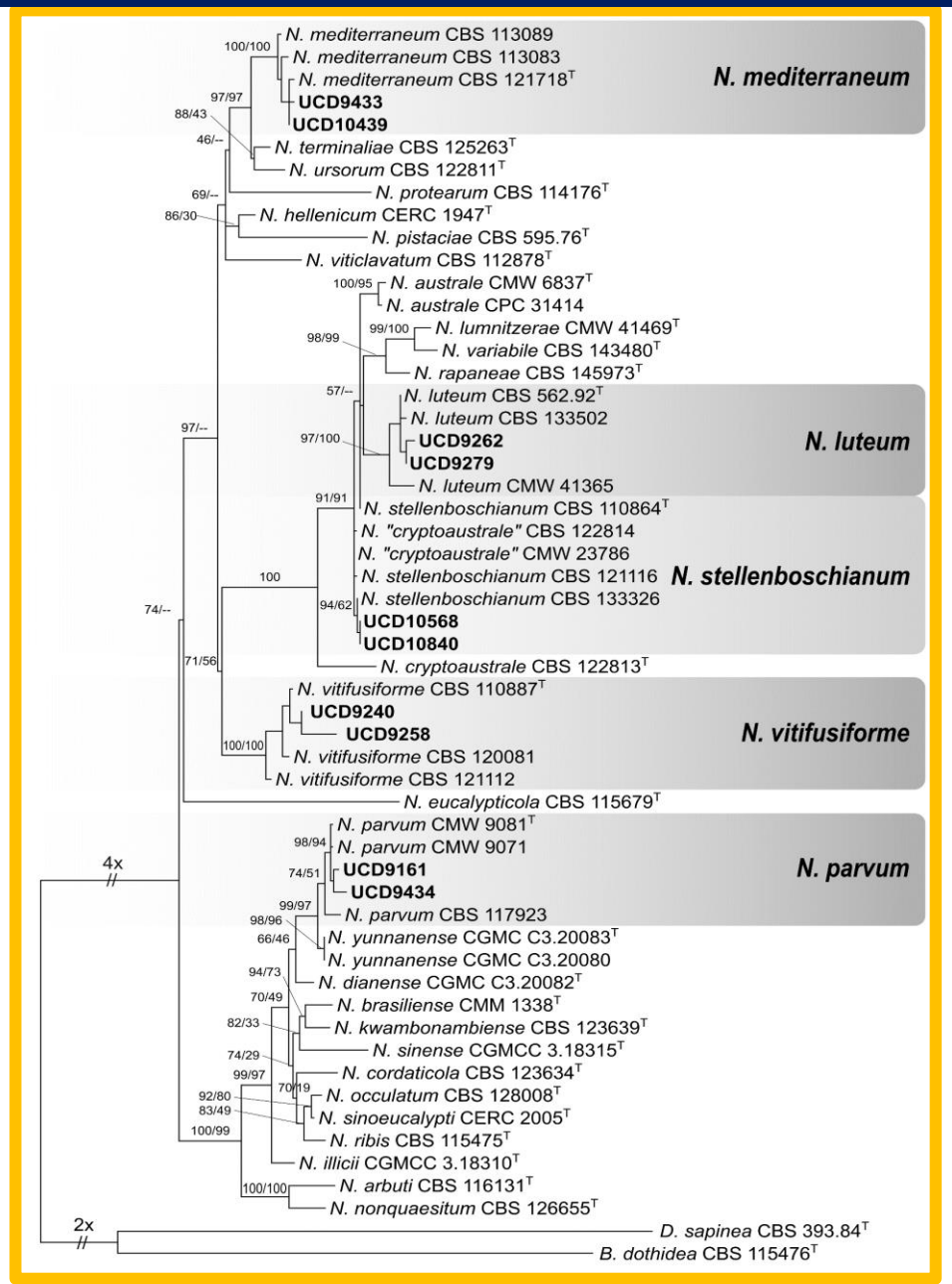
Published Online: 8 Apr 2016 | https://doi.org/10.1094/PDIS-09-15-1077-RE



DNA sequences allowed for accurate fungal ID

DNA extraction → PCR and sequencing of ITS, *tef1*, *tub2*, and *rpb2* → Phylogenetic inferences (MP, ML)





What are Botryosphaeriaceae fungi?

Taxonomy

Kingdom: **Fungi**

Division: **Ascomycota**

Class: **Dothideomycetes**

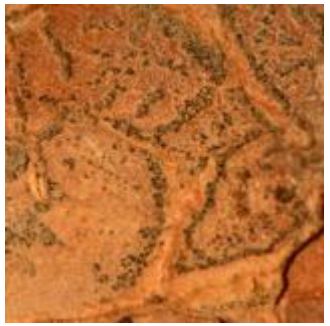
Family: **Botryosphaeriaceae**

Genus: *Botryosphaeria*

Neofusicoccum

Diplodia

Lasiodiplodia (and many others…)



Ecologically…

- **Endophytes** ☺ – **Parasites** ☠ – **Saprophytes** 😐

- **Affect multiple plant hosts**
  - Perennial crops 🍇 🍎 🥑 🫐
  - Ornamental plants 🌳 🌴
  - Native and introduced forest trees 🌲 🌲

- **Cause different diseases**
  - Cankers and dieback (wood)
  - Fruit rots

- **Worldwide distributed** 🌍 🌍 🌏

Pathogenicity tests *Koch's Postulates*

Inoculation of healthy branches with mycelium

↓

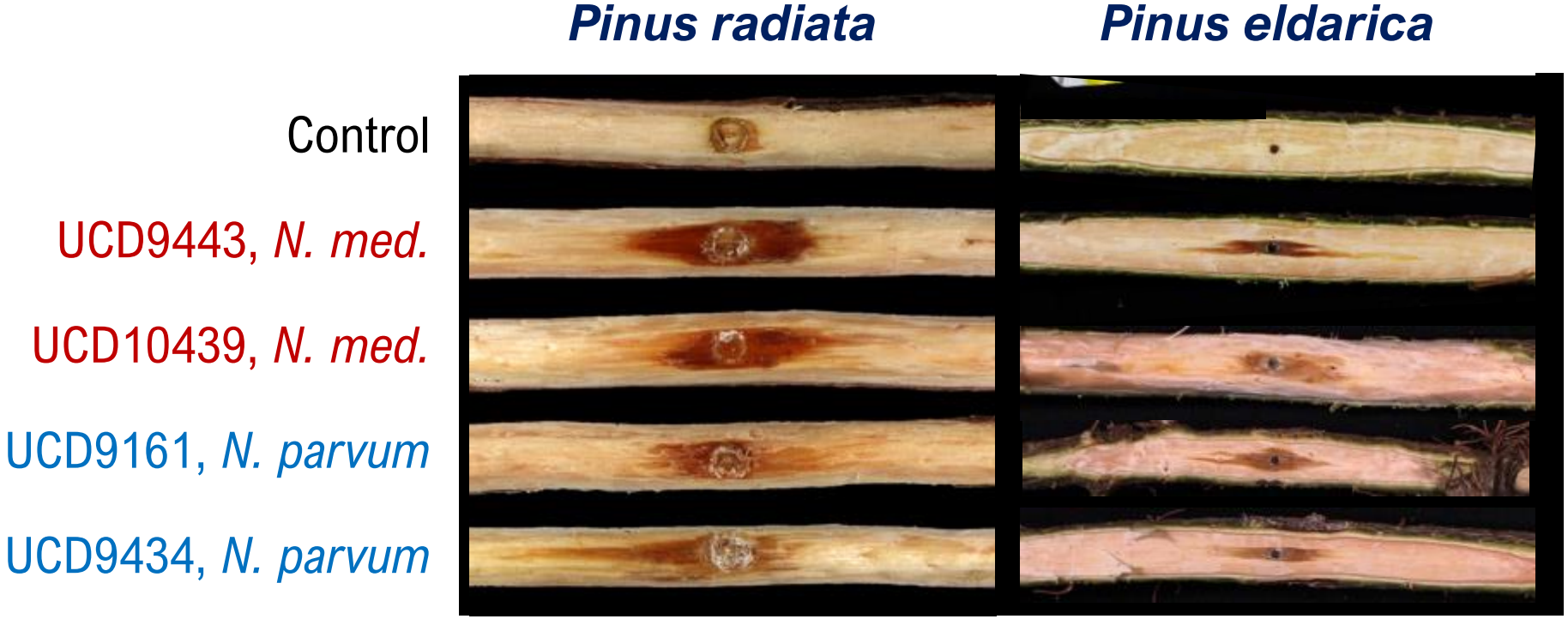
Incubation of 3 months

↓

Lesion length measurement

↓

Re-isolation of resulting lesions



100% recovery of both pathogens → Koch's postulates complete ✓

Neofusicoccum spp. were equally pathogenic/virulent

	Lesion length (mm)		Recovery (%)
Control	7.8	a	0
UCD9262, *N. luteum*	30.5	b	40-75
UCD9428, *N. luteum*	32.0	b	17-100
UCD9433, *N. mediterraneum*	40.7	b	33-100
UCD10439, *N. mediterraneum*	29.5	b	60-67
UCD9161, *N. parvum*	35.8	b	17-50
UCD9434, *N. parvum*	34.3	b	40-80
UCD10568, *N. stellenboschiana*	22.2	b	33
UCD10840, *N. stellenboschiana*	27.7	b	75
UCD9258, *N. vitifusiforme*	41.0	b	0-100
UCD9240, *N. vitifusiforme*	33.6	b	20-80

Pathogenicity tests on Monterey pine branches

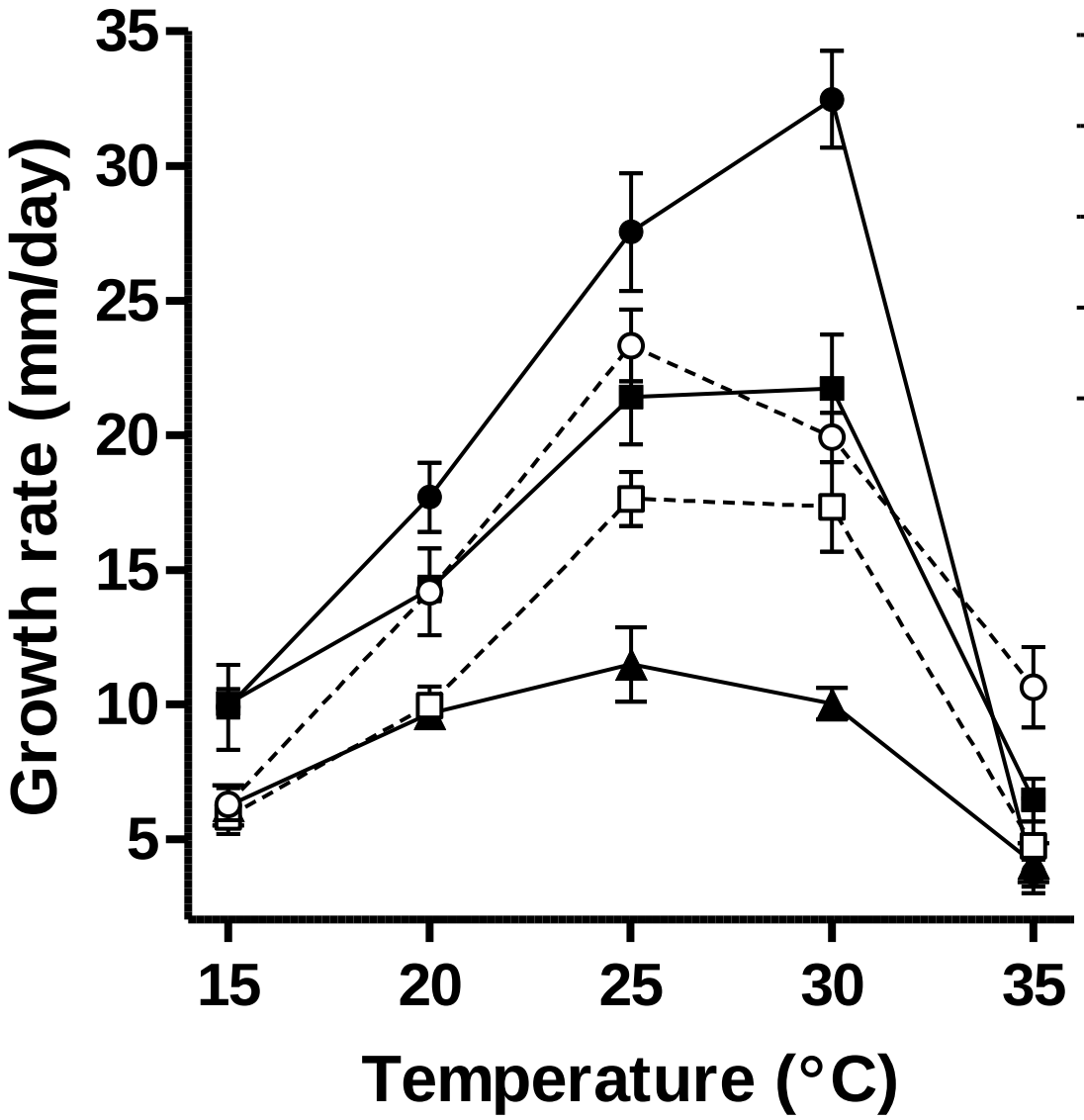
Control

Botryosphaeriaceae

Sporocadaceae

Diaporthaceae

Neofusicoccum spp. have differential growth rates



- *N. luteum* **(Fast-growing)**
- *N. mediterraneum* **(Slow-growing)**
- *N. parvum* **(Intermediate)**
- *N. stellenboschianum* **(Slow / intermediate)**
- *N. vitifusiforme* **(Intermediate)**

Similar diseases around the world

Neoscytalidium novaehollandiae causes dieback on *Pinus eldarica* and its potential for infection of urban forest trees

Mehrdad Alizadeh, Naser Safaie ✉, Masoud Shams-Bakhsh & Mohammad Mehrabadi

Scientific Reports **12**, Article number: 9337 (2022) | Cite this article

Characterization and Pathogenicity of Botryosphaeriaceae Fungi Associated with Declining Urban Stands of Coast Redwood in California

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Fig. 1. Needle and shoot blight symptoms on coast redwood caused by Botryosphaeriaceae fungi from different cities in California: **A,** San Marino; **B,** Pomona; **C,** Descanso; **D,** Pasadena; **E,** Modesto; **F,** Pasadena.

Conclusions

1. Pine Ghost Canker is a new disease detected in Southern California affecting multiple pine species in urban forests and parks.

2. Multiple *Neofusicoccum* spp. were **consistently isolated** from symptomatic trees.

3. Five *Neofusicoccum* spp. were **pathogenic** on Monterey pine branches.

4. Environmental conditions may predispose the pines to this disease.

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