

# 华南地区褐根病发生及生物防治研究

# Occurrence of Brown Root Rot Disease in South China and its Biological Control

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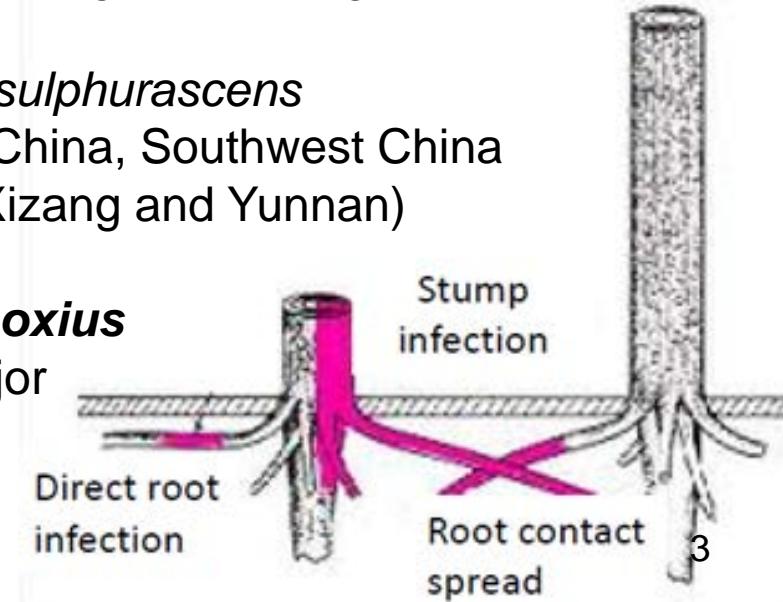
March 18, 2017 (Hong Kong)

# Outline

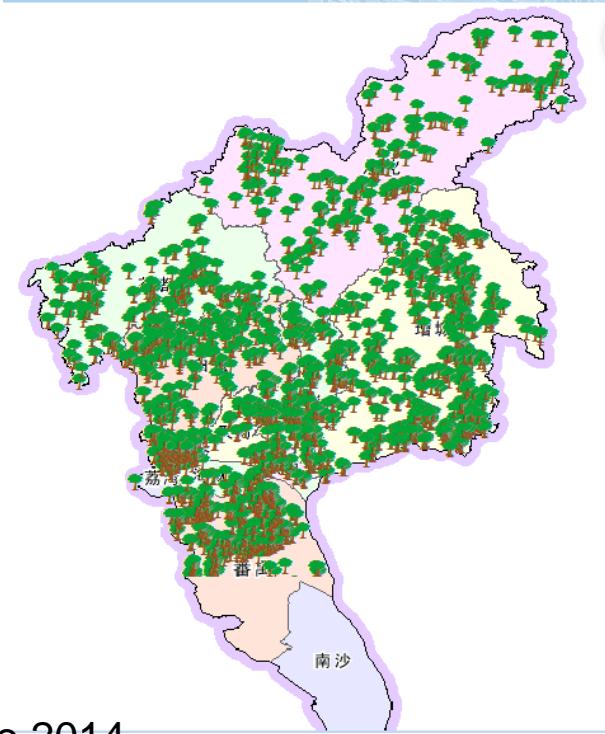
- General information about BRRD and *Phellinus noixus*
- The presence of BRRD in South China
- Research on Biological control and Further Work

# Root Diseases: The Hidden Enemy

- Armillaria root disease –caused by *Armillaria ostoyae*  
Distribution: Northeast China
- Brown root and butt rot –caused by *Phaeolus schweinitzii*  
Distribution: Northeast China, Northwest China, Southwest China
- Annosus root and butt rot –caused by *Heterobasidion parviporum*  
Distribution: Northeast China, Northwest China, Southwest China (Jilin, Yunnan, Sichuan and Hubei and Xinjiang and Xizang)
- Laminated root rot –caused by *Phellinus sulphurascens*  
Distribution: Northeast China, Northwest China, Southwest China (Nei mongol, Heilongjiang, Jilin, Xijiang, Xizang and Yunnan)
- **Brown root rot –caused by *Phellinus noxius***  
In recent years, BRRD has become a major concern in South China



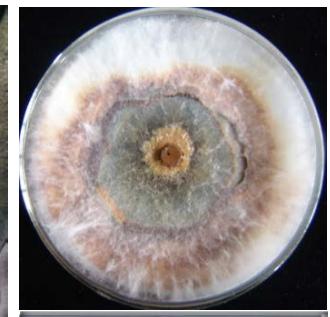
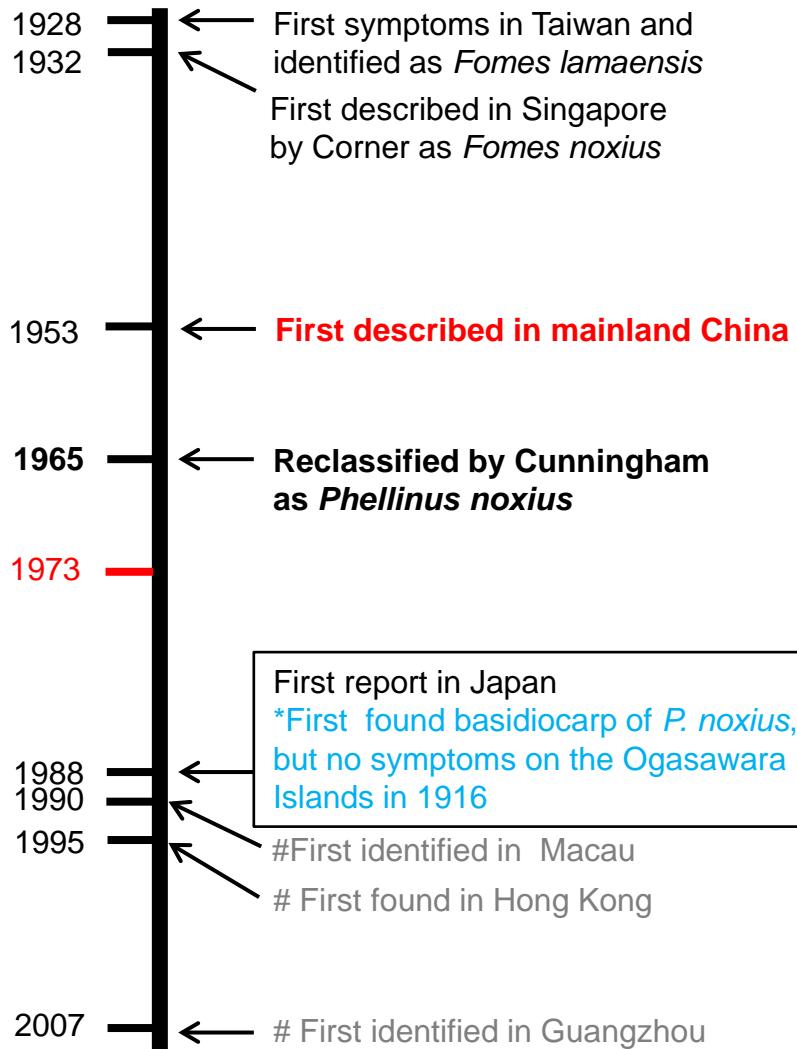
# Why Should We Care about *Phellinus noxius*?



**Table 1** Profile of notable and ancient trees in Guangzhou up to 2014

Ages Class	> 300 yrs	100-299 yrs	> 100 yrs
Category	First-class ancient trees	Second-class ancient trees	Notable trees (rare species or historical value, with memorable names)
Number	9924	1537	38
Total	11499		

# Timeline of BRRD and *Phellinus noxi*us



BRRD: Brown root rot disease



# Important Characteristics of *Phellinus noxius*

## □ Taxonomy

*Basidiomycota* (担子菌门), *Hymenomycetes*(层菌纲), *Aphyllophorales* (无褶菌目), *Hymenochaetaceae* (刺革菌科), *Phellinus* (木层孔菌属)

Synonyms:

*Fomes noxius* Corner, (1932)

*Phellinidium noxiun* (Corner) Bondartseva & S. Herrera, (1992)

- Extremely broad host range (> 200 species in 59 families)
- Prevalent in tropical and subtropical regions
- Symptoms might not always be visible !
- Slower infection and colonization rate (5-15 yrs)

# The List of Some Significant Economic Plants Affected by *P. noxius*

Over 200 species are known to be affected from approximately 100 different genera in 59 families

● In Macau, 44 species in 26 families

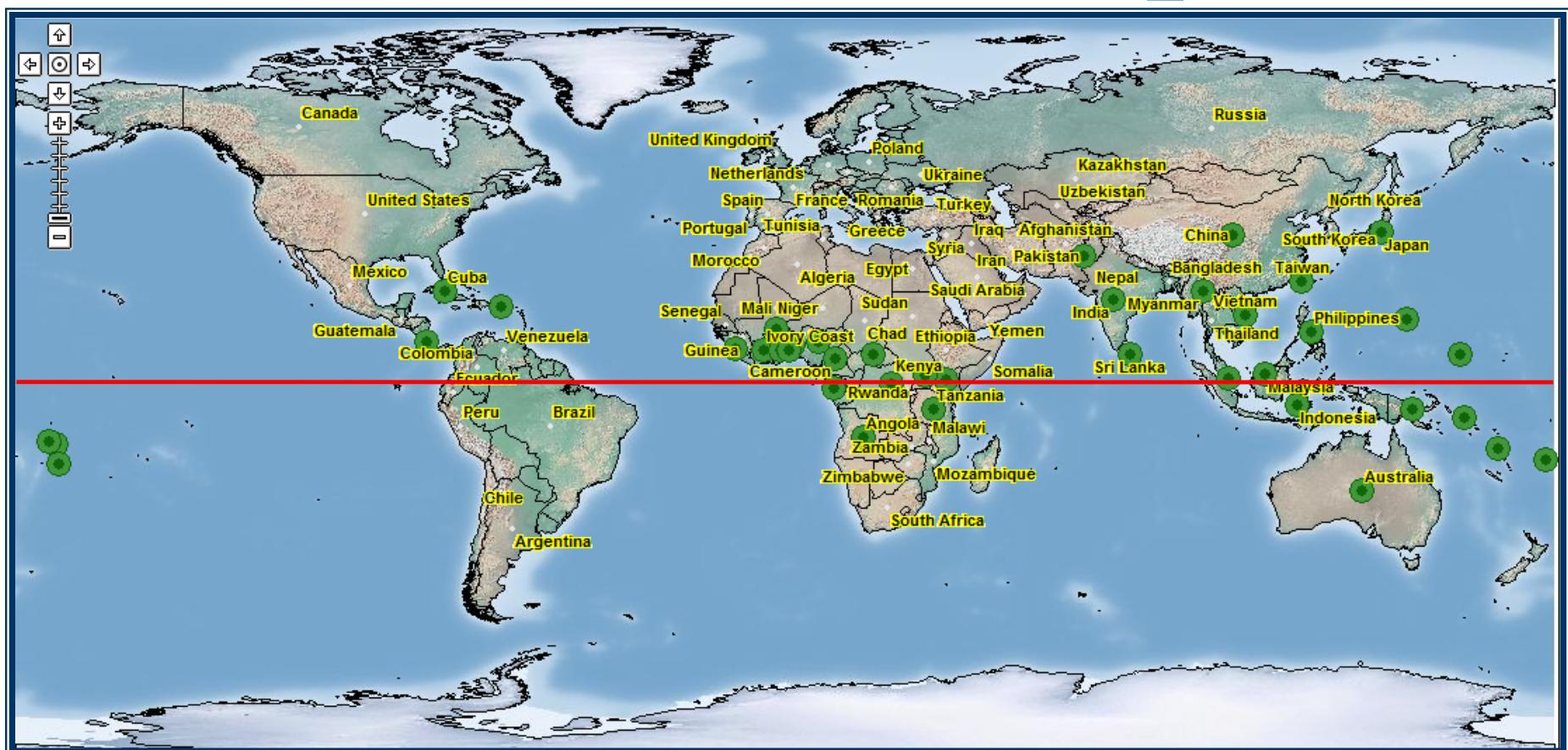
● In Taiwan, more than 126 species in 102 families

● In Japan, 33 species in 26 families (the Ogasawara Islands) ; 53 species in 32 families (the Ryukyu Islands)

序号	名称
1	台湾相思 ( <i>Acacia confusa</i> )
2	南洋杉 ( <i>Araucaria cunninghamii</i> )
3	面包树 ( <i>Artocarpus altilis</i> )
4	羊蹄甲 ( <i>Bauhinia variegata</i> )
5	琼崖海棠 ( <i>Calophyllum inophyllum</i> )
6	茶 ( <i>Camellia sinensis</i> )
7	木麻黄 ( <i>Casuarina equisetifolia</i> )
8	咖啡 ( <i>Coffea</i> )
9	油棕 ( <i>Elaeis guineensis</i> )
10	榕树 ( <i>Ficus microcarpa</i> )
11	山竹 ( <i>Garcinia mangostana</i> )
12	橡胶 ( <i>Hevea brasiliensis</i> )
13	台湾栾树 ( <i>Koelreuteria elegans</i> var. <i>formosana</i> )
14	栾树 ( <i>Koelreuteria paniculata</i> )
15	罗汉松 ( <i>Podocarpus macrophyllus</i> )
16	垂柳 ( <i>Salix babylonica</i> )
17	桃花心木 ( <i>Swietenia mahagoni</i> )
18	缅甸柚木 ( <i>Tectona grandis</i> )
19	可可树 ( <i>Theobroma cacao</i> )

# Global Distribution of *P. noxius*

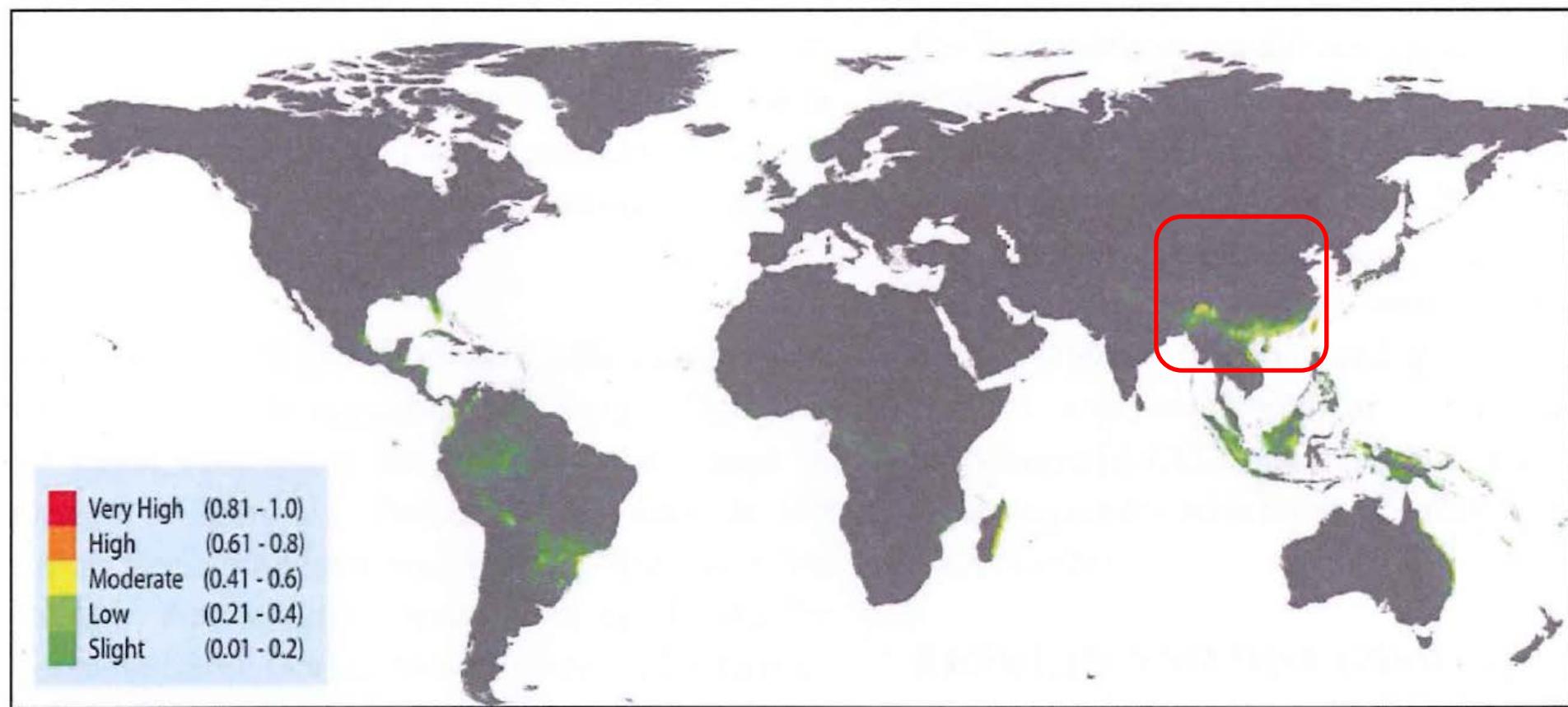
 = Record



Source: [http://www.plantwise.org/KnowledgeBank/Map/GLOBAL/Phellinus\\_noxius/](http://www.plantwise.org/KnowledgeBank/Map/GLOBAL/Phellinus_noxius/) [Accessed 16 January 2017]

> 40 countries and areas; the Asian accounts for about 1/3

# Predicted suitable Climate Space for *P. noxi*us (Preliminary )

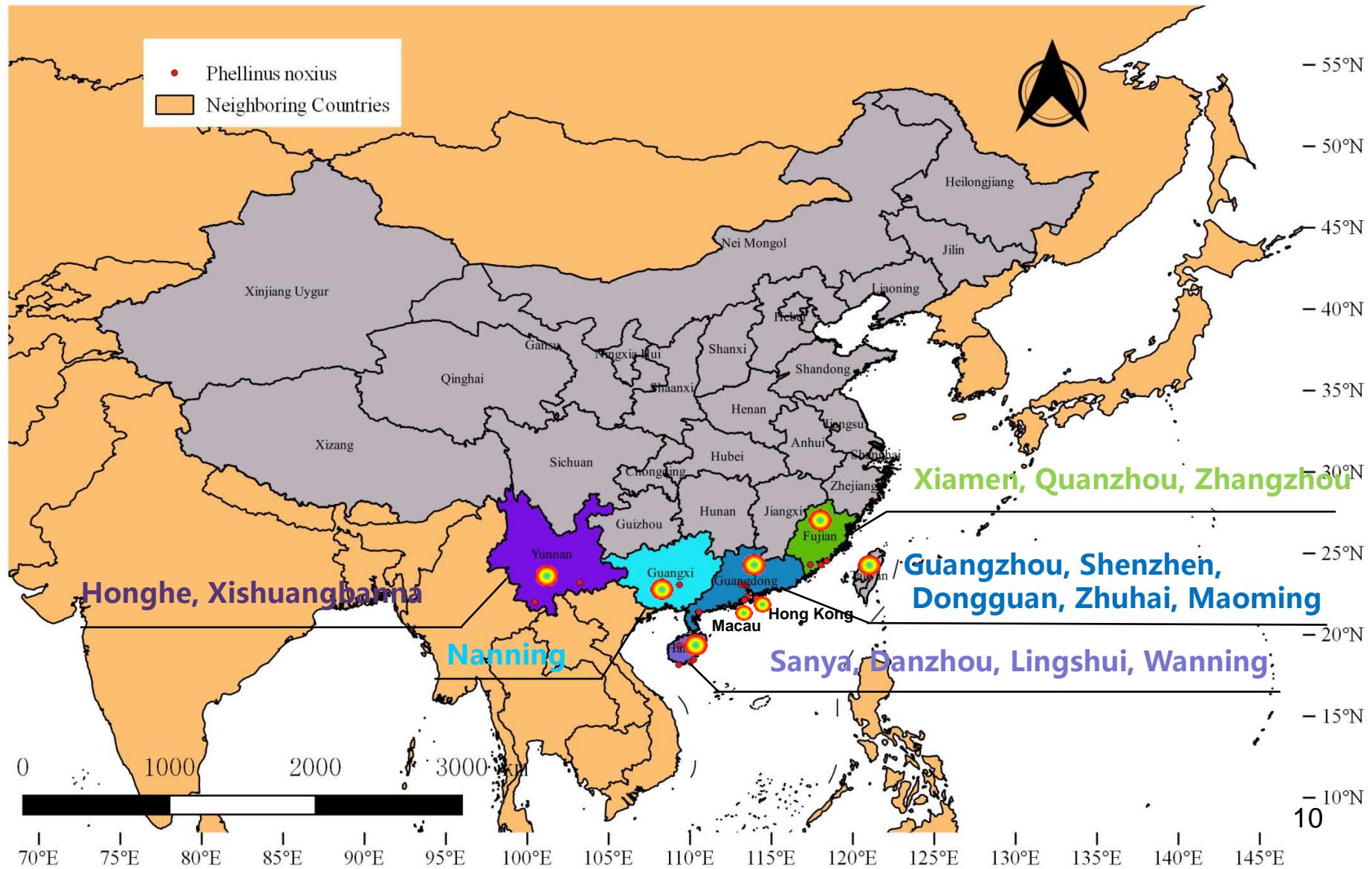


Source: In: Ramsey, A. & P. Palacios (Comps). Proceedings of the 63rd Annual Western International Forest Disease Work Conference; 2015 Sept. 21-15;

**Based on isolates from southeastern Asia, Australia, and Pacific islands;**

**BUT not included isolates from Central America, Caribbean, South America, and Africa.** 9

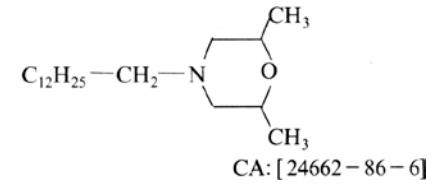
# Distribution of *Phellinus noxius* in South China



# In Yunnan, Guangxi & Hainan Provinces since 1950s



*Hevea brasiliensis*

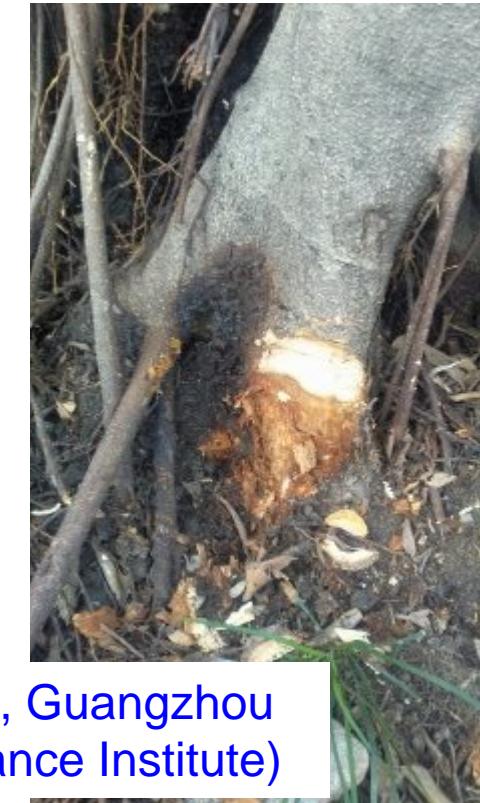


Photos from internet

## In Guangdong Province

In 2007, the 132-year-old *Ficus microcarpa* tree (No. 01050027) infected by *P. noxius* was first reported in Wa King Town Hotel (华金盾酒店) in Guangzhou.





September, 2015, Guangzhou  
(Guangdong Finance Institute)



November 21, 2016





## Maonan, Maoming



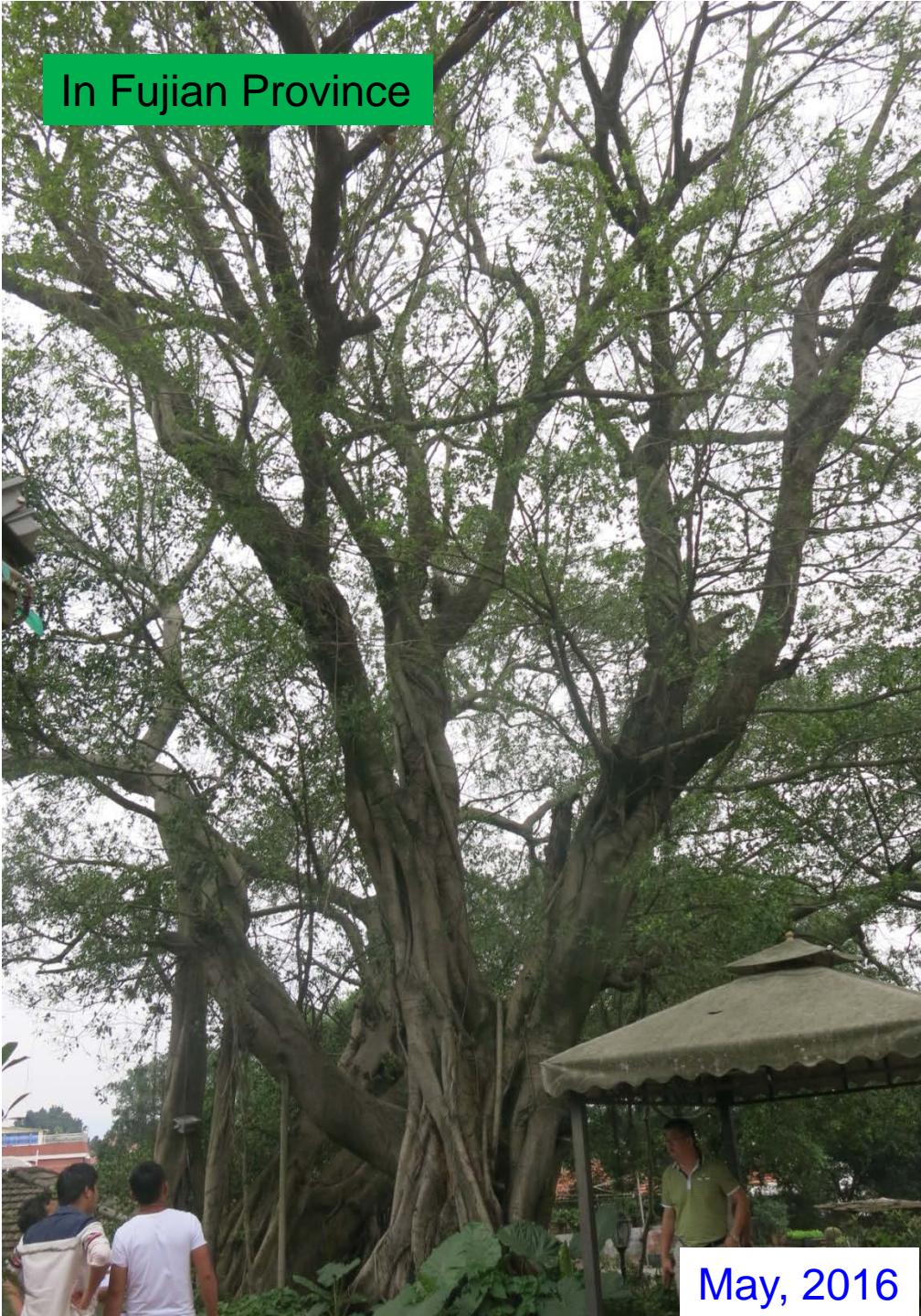
July, 2011, cut down the tree



## *Swietenia mahagoni*

December, 2012

In Fujian Province





## In Macau



October, 2014  
Matsuyama Municipal Park, Macau





October 2014, Macau





June 2012, Macau

**BUT there is limited knowledge  
on how to manage this pathogen.**



October 2014, Macau

# Managing BRRD in Our Case

- Removing all the infected source (Stumps and Roots)
- Installing root barriers to reduce rate of spread
- replacing the infested soil
- Chemical control (Calixin, 0.75%)
- Or Biological control agent (M18, 0.25%)



□ **Removing all the infected source (Stumps and Roots)**





**Replacing the infested soil with substrate mixture  
(with Calixin, other chemicals and biocontrol agents)**





# Chemical agents for *Phellinus noxius*

Control

Sportak  
1000X

Tilt  
4000X

Difenoconazole  
1000X

Opus  
2000X

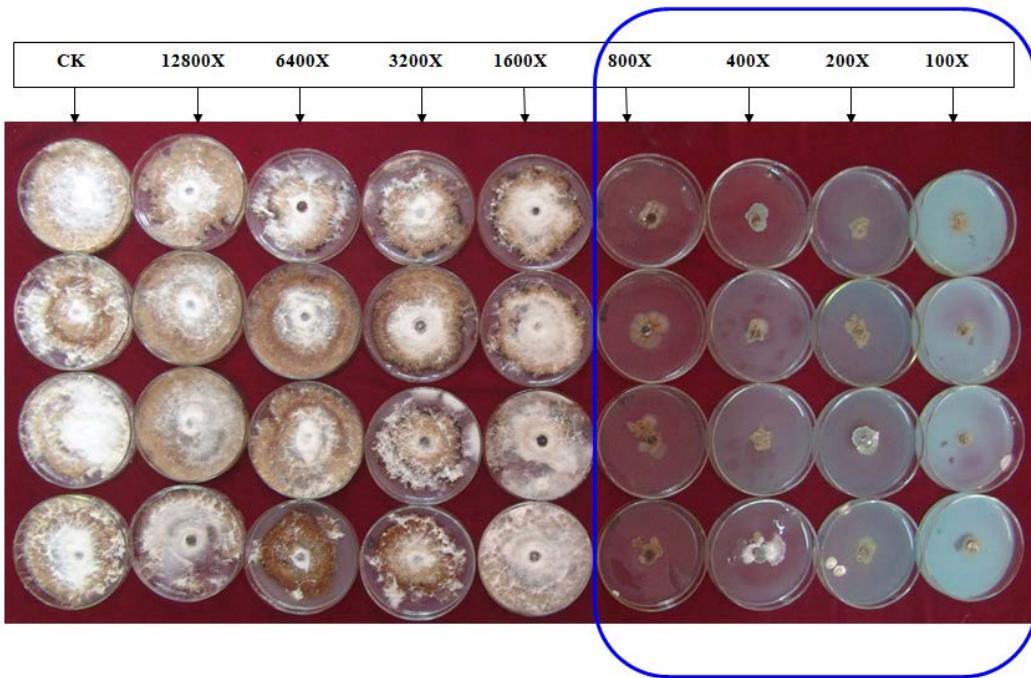
Tebuconazole  
2000X

Shuangguan  
2000X

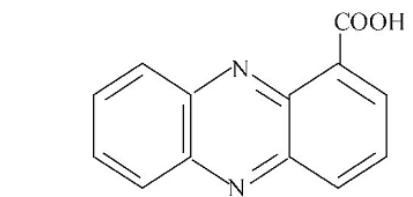
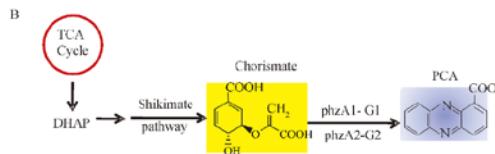
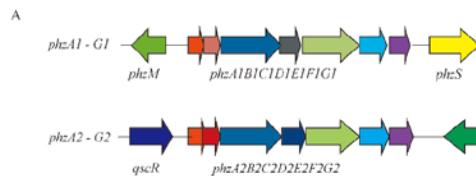
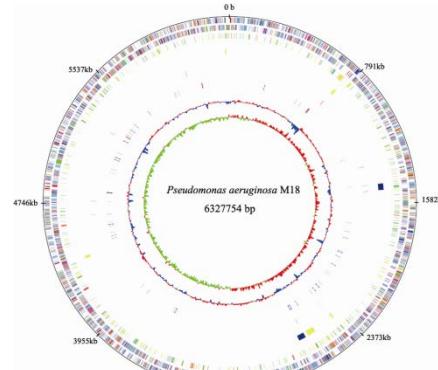


Chemicals	Dilution Factor	Infected Plant	Control Efficacy (%)
Sportak	1000	80(1)	98.44b
Tebuconazole	2000	80(0)	100a
Difenoconazole	1000	80(2)	96.88c
Shuangguan	2000	80(0)	100a
CK	—	80(80)	—

# Biological control agents for *Phellinus noxius*



# M18 strain and its product PCA



Phenazine-1-carboxylic acid (PCA)



Shenqinmycin

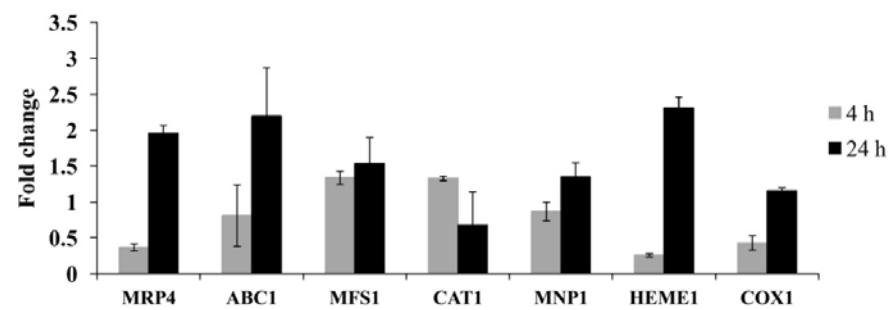
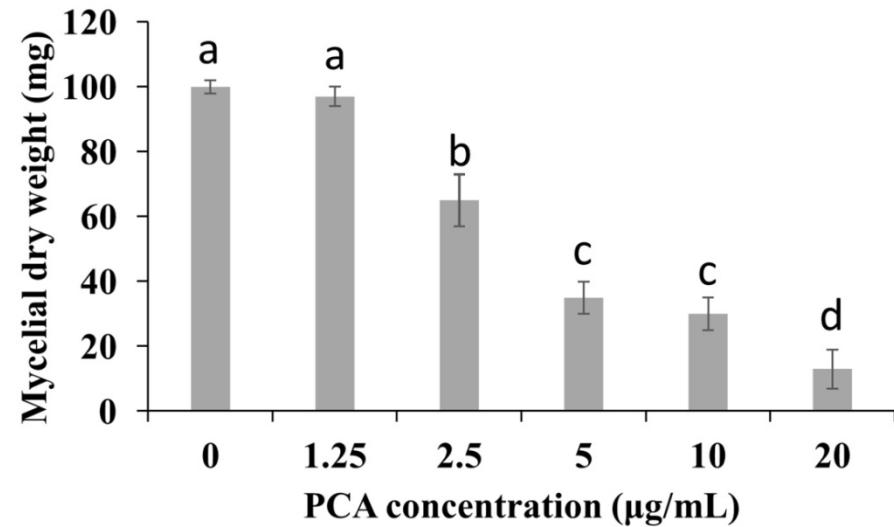
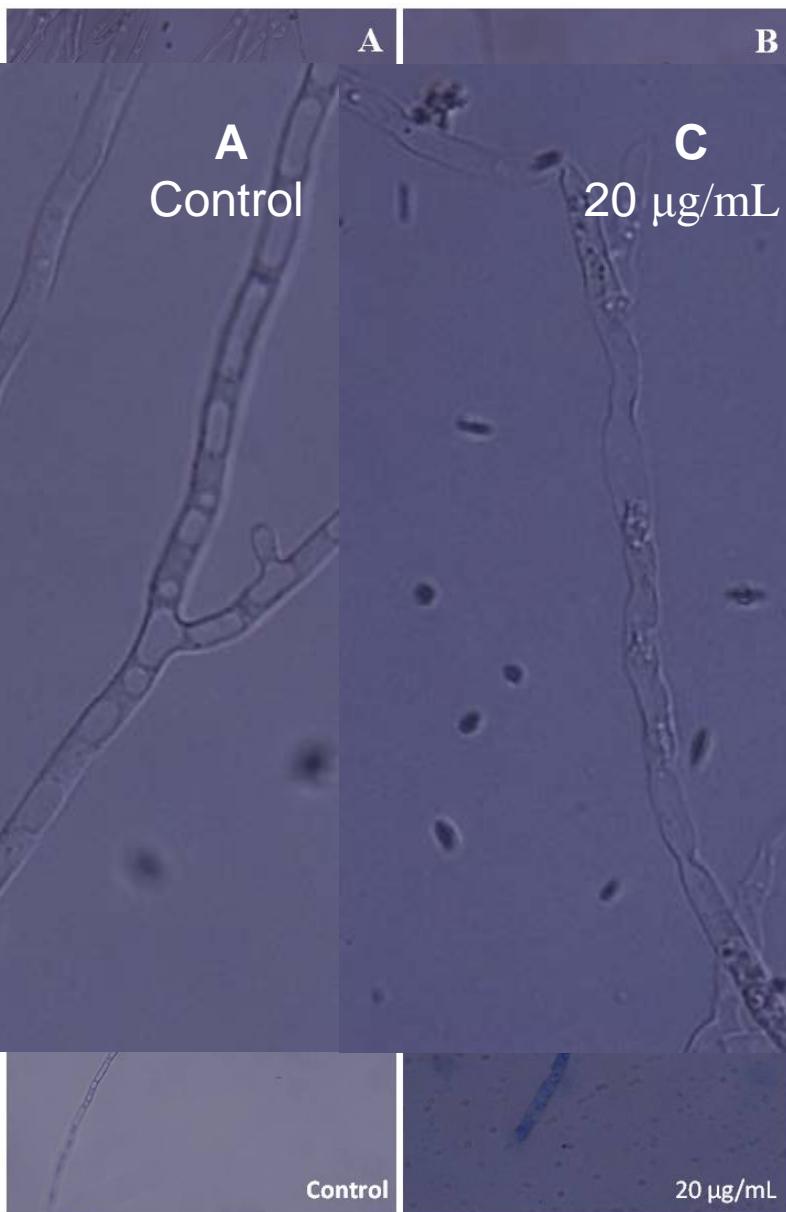
Control      1.25 µg/mL      2.5 µg/mL      5 µg/mL      10 µg/mL      20 µg/mL      40 µg/mL



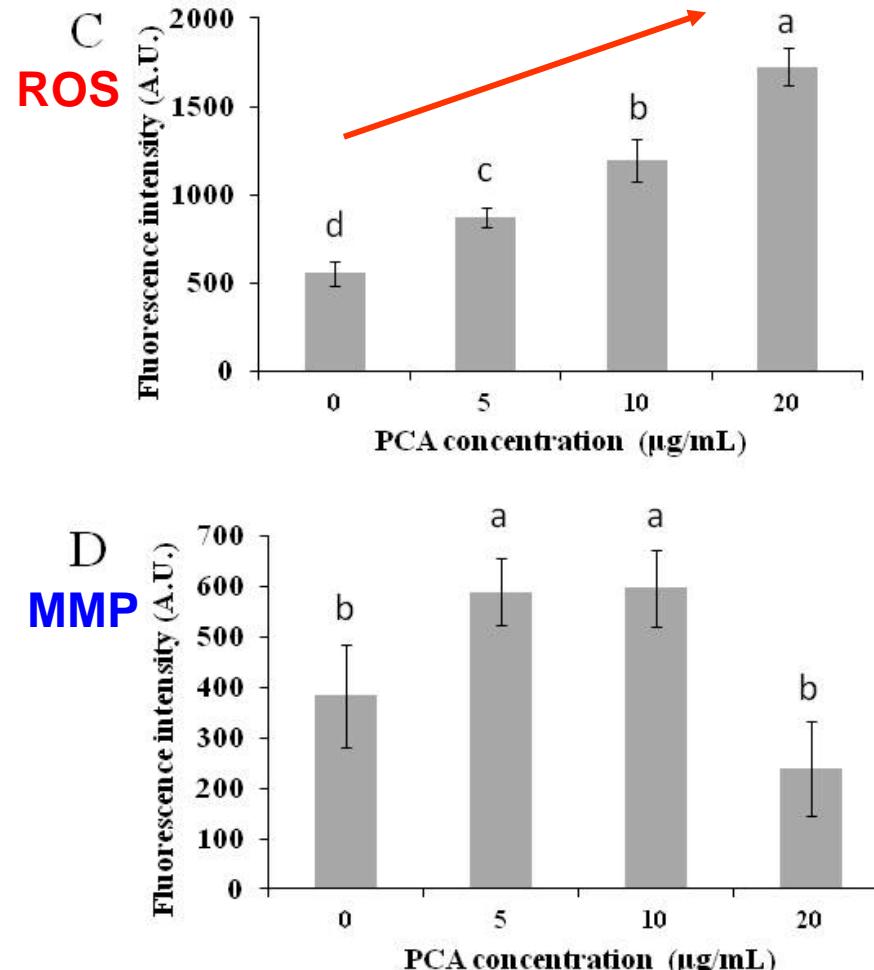
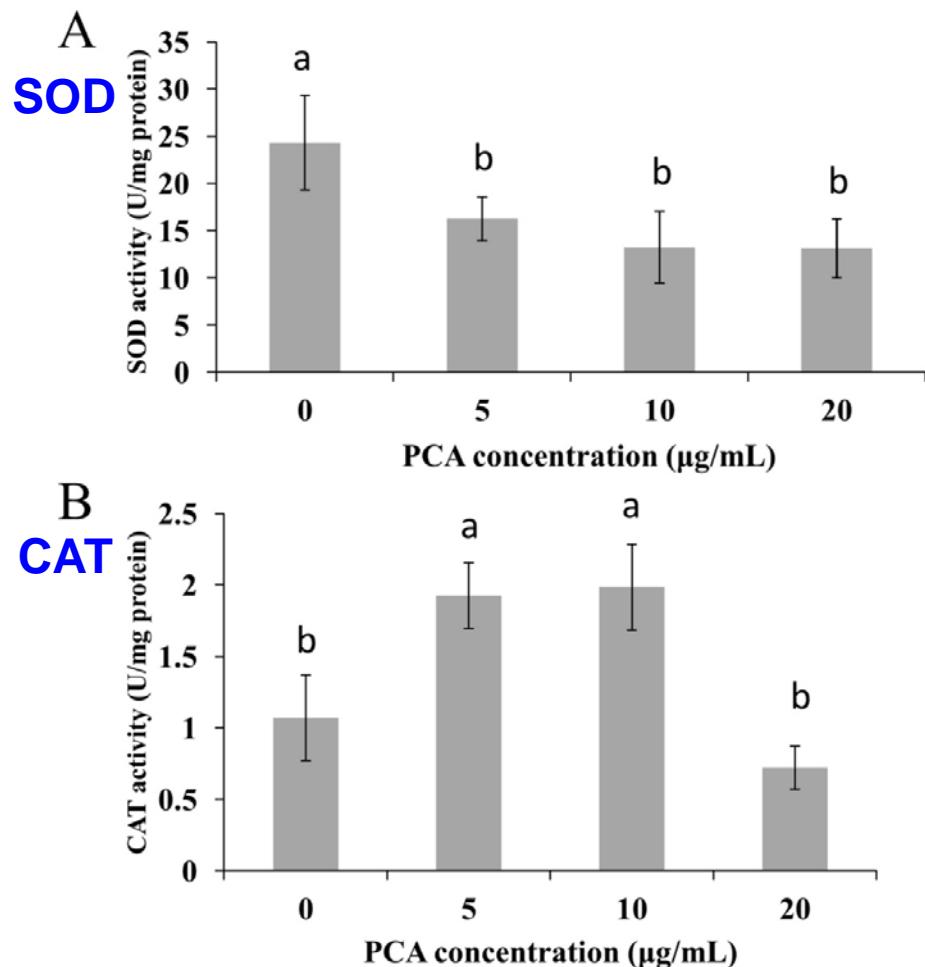
Wu et al., BMC Genomics, 2011,12: 438

Fang et al., Chinese Journal of Pesticide Science, 2014,16(4):387-393

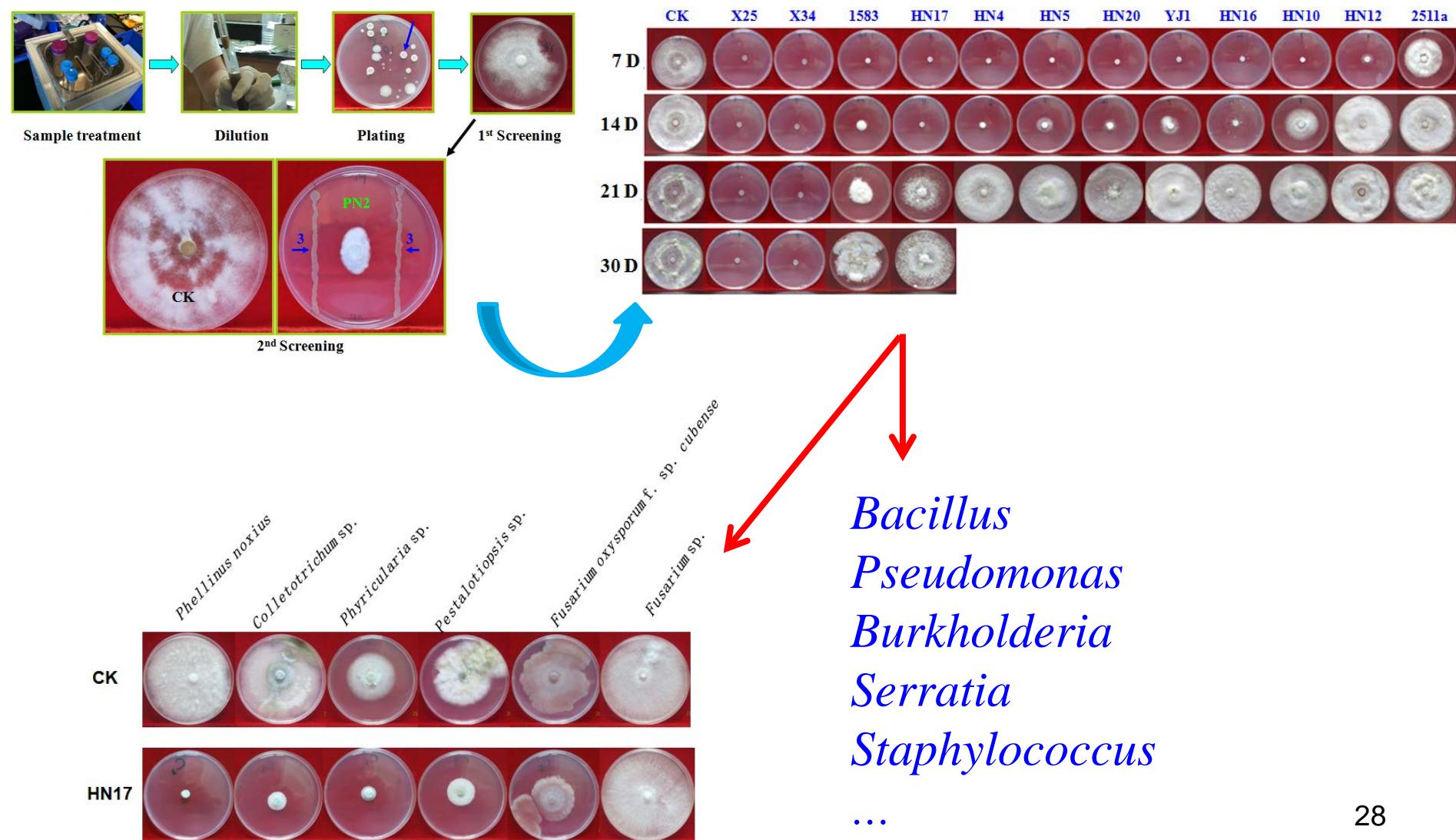
# PCA is fungicidal activity, not fungistatic activity



# Effects of PCA on SOD (A) , CAT (B), intracellular ROS accumulation (C) and mitochondrial membrane potential (D) in *P. noxius*



# Screening antagonistic bacteria for *Phellinus noxi*us



# Further Work

- Phylogenetic analysis with DNA markers
  - To construct phylogenetic relationship among *P. noxius* and find out the origin of *P. noxius*
  
- Biological control
  - Use antagonistic bacteria to treat BRRD caused by *P. noxius*, such as *Bacillus* spp. or *Pseudomonas* spp.

# Acknowledgments



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<http://www.gzyks.com/>



Thanks for your attention

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