

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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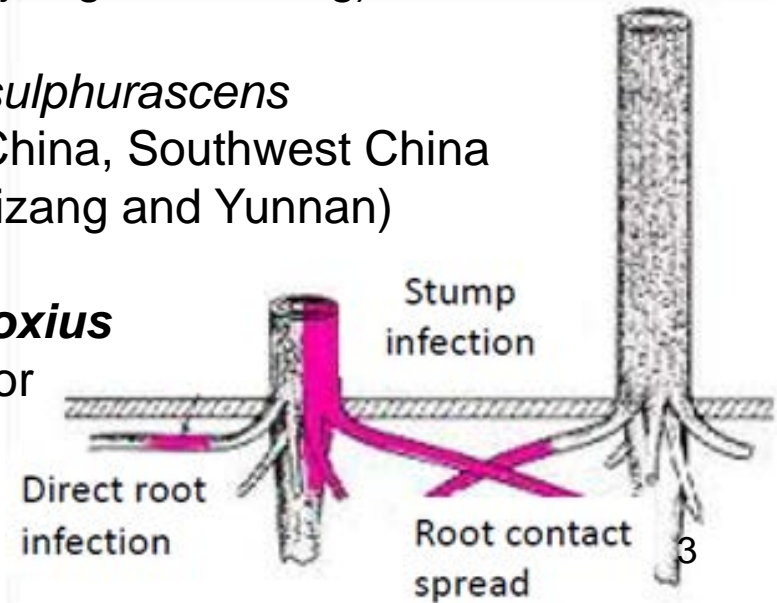
March 18, 2017 (Hong Kong)

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*?

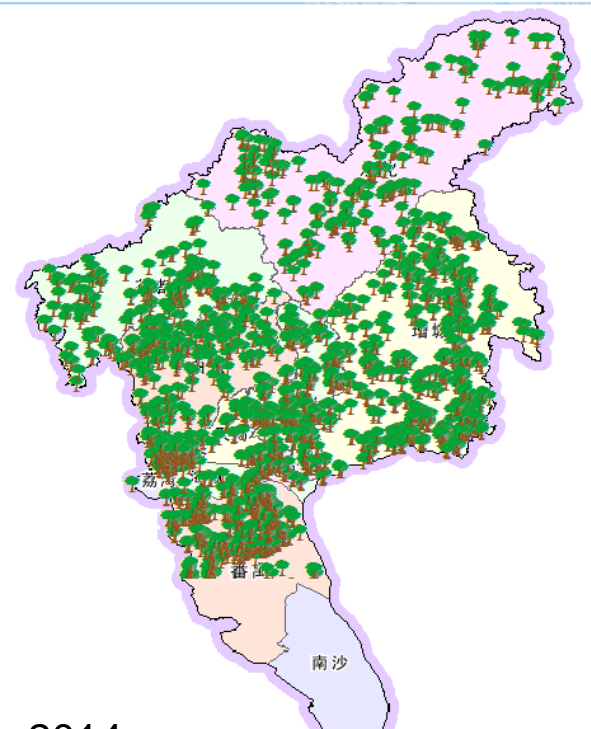
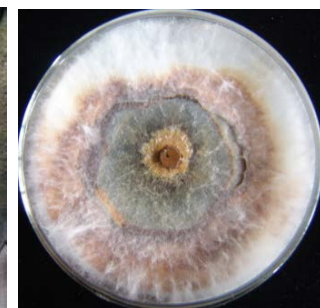
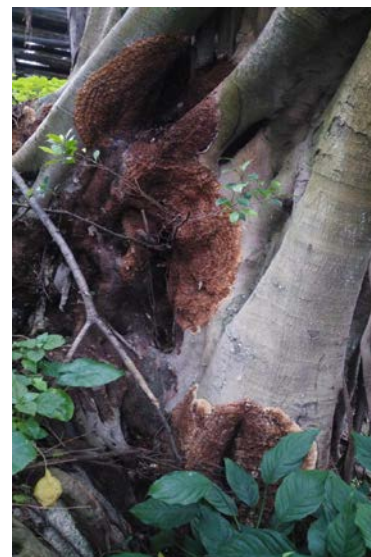
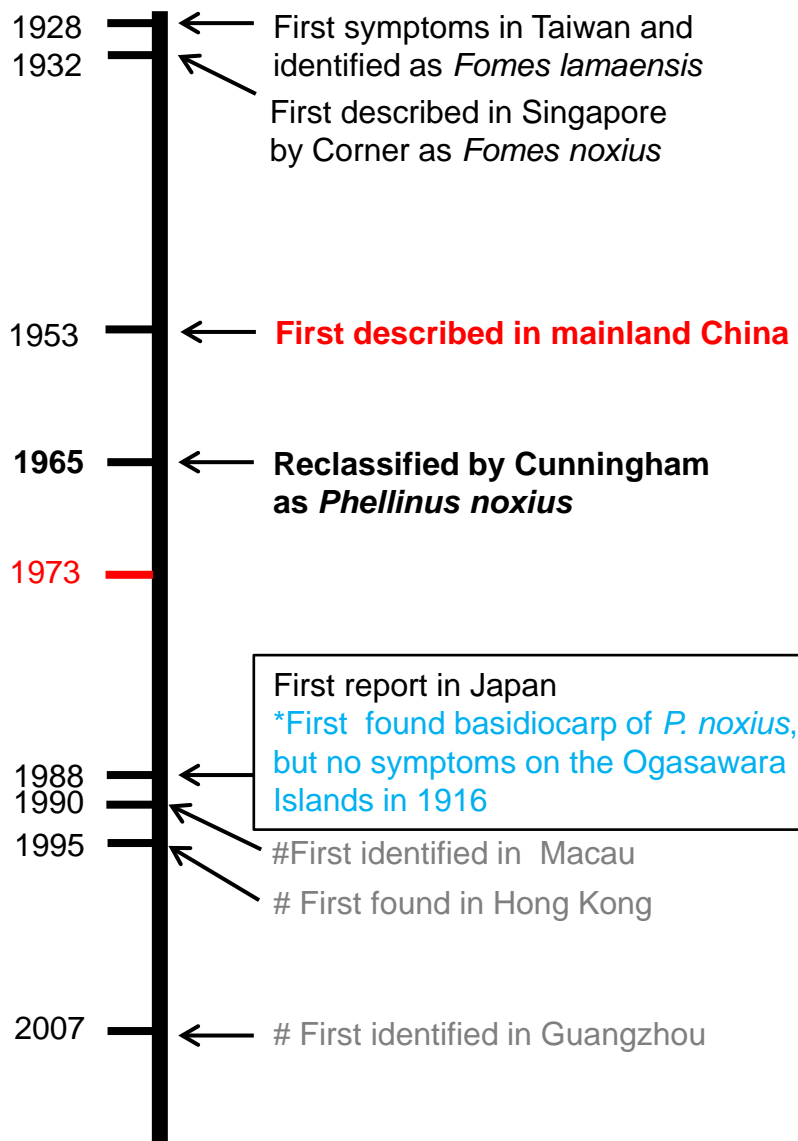


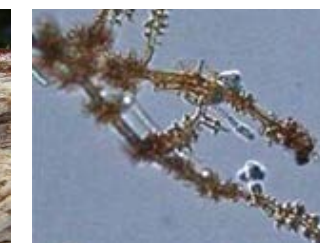
Table 1 Profile of notable and ancient trees in Guangzhou up to 2014

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 noxius*



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 noxium (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

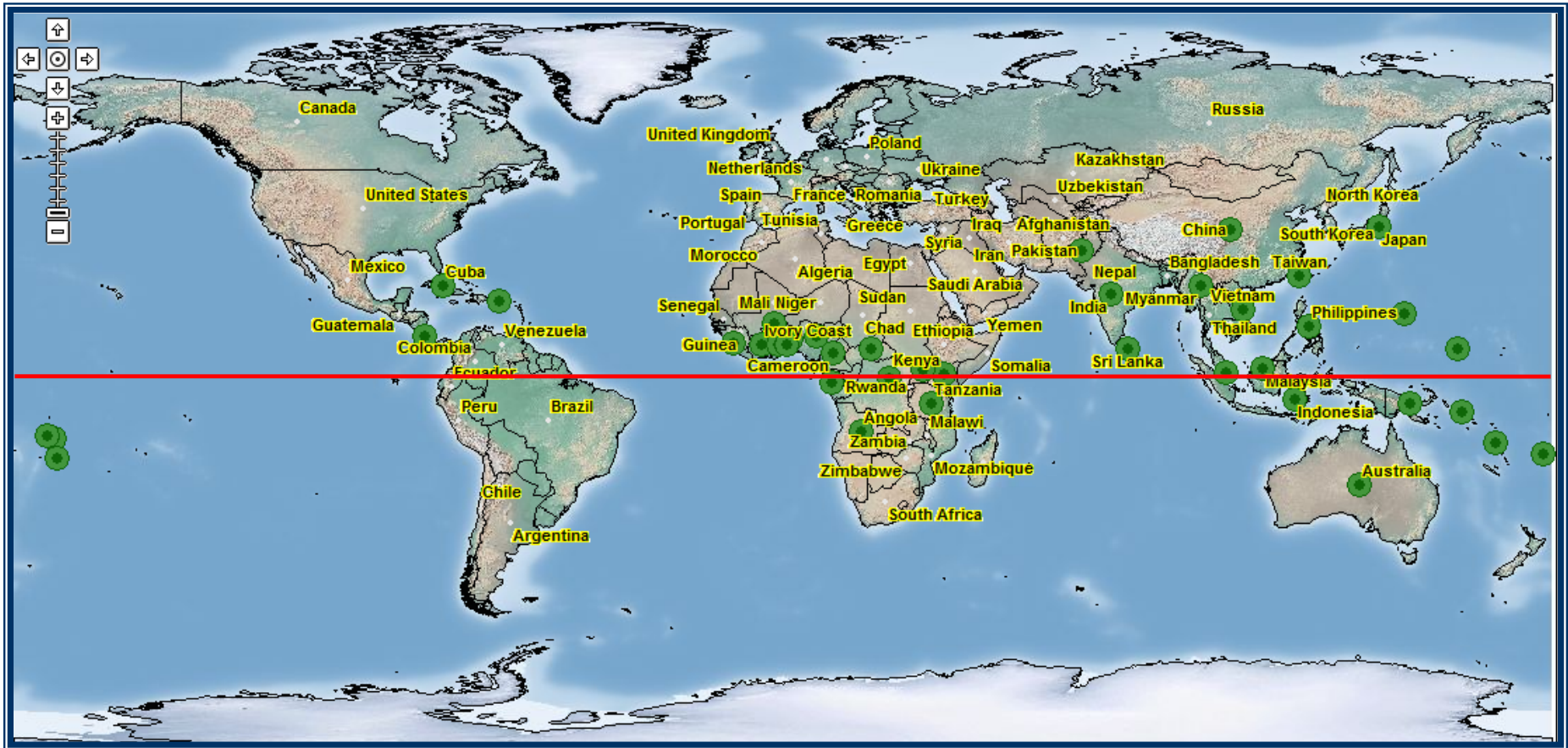
●In Taiwan, more than 126 species in 102 families

●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	台湾栎树 (<i>Koelreuteria elegans</i> var. <i>formosana</i>)
14	栎树 (<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*

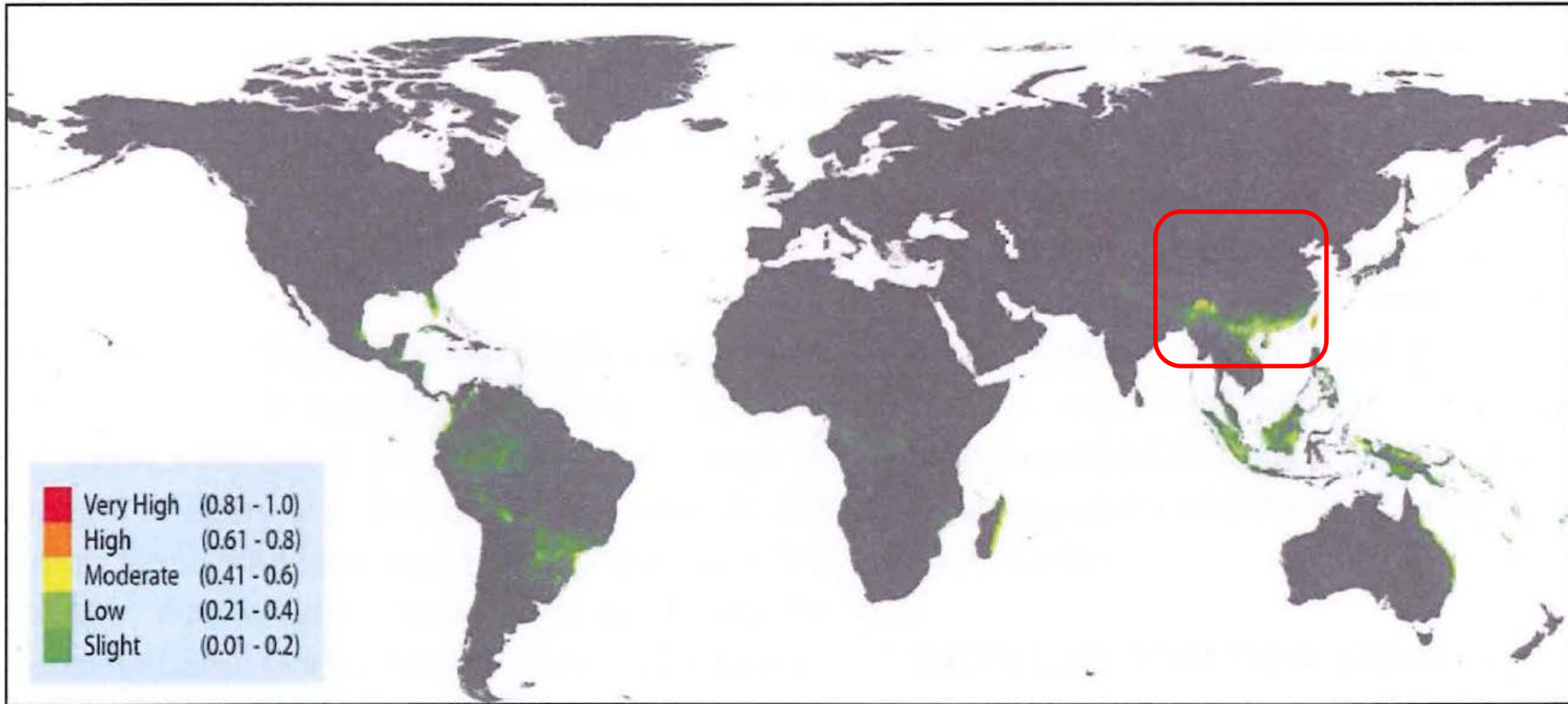
● = Record



Source: http://www.plantwise.org/KnowledgeBank/Map/GLOBAL/Phellinus_noxius/ [Accessed 16 January 2017]

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

Predicted suitable Climate Space for *P. noxius* (Preliminary)

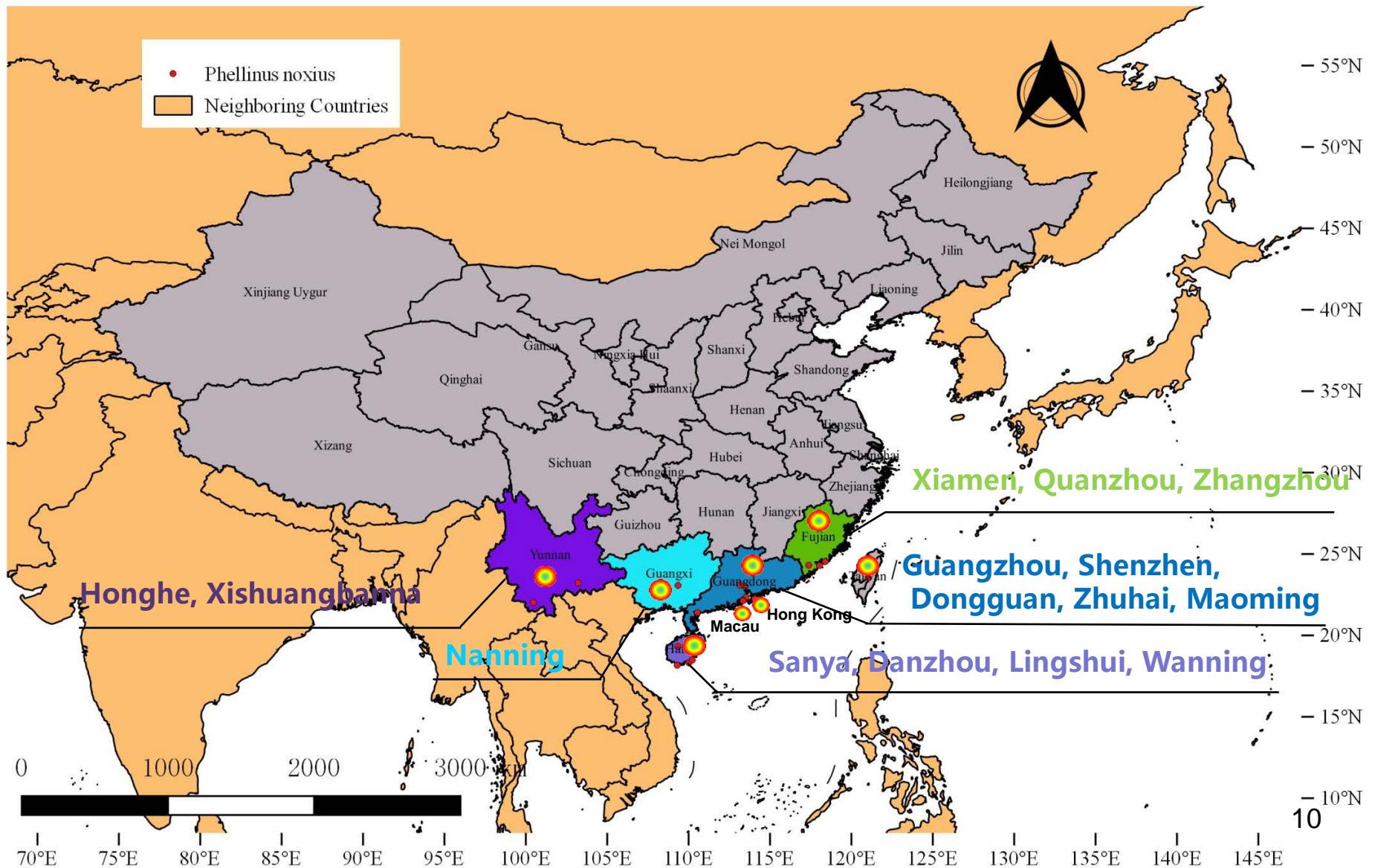


Source: In: Ramsey, A. & P. Palacios (Comps). Proceedings of the 63rd Annual Western International Forest Disease Work Conference; 2015 Sept. 21-15;

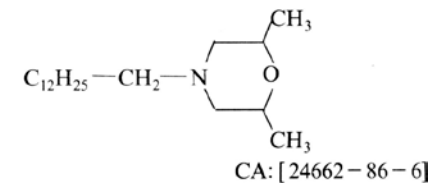
Based on isolates from southeastern Asia, Australia, and Pacific islands;

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



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



Swietenia mahagoni



July, 2011, cut down the tree



December, 2012

In Fujian Province



May, 2016



Kulangsu (鼓浪屿), Xiamen



July, 2016



September 15, 2016
Typhoon Meranti (莫兰蒂)

In Macau



October, 2014
Matsuyama Municipal Park, Macau





October 2014, Macau





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

June 2012, Macau



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 Opus
1000X

Opus
2000X

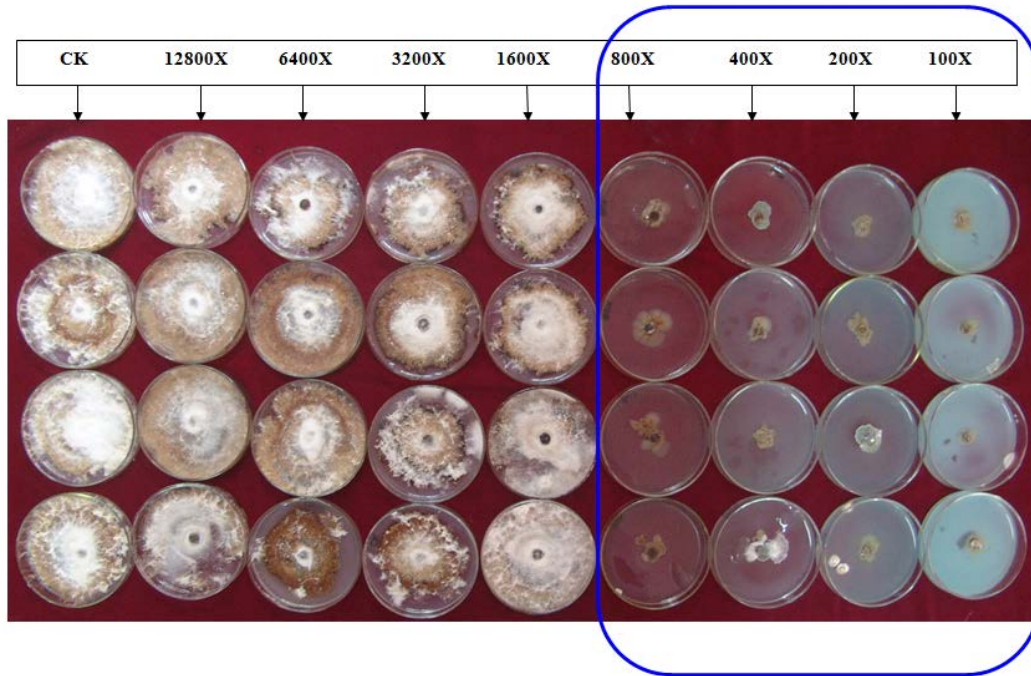
Tebuconazole
2000X

Shuangguan
2000X

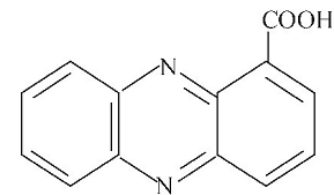
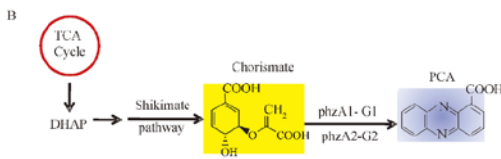
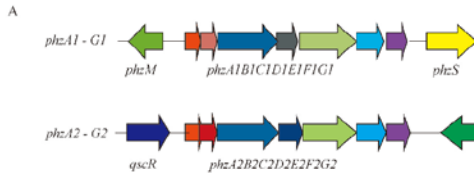
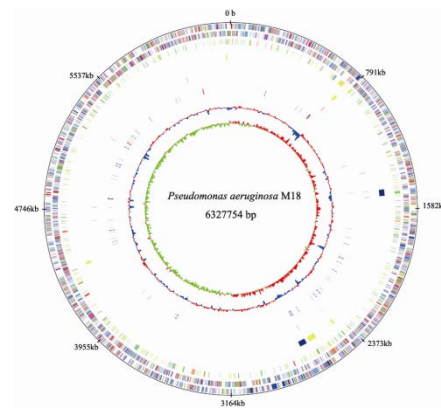
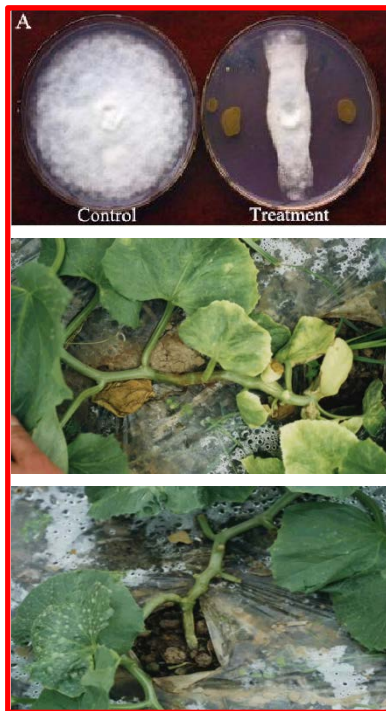


Chemicals	Dilution Factor	Infected Plant	Control Efficacy (%)
Sportak	1000	80(1)	98.44b
Tebuconazole	2000	80(0)	100a
Difenoconazole	1000	80(2)	96.88c
Shuangguan	2000	80(0)	100a
CK	—	80(80)	23 —

Biological control agents for *Phellinus noxius*



M18 strain and its product PCA

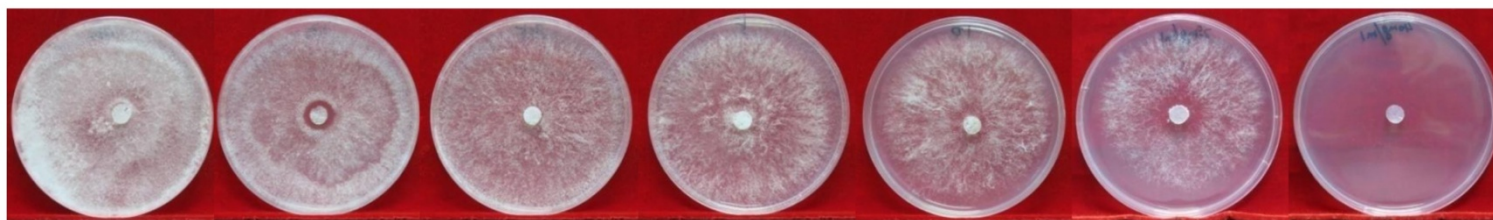


Phenazine-1-carboxylic acid (PCA)

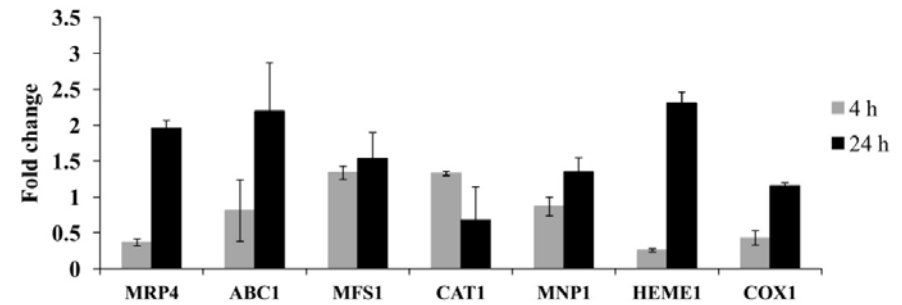
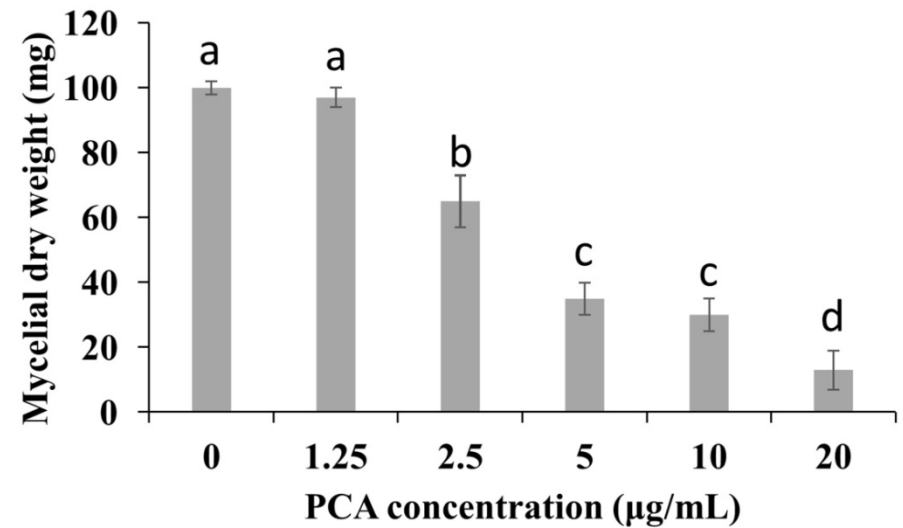
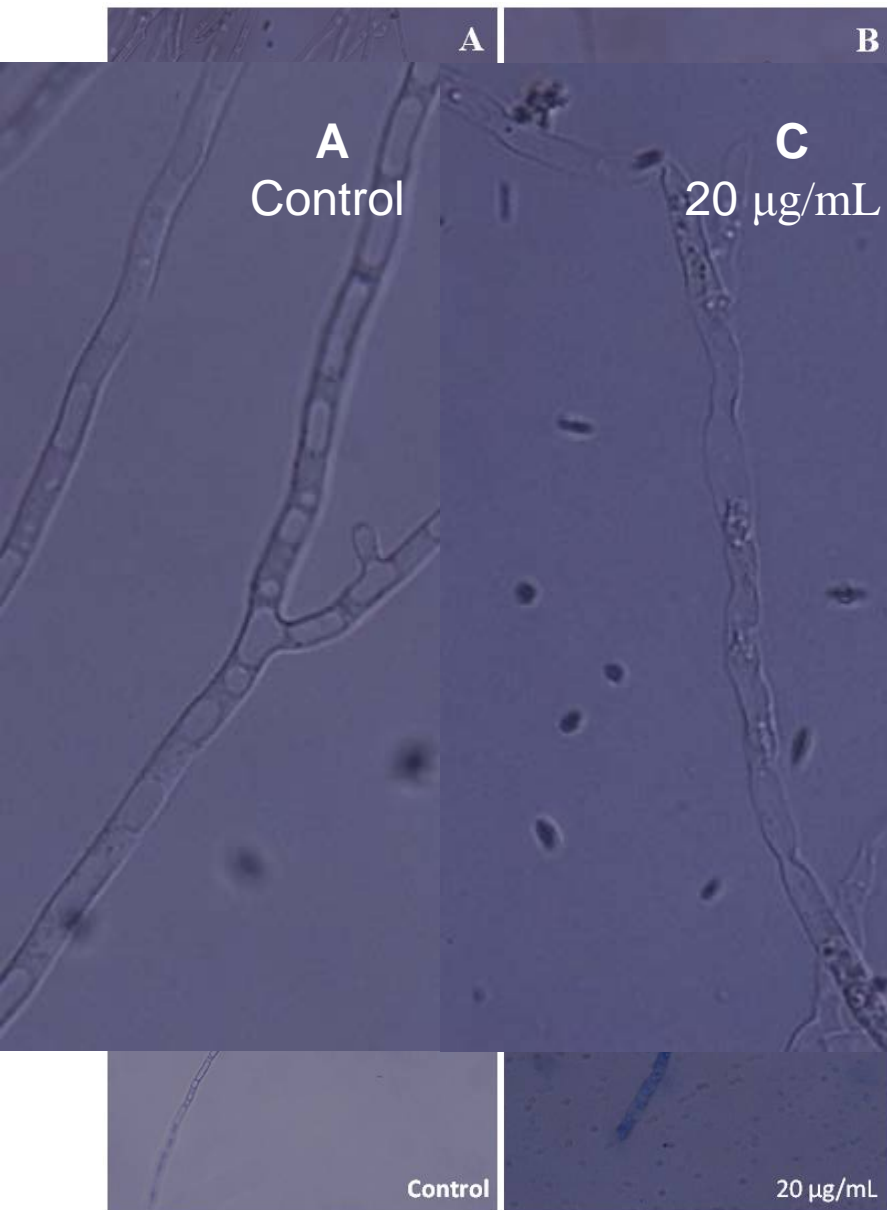


Shenqinmycin

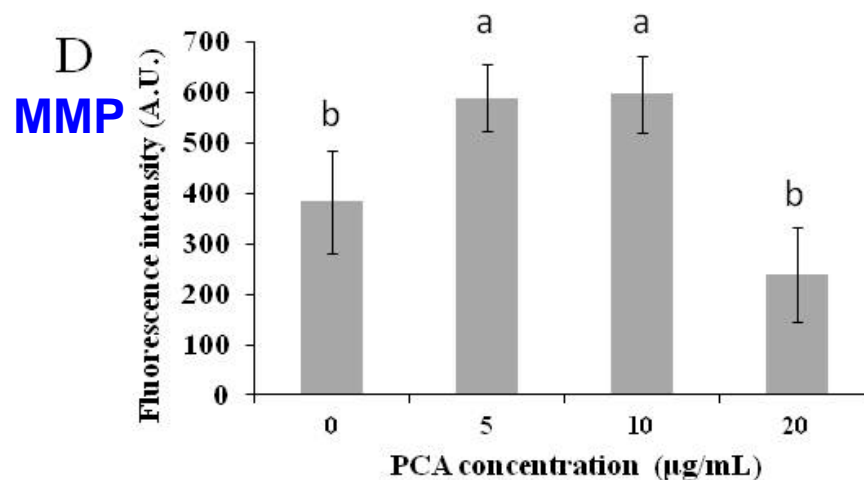
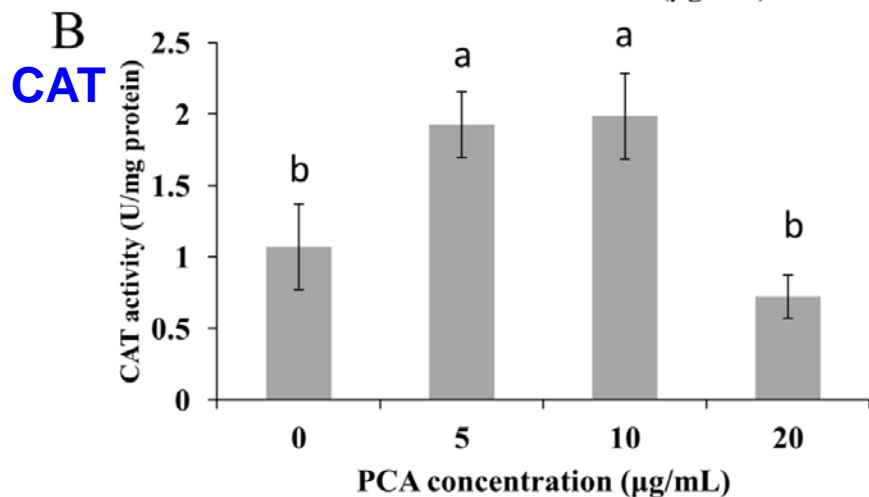
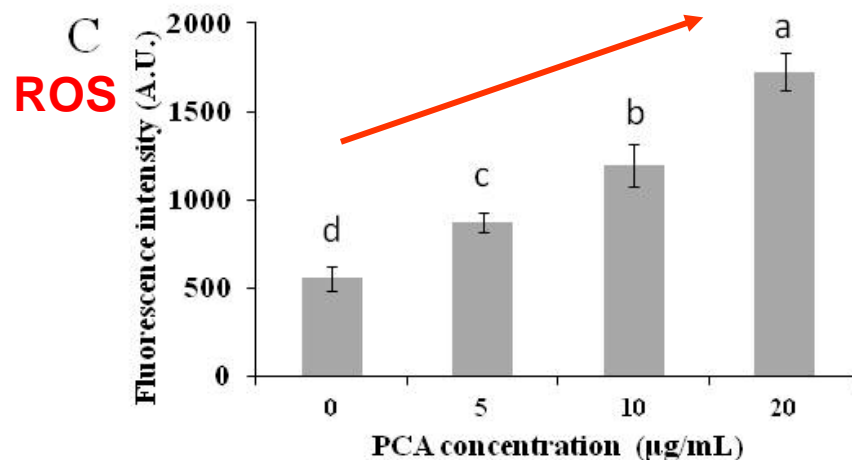
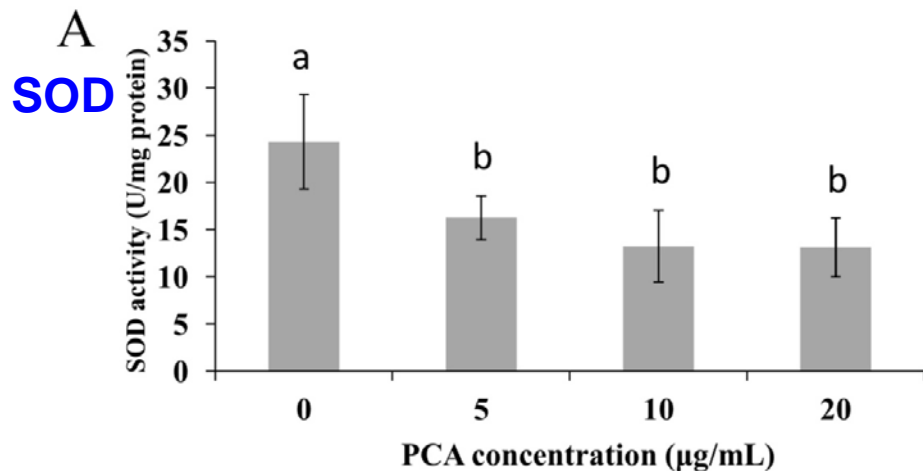
Control 1.25 $\mu\text{g/mL}$ 2.5 $\mu\text{g/mL}$ 5 $\mu\text{g/mL}$ 10 $\mu\text{g/mL}$ 20 $\mu\text{g/mL}$ 40 $\mu\text{g/mL}$



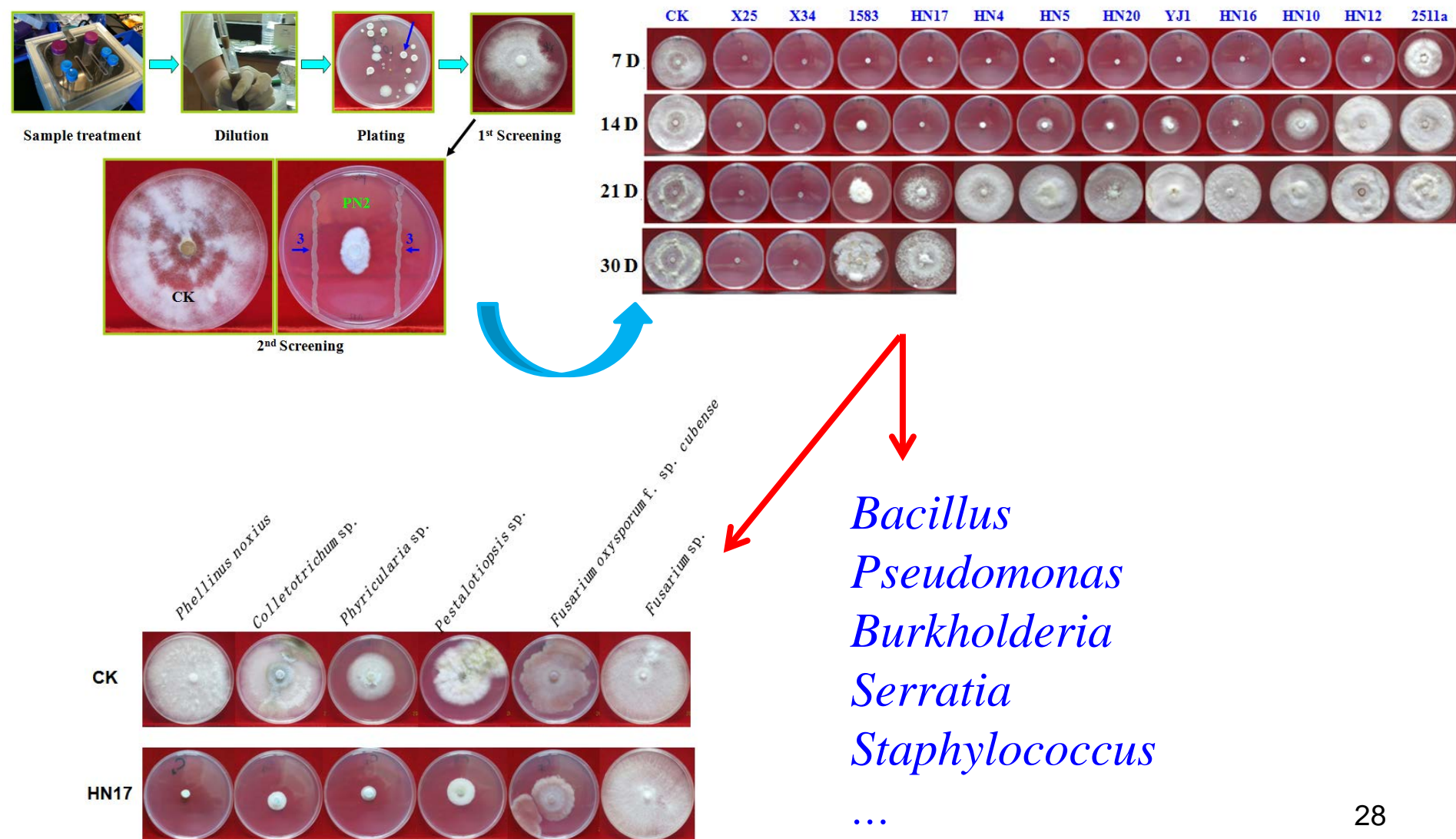
PCA is fungicidal activity, not fungistatic activity



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 noxius*



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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科研出成果 成果出效益



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



Thanks for your attention

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