

# PROTOCOLS FOR MANAGING INVASIVE PLANT PATHOGENS TO PLANTATION FORESTS IN SOUTH EAST ASIA

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- Major pathogens of *Eucalyptus* plantations and their impacts
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# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA

- Southeast Asia's forests cover 214 million hectares and constitute 29 percent of the Asia-Pacific region's total forest area.
- Forests covered 49 percent of the land area in 2010.
- Plantation forests (Acacia and Eucalyptus) are making a significant positive contribution to the environment as well as to live hoods of millions of people in SE Asia.

# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA

- There are over 4.3 million ha of *Eucalyptus* and nearly 2.5 million ha of *Acacia* plantations in SE Asia and China. Vietnam about 1.3 million ha *Acacia* spp.
- Plantations are mostly monocultures but may be integrated with agriculture.

# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA

- The productivity range is broad, with the Mean Annual Increment (MAI) from less than 10 to over 45 m<sup>3</sup> per ha per yr for eucalypts and 20 to over 50 m<sup>3</sup> per ha per yr for acacia.
- Plantations are mostly managed for short rotation pulp wood.

# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA



- Monoculture of a single clone at high density.
- The main genetic materials used for plantations are: *E. urophylla* x *grandis*, *E. grandis* x *urophylla*, *E. urophylla* x *tereticornis*, *E. urophylla* x *camaldulensis*, *E. grandis*.

# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA



Interplanting



Rừng trồng keo lá tràm dòng AA1, AA9 7 tuổi tại Bầu Bàng, Bình Dương - Ảnh Kiều Tuấn Đạt

Monoculture (*A. Auriculiformis* clone)

# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA



short-rotation plantation (5-7 yrs) for pulp wood



# 1. SITUATION OF PLANTATION FORESTS IN SE ASIA



Longterm rotation plantation (10-15yrs) for furniture

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Phyllode rust

- *Atelocauda digitata* was found in Indonesia and Malaysia
- The disease damages foliage in nurseries and young plantations.



Malaysia, photo Lee Su See

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Pink disease

- Pink disease caused by *Corticium salmonicolor* become more widespread in Indonesia, Lao PDR, Malaysia and Vietnam.
- Pink disease has high impact in some clones of *A. mangium* and acacia hybrids in high rainfall area.



# 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

## Ceratocystis wilt disease

- Ceratocystis wilt disease becomes more widespread in Indonesia, Lao PDR, Malaysia and VN.
- Cause severe damage leading to tree dieback and death with large scale.



## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Ceratocystis wilt disease



*Acacia* spp plantations at various ages infected by *C. manginecans*

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Ceratocystis wilt disease



*Acacia* spp plantations at various ages infected by *C. manginecans*

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Heart rot

Various Basidiomycetes: *Phellinus*, *Tinctoporellus*, *Rigidoporus* and *Ganoderma* are the main pathogens.



## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Heart rot

- Basidiomycete fungi attack dead parts of living trees causing considerable loss in plantations in Indonesia, Malaysia, Vietnam and Lao PDR.
- The percentage of logs with heart rot at harvest ranged from 5–47% in Indonesia and Malaysia.
- Problematic for saw-log production





## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Basidiomycete root rot diseases

The diseases caused by *Amauroderma*, *Ganoderma* spp. (red rot), *Phellinus noxius*, *Tinctoporellus epimiltinus* (brown rot), *Rigidoporus lignosus* (white rot) widespread in wet tropics.



Sabah, photo David Boden

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Basidiomycete root rot diseases

Level of impact varies with site and may exceed 30% depending on infection levels in previous forest or plantations in Malaysia and Indonesia



*Phellinus* sp.



*Amauroderma* sp.

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Basidiomycete root rot diseases

- Basidiomycete root rot diseases are problematic where trees are established in previously infested areas.
- Mortality due to root rot tends to increase in successive rotations.
- From 3–29% of trees showed symptoms of root rot in second-rotation *A. mangium* plantations in Sumatra and up to 35% in the third rotation.

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Basidiomycete root rot diseases



Root rot of *A. Crassicarpa*  
In Thailand



Patch decline in Sabah (Photo  
David Boden

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Phytophthora diseases

- The diseases caused by *Phytophthora* spp. to Acacia are new emerging problem in SE Asia.
- *Phytophthora cinnamomi*, the tropical water mold has been widely dispersed around the world causing diseases for various trees.
- This pathogen has recently been associated with loss of *A. mangium* stands in north Vietnam.

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Phytophthora diseases



*A. mangium* plantation  
infected



*Phytophthora cinnamomi*

## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Phytophthora diseases



Diseased *A. mangium* plantation



*Phytophthora parvispora*



## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Powder mildew diseases

The disease causes sometimes problematic in nurseries in Vietnam and Thailand also in one year old plantations in Vietnam



*Oidium acaciae*



## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Ambrosia beetle and symbiotic fungi:

- Ambrosia beetle  
*Xylosandrus crassiusculus* causes damage to *A. mangium* in some countries.
- This beetle carries spores/conidia of *Ceratocystis* spp. causing wilt disease.



## 2. MAJOR PATHOGENS THREAT TO ACACIA PLANTATION

### Ambrosia beetles and symbiotic fungi

- PSHB *Euwallacea fornicatus* causes damage to *Acacia* spp.
- PSHB symbiotic with pathogens such as: *Fusarium* spp. and *Ceratocystis* spores or conidia.



### 3. MAJOR PATHOGENS THREAT TO EUCALYPTUS PLANTATION

#### *Puccinia psidii* (Guava rust)

This rust fungus is a major quarantine concern for Asia. This disease can cause deformation of leaves, heavy defoliation of branches, dieback, stunted growth and even death.



# 3. MAJOR PATHOGENS THREAT TO EUCALYPTUS PLANTATION

## Leaf diseases

*Cylindrocladium* spp.  
(Teleomorph = *Calonectria*): Under conditions of high humidity, necrotic lesions cover the entire area of the leaf, young shoot tips, resulting in leaf and shoot blight symptoms.



# 3. MAJOR PATHOGENS THREAT TO EUCALYPTUS PLANTATION

## Leaf diseases

*Teratosphaeria destructans* (Synonyms *Kirramyces destructans*, *Phaeophleospora destructans*): The fungus causes a severe blight of shoots and leaves. It was first described from Sumatra (Wingfield et al. 1996) and has spread rapidly into eucalypt plantations across Asia



# 3. MAJOR PATHOGENS THREAT TO EUCALYPTUS PLANTATION

## Leaf diseases

- *Cryptosporiopsis eucalypti*  
Infected shoot tips become distorted, drop their leaves, flattened crown and die. These may also become reinfected the following season.
- Well established in SE Asia and severe in Thailand and Vietnam and Laos.



# 3. MAJOR PATHOGENS THREAT TO EUCALYPTUS PLANTATION

## Bacterial wilt diseases

- *Ralstonia solanacearum*: Bacterial wilt typically affects young trees growing on ex-agricultural sites in hot wet areas.
- Moderate in Vietnam and China; *E. urophylla* clone PN2 very susceptible



## 4. PROTOCOLS FOR DISEASE MANAGEMENT

- Reduce spread of pathogens through improvement in quarantine,
- Monitor plantation health and condition on a regular basis in order to detect change,
- Undertake surveillance of diseases of concern,
- Identify new diseases accurately and early,



## 4. PROTOCOLS FOR DISEASE MANAGEMENT

- Undertake comprehensive risk analysis, including simulation modeling and climate mapping, to identify high-risk species and areas,
- Increase the diversity of clones in plantations, and
- Breed for resistance to pathogens of greatest impact, that are present in the region or have the potential to persist if introduced.

## 5. CONCLUDING REMARKS

- The health of acacia and eucalypt plantations is dynamic, changing in place and time, impacts to productivity and strategy for saw-log production.
- The biology of some pathogens is incomplete, research is needed to underpin adaptive actions by plantation managers in the future.
- Very little new tree genetics has been introduced into the field with any resistance to these pathogens in SE Asia.

## 5. CONCLUDING REMARKS

- Clonal forestry continues with a low number of clones, the risk of damage in the future remains high.
- It is inevitable that further incursions of damaging pathogens will occur in regional level.
- *Phytophthora* root rot diseases, Basidiomycete root rot diseases, phyllode rust and ambrosia beetle symbiotic with plant pathogens are the most likely candidate diseases in very near future in SE Asia.

## 5. CONCLUDING REMARKS

- Protocols for disease management should be set up for the region.
- Case studies need to undertake to stop spread of major pathogens.

**THANK YOU  
FOR YOUR ATTENTION!**