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

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- Situation of plantation forests in SE Asia
- Major pathogens of Acacia plantation and their impacts
- Major pathogens of Eucalyptus plantations and their impacts
- Protocols for disease management
- Concluding remarks

- 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.

- 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.

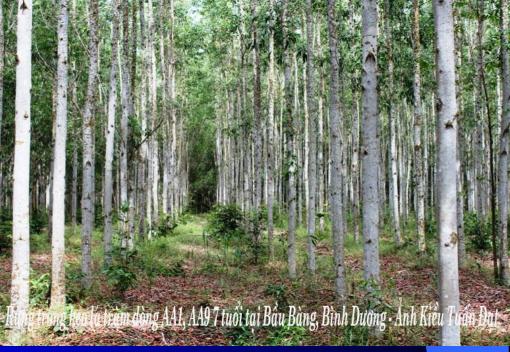
- The productivity range is boad, with the Mean Annual Increment (MAI) from less than 10 to over 45 m<sup>3</sup> per ha per yr for eucalypts and 20 to over 50 m<sup>3</sup> per ha per yr for acacia.
- Plantations are mostly managed for short rotation pulp wood.



- 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*.



Interplanting



Monoculture (A. Auriculiformis clone)





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



Longterm rotation plantation (10-15yrs) for furniture

#### Phyllode rust

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



Malaysia, photo Lee Su See

#### 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.



#### **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.











#### **Ceratocystis wilt disease**





Acacia spp plantations at various ages infected by C.

manginecans

Ceratocystis wilt disease



Acacia spp plantations at various ages infected by C.

manginecans

#### Heart rot

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



#### 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 Malysia.
- Problematic for saw-log production



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

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.

#### 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.

#### Basidiomycete root rot diseases



Root rot of *A. Crassicarpa*In Thailand



Patch decline in Sabah (Photo David Boden

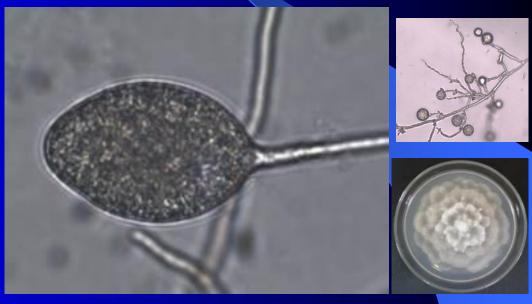
#### Phytophthora diseases

- 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.

#### Phytophthora diseases



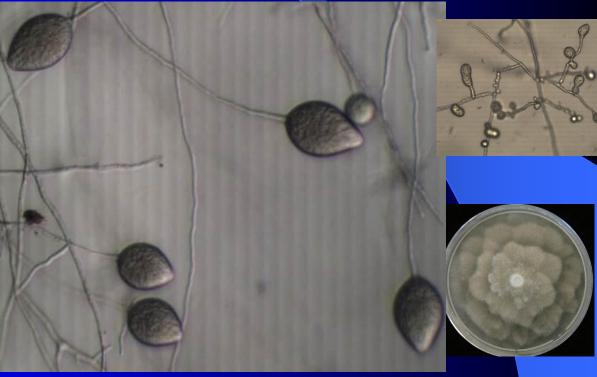




Phytophthora cinnamomi

Phytophthora diseases





Diseased A. mangium plantation

Phytophthora parvispora

Powder mildew diseases

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



Oidium acaciae

#### 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.







#### Ambrosia beetles and symbiotic fungi

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











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.



#### 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.



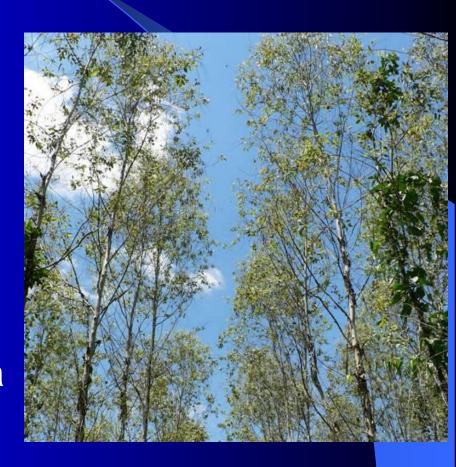
#### Leaf diseases

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



#### Leaf diseases

- 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.



#### **Bacterial wilt diseases**

- Ralstonia solanacearum:
   Bacterial wilt typically affects young trees growing on exagricultural 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!