BRS SEMINAR SERIES PRESENTS:

Friday 10 November 2006

Developing an Australian Guava Rust Strategy
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Jack Simpson - DAFF & Mike Cole - DAFF

The forestry program of the Australian Centre for International Agricultural Research (ACIAR) aims to optimise the contribution of forestry to economic development in a range of ACIAR’s partner countries in the Asia-Pacific region. Forest health is one of a number of important issues addressed. As part of this objective, ACIAR has supported some pioneering work on guava rust. This seminar will present the rationale for and scope of this work, and then go on to discuss the risk that guava rust poses for Australia, and the interest of State and federal biosecurity and agricultural authorities in participation in a regional approach to the threat.
Guava rust research, and ACIAR’s contribution to Asia-Pacific forest health

November 2006

Dr Russell Haines
OUTLINE

• ACIAR and its role
• ACIAR’s Forestry Program
• Involvement in forest health projects
• Guava rust work
ACIAR AND ITS ROLE

• Small Statutory Authority within DFAT

• Part of Australia’s Development Assistance Program

• Established in 1982

• Poverty alleviation and sustainable development in developing countries

• Fund partnerships: Australian-developing country research organisations
ACIAR AND ITS ROLE

• Budget around $50 million

• Bilateral project budget $30 million

• Australian partner contributions $39 million

• 21 partner countries
  o SE Asia 48-50%
  o S.Asia 12-13%
  o N.Asia 15-16%
  o Africa 2-3%
  o PNG & Pacific 19-20%
  o Other 2%
ACIAR AND ITS ROLE

• Mutual benefits intended
  o developing countries
  o Australia

• Expect co-investment
  o Australia
  o target countries

• Focus on economic impacts

• Also fund training programs
ACIAR AND ITS ROLE
Technical Disciplines

- Animal sciences
- Forestry
- Horticulture
- Ag. Systems economics & m’ment
- Crop protection
- Impact assessment
- Crop improvement & m’ment
- Soil m’ment & crop nutrition
- Agricultural development policy
- Land & water resources
- Fisheries
THE FORESTRY PROGRAM

• **Countries**
  - PNG
  - Pacific
  - Laos
  - Indonesia
  - Vietnam

• **Optimising the contribution of forestry to economic development and livelihood enhancement**

• **Budget just below $3 million annually**
THE FORESTRY PROGRAM

- A strategic approach
  - developing vision and strategies
  - proactivity
- Balanced portfolio of projects
  - appropriate coverage of the issues
  - integration where possible
- Appropriate balance of Australian partners
PROGRAM SCOPE

- Plantation establishment and management
- Domestication of tree species
- Sustainable management of native forests
- Agroforestry
- Non-timber forest products
- Timber processing
- Forest health
- Socio-economic dimensions
FOREST HEALTH PROJECTS

- Pacific forest health surveillance
- Mahogany shoot borer
- Heart rot and root rot in acacia
- Guava rust
GUAVA RUST WORK

• Pathogenicity project
  • 121 mainly Myrtaceous species tested for susceptibility
  • detection methods developed

• Workshop on Asia-Pacific regional strategy for guava rust
  • biosecurity planning and need for a regional approach – APFISN
  • raise awareness of the regional threat
Guava Rust

Jack Simpson
November 2006
• The Myrtaceae is monophyletic.
• It comprises:
  • 2 subfamilies
  • 17 tribes
  • ~130 genera
  • ~4600 species
Myrtaceae and Rusts

- Eight species of rust are known from species of Myrtaceae:
  - One species of Phakopsora
  - Two species of Physopella
  - Two species of Puccinia
  - Three species of Uredo
• Two species of rust on Myrtaceae are known from Australia.
• One of these species established in New Zealand but is now thought to have been eradicated.
Life cycle of *Puccinia psidii* showing life history stages I-IV in the outer circle and the repetitive stage II, which is responsible for epidemic development, in the inner circle.

**Stage I**
- Basidiospore germination, host penetration,
- haustorium development, colony and aeciospore formation with aeciospores

**Stage II**
- Urediospore germination, host penetration,
- aeciospore formation, inoculation of young leaf/shoot/fruit/flower bud

**Stage III**
- Urediospore germination, host penetration,
- haustorium development, colony and teliospore formation

**Stage IV**
- Teliospore germination, basidiospore development

**Inoculation of young leaf/shoot/fruit/flower bud**
Myrtaceae and Rusts

- The guava rust complex comprises *Puccinia psidii* and three species of *Uredo*. Each of these rust species is known from more than one genus of Myrtaceae.
- Each of the other rusts of Myrtaceae is known only from one host genus.
Myrtaceae and Rusts

- The hosts of the guava rust complex include species of:
  - Both subfamilies of Myrtaceae
  - One tribe of Psiloxylloideae
  - Seven of the 15 tribes of Myrtoideae
  - >20 genera
  - >71 species
• In Central and South America the number of exotic host species is much greater than the number of indigenous hosts.
• There are:
  • 28 from Americas (<2%).
  • 43 from Australia, South East Asia and Pacific.
  • one from Africa and one from the Mediterranean Region.
Myrtaceae and Rusts

• In 2005 *Puccinia psidii* was found on *Metrosideros polymorpha* plants in a commercial nursery on Oahu Island, Hawaii.

• The guava rust spread throughout the Hawaiian Island chain, a distance of 600 kilometres, in less than six months.
Guava rust on hosts in Hawaii

*Metrosideros polymorphica*  *Syzygium jambos*
Lyptus – Nova Vicosa
Eucalyptus Plantations
Aracruz Celulose - Nursery

Production - 40 million seedlings per year
All from cuttings – 6 clones
Conditions for infection:
• Urediniospores have a constitutional dormancy
• Juvenile tissue
• 8 hours darkness
• 6 hours surface moisture
• 20 – 25°C
Melaleuca – Guava Rust
CLIMATE Predictions
CLIMATE Predictions
Conclusions

• Guava rust poses a significant threat to Myrtaceae and biodiversity in Australia, the Pacific and South-East Asia.
• The rust can disperse over large distances very quickly.
• Only juvenile foliage and shoots are susceptible but this includes coppice shoots and epicormic shoots.
Conclusions continued

- Resources should be concentrated on increasing our knowledge of the population biology of the *Puccinia psidii* species complex and of the genetic basis of resistance in susceptible host species rather than on further host susceptibility testing.
Conclusions continued

• Within populations of susceptible native plants there is a wide variation in host sensitivity and resistance.
• Different isolates of rust differ in virulence to different hosts.
Conclusions continued

• Teliospores readily germinate in water but urediniospores do not.
• Urediniospores seem to have several dormancy factors operating.
• There is no robust information on survival of teliospores or urediniospores under different conditions of temperature and humidity.
Conclusions continued

- The risk of introduction of guava rust on kiln dried timber would seem to be very low.
- Florida and Hawaii pose a higher risk than Brasil of causing spread of *P. psidii* to Australia.
Conclusions continued

• Need confirmation of the specificity of available PCR diagnostics for members of the *Puccinia psidii* species complex.

• A program of monitoring of containers and commodities from guava rust countries and regions for presence of urediniospores of *Uredo psidii* is needed.
Conclusions continued

• There is a high likelihood of contamination of military personal and equipment with *Puccinia psidii* spores during exercises in Florida and Hawaii.
• Joint military exercises pose a high risk to Australia.
Conclusions continued

- Contamination of clothing and personal effects of tourists is a serious concern.
- People entering Australia from guava rust countries/regions to be given a leaflet highlighting risk and requesting they clean their belongings as soon as practicable.
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Guava/Eucalyptus Rust Strategy

Key issues and a case study in preparation and response to a pest of commercial and conservation forests

Mike Cole
OCPPO
Commercial/Plantations

- Eucalyptus /Timber
- Tea Tree
- Guava

Conservation /Amenity Forests

- Syzygiums
- Callistemons

IMPACTS
- Commercial yield and quality loss up to $96 million/yr??
- Genetic Resource??
- Biodiversity/habitat loss??
- Resource/Land Management (fire regimes, catchments)??
- Amenity value ??
*Puccinia psidii* spread through all Florida populations of *Melaleuca quinquenervia* in 6 years – Hawaiian islands in 3 months
Potential Distribution of Eucalyptus Rust in Australia (from Booth & Jovanovic 2005)
Strategy - Key Issues

Pathway analysis-identifying threats
- BA risk analysis, offshore intelligence-germplasm and contamination threats, high risk areas

Early Detection/Response
- Expert opinion- unless detected very early and in limited distribution, eradication probably not feasible
- Hazard site surveys DAFF/States
- Awareness (industry, whole of government, public)
Strategy - Key Issues

Institutional Arrangements/roles & responsibilities

- Funding, Implementation, Monitoring
- Industry/commercial forestry- Plant Cost Sharing Deed, Industry Biosecurity Planning, PHA/specific industries
- Australian and state governments primary industry/environmental agencies Whole of Government Approach- AusBiosec, State integration, EPBC Act, Quarantine/Plant Health Legislation
Strategy - Key Issues

Contingency Planning-Response (ENSIS/DAFF)
- Diagnostic protocol (being finalised)
- Delimiting Surveillance
- Control treatments
- Quarantine
- Decision making/cost-benefit, feasibility

Biosecurity/Management Plan for Industries and Properties
- Plantation Industry Biosecurity Plan (PHA & specific industries)
Strategy-Key Issues

R&D

- Impact on native hosts and ecosystems
- Rust variability
- Cost benefit analysis especially for conservation forest issues
- Need for specific and general surveillance methods for early detection-hazard site surveys, spore trapping, other?
- Resistance/breeding for commercial spp.
- Need and scope of treatments
- Rust biology and epidemiology
Strategy – Key Issues

International Cooperation-Keeping the Risk Offshore

- Risk assessment and monitoring capacity in Australia and the region
- Quarantine protocols/procedures and capacity in Australia and the region- germ plasm, decontamination, other
- Regional Cooperative Biosecurity Strategies/Activities surveillance, diagnostic, response, R&D, management
  - ACIAR
  - NAQS
  - Asia Pacific Forum Invasive Spp Network
  - Others