Plant Disease Diagnosis and Management for South-western Australian Flora

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Science Division DEC

Aims:

- Understand and recognise the major diseases affecting south-west Australian flora
- Diagnose the cause of poor plant health
- Application of appropriate management options

Outline for rest of day:

- Afternoon (Inside):
  - Disease diagnosis relevant to south-western Australian flora with examples
- Tomorrow morning (Outside):

  At *Phytophthora cinnamomi* disease centre:
  - Diagnosis – what to look for
  - Sampling procedure
  - Control – demonstration of various phosphite application methods

Disease Diagnosis

Proper diagnosis essential :

- Accurate diagnosis extremely important in preventing problem on other plants and preventing the problem in the future
- Management options depend on proper diagnosis of disease and the causal agents
- Misidentification of disease leads to wastage of time and money and further plant losses – e.g *Omphalotus* misidentified as *Armillaria* – control measure a waste of money

How does one go about diagnosing plant problems?

- Must have good observation skills;
- Be a good detective
- Keep an open mind until all the facts related to the problem have been collected – use recording sheets for a structured approach
- The possibility of multiple causal factors must be considered

7 Basics steps of disease diagnosis:

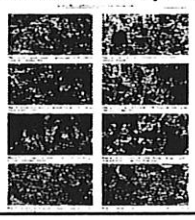
1. KNOW WHAT IS NORMAL
2. CHECK FOR SIGNS & SYMPTOMS
3. KNOW THE MAJOR DISEASES
4. OBSERVE PATTERNS
5. ASK QUESTIONS
6. LABORATORY TESTS
7. FINAL DIAGNOSIS

1. KNOW WHAT IS NORMAL

Proper plant identification:

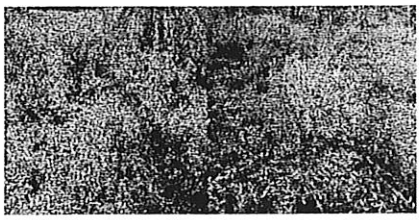
Recognise healthy plant appearance:

- If you do not know what to expect of the plant you cannot recognise when something is wrong.
- Understand the growth habits, colours, growth rates and habitats of the plants of interest. e.g. many plants undergo colour changes associated with dry conditions in summer



Gastrolobium calycinum (York road Poison)

SUMMER WINTER



1. KNOW WHAT IS NORMAL

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- If you do not know what to expect of the plant you cannot recognise when something is wrong
- Understand the growth habits, colours, growth rates and habitats of the plants of interest. e.g. many plants undergo colour changes associated with dry conditions in summer.
- Healthy plants have background damage from environment, low level insect and fungal attack
- Complicated by declines such as Wandoo and Tuart decline. Not associated with a particular pathogen or cause – often a combination of environmental, and insect interactions

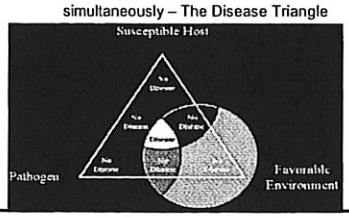
2. CHECK FOR SIGNS AND SYMPTOMS OF DISEASE

What is disease?

- Using the strict definition:
  Result of an infectious organism (pathogen) that can multiply and spread to other nearby plants and interact with the environment and host plant to produce plant damage and characteristic symptoms
- Most pathogens are microscopic and include bacteria, fungi, nematodes, viruses, mollicutes, protozoa and parasitic plants

2. CHECK FOR SIGNS AND SYMPTOMS OF DISEASE

- **Conditions necessary for disease?**
- Three conditions must be met for biotic plant disease to occur:
  - » the host must be susceptible
  - » a pathogen must be present
  - » the environment must be favourable
  - » All three of these factors must occur simultaneously – The Disease Triangle



2. CHECK FOR SIGNS AND SYMPTOMS OF DISEASE

- Signs
  - Physical evidence of the pathogen causing disease such as fruiting bodies (see display)

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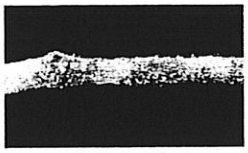
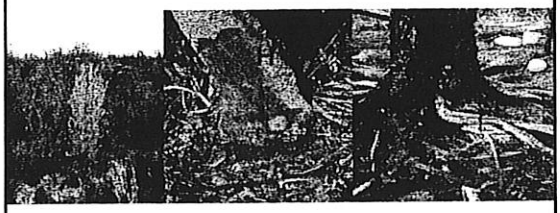
- Signs
  - Physical evidence of the pathogen causing disease such as fruiting bodies (see display)
  - mycelium, mushrooms and spore bodies



- *Phytophthora* is problematic in that pathogen structures are microscopic – depend on symptoms, sampling and laboratory tests

2. CHECK FOR SIGNS AND SYMPTOMS OF DISEASE

- Symptoms
  - The visible effects of disease such as:
    - plant death, lesions, wood decay



3. KNOW THE MAJOR DISEASES OF SOUTH-WESTERN FLORA

- Major pathogens are fungi – 3 main groups
  - Diseases caused by species of *Phytophthora*
  - Disease caused by *Armillaria luteobubalina*

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  - Disease caused by *Armillaria luteobubalina*
  - Diseases caused by canker fungi
  - Web page - Pathogen of the Month provided by Australasian Plant Pathology Society

http://www.australasianplantpathologysociety.org.au/

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  - Diseases caused by canker fungi

Briefly mention rusts and other pathogens

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

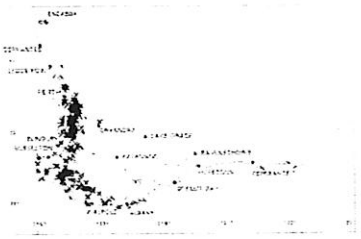
CAUSAL ORGANISM(s):

P. aspargi
P. boehmeriae
P. cinnamomi (introduced)
P. citricola
P. cryptogea
P. cambivora
P. drechsleri
P. gonapodyides
P. inundata
P. megasperma
P. nicotianae
P. niederhauserii

+ 9 other species undetermined

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DISTRIBUTION:



Eneabba to Cape Arid, old inner dunes to W edge of wheatbelt – mainly on leached laterites and sands.

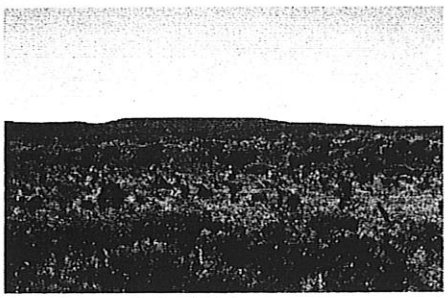
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DAMAGE:

Pc - W of Eneabba

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

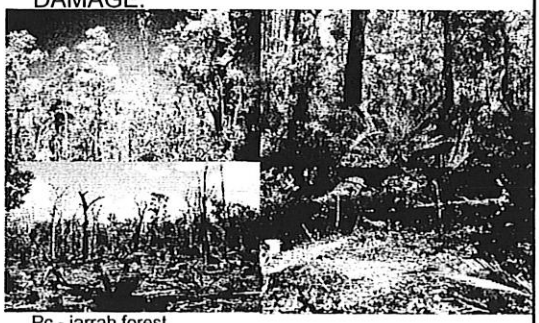
DAMAGE:



Pm - Badgigarra National Park

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DAMAGE:



Pc - jarrah forest

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DAMAGE:

Pc - *Banksia brownii* - South Coast

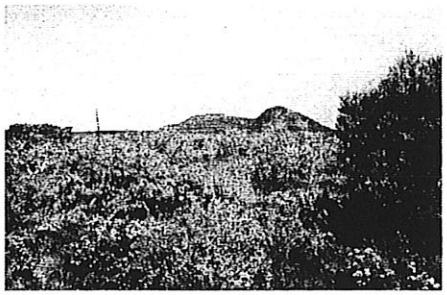
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DAMAGE:

Pc – *Lambertia* - *Banksia* shrubland, Bell Track FRNP

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

DAMAGE:



Pc - *Banksia occidentalis* Cape Arid National Park

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

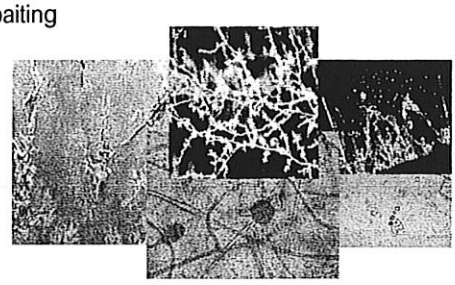
DETECTION & DIAGNOSIS:

Crown symptoms

Basal symptoms

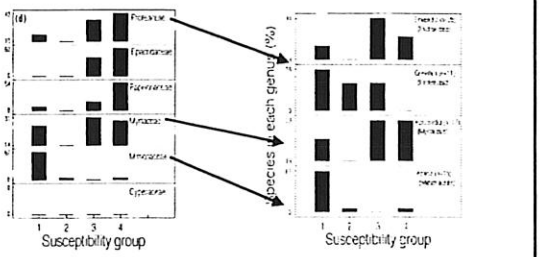
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

Signs: determined in the lab by plating and baiting



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

Hosts: wide host range (e.g.) threatened flora



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

Hosts: wide host range

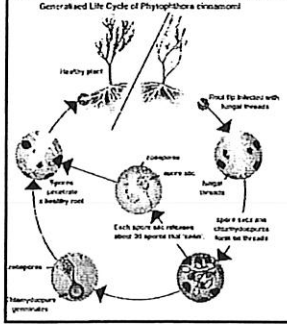
Susceptibility of South-western flora to *Phytophthora cinnamomi*

Database	Infection	Susceptible (%)	Highly susceptible (%)
Jarrah forest	natural	44	12
Banksia woodland	natural	33	15
Stirling Range NP	natural	36	10
Threatened flora	artificial	49	21
Mean		40 ± 4 [A]	14 ± 2 [B]

[A] 2300 species of the 5710 species in the South-west Botanical Province
[B] 800 species of the 5710 species in the South-west Botanical Province

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

INFECTION & SPREAD: soil, water, roots



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

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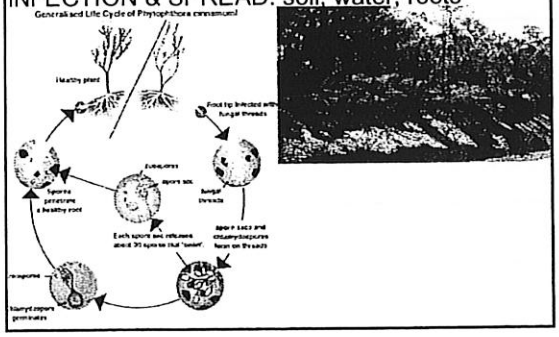

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

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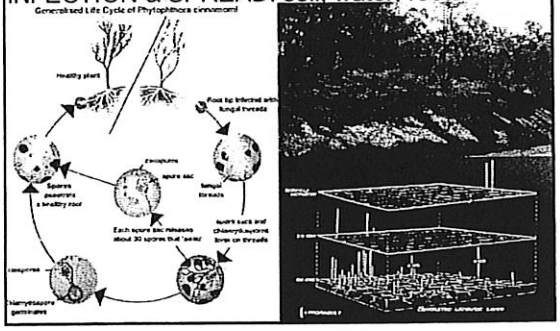
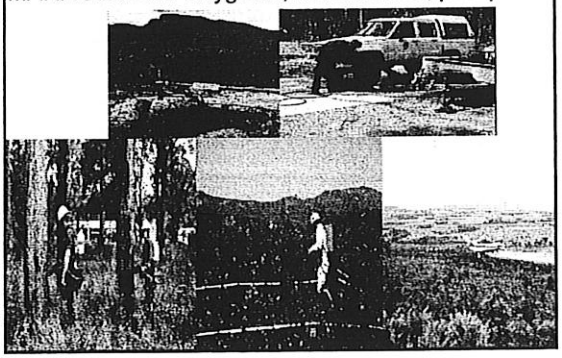


MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Phytophthora*

MANAGEMENT: Hygiene, translocation, phosphite



Dieback Working Group

A very useful contacts point for all things Phytophthora in Western Australia

http://www.dwg.org.au/

http://www.dieback.org.au/

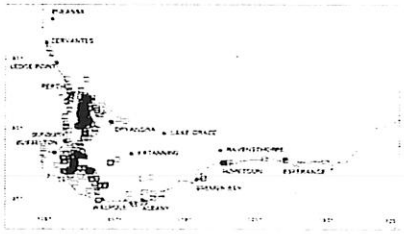
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

CAUSAL ORGANISM:

Armillaria luteobubalina (native)

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

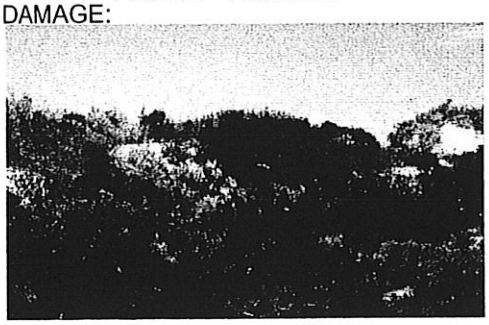
DISTRIBUTION:



Cervantes to Cape Arid, coastal dunes to W edge of wheatbelt – on wide range of soil types

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

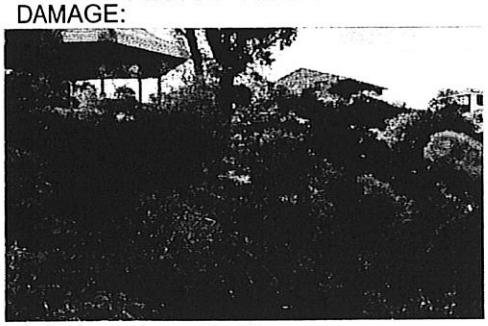
DAMAGE:



Armillaria - coastal dune Cervantes

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

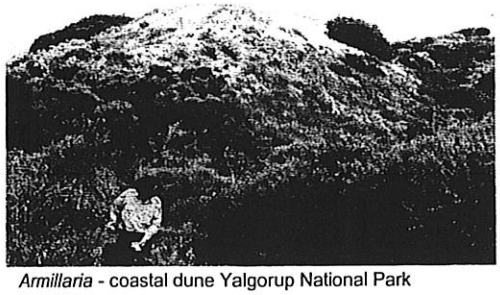
DAMAGE:



Armillaria - gardens metropolitan area

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DAMAGE:



Armillaria - coastal dune Yalgorup National Park

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DAMAGE:

Armillaria - jarrah forest

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DAMAGE:

Armillaria - wandoo forest

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DAMAGE:

Armillaria - karri forest

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DAMAGE:

Armillaria - coastal dune Hopetoun, south coast

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DETECTION & DIAGNOSIS:

Crown symptoms

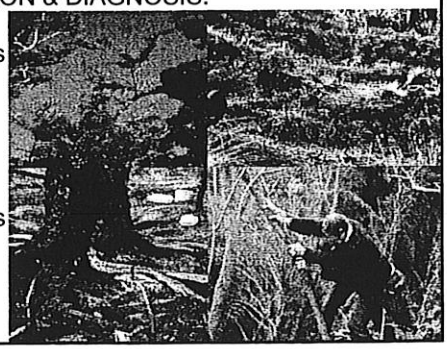
Basal symptoms

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

DETECTION & DIAGNOSIS:

Crown symptoms

Basal symptoms

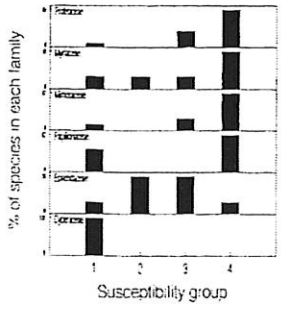


MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

Signs: mycelial sheaths, fruiting (unreliable)

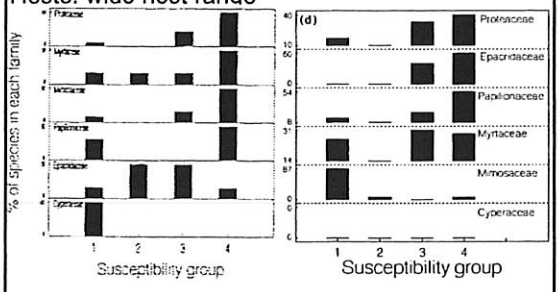
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

Hosts: wide host range - few threatened flora



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

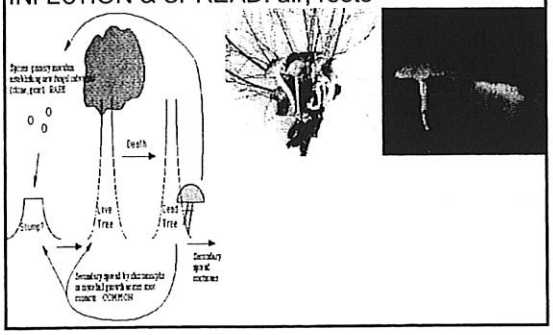
Hosts: wide host range



Armillaria *Phytophthora*

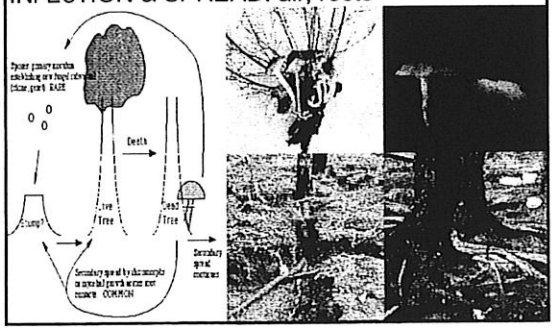
MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

INFECTION & SPREAD: air, roots



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

INFECTION & SPREAD: air, roots



MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Armillaria*

MANAGEMENT:

Hygiene - no movement of infected roots

Prevent stress

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

CAUSAL ORGANISM(s): (most native)

Cryptodiaporthe
Endothia, Quamballaria
Botryosphaeria
Zythiostroma

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

DISTRIBUTION:

Very widespread – on wide range of soil types

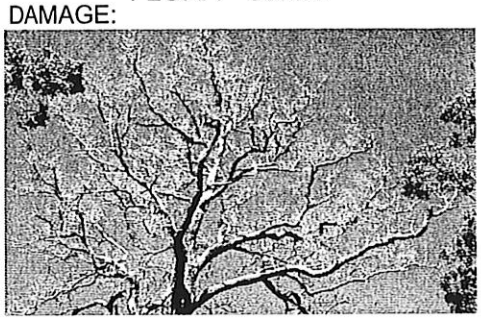
MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

DAMAGE:

Canker - Tuart Mandurah

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

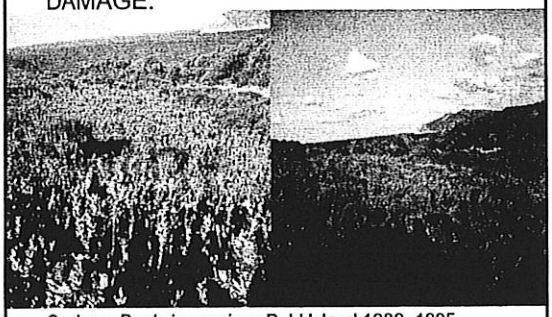
DAMAGE:



Canker - Marri throughout the south-west

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

DAMAGE:

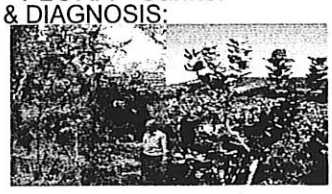


Canker - *Banksia coccinea* Bald Island 1989, 1995

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

DETECTION & DIAGNOSIS:

Crown symptoms



MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

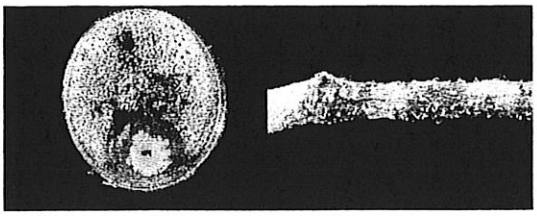
DETECTION & DIAGNOSIS:

Crown symptoms

Stem cankers diffuse perennial

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

Signs: often determined in the lab by plating



MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

Hosts:

- Wide host range
- Many proteaceae - threatened *Banksia* susceptible to *Zythiostroma*
- Eucalypts resistant to *Phytophthora* susceptible to canker

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Canker*

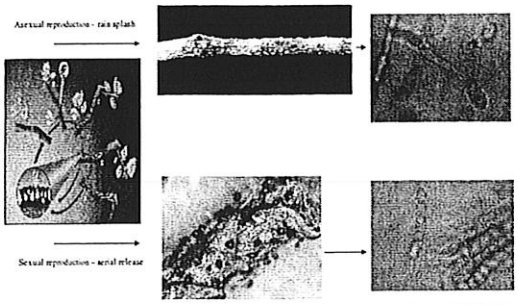
INFECTION & SPREAD: air, water splash

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Canker*

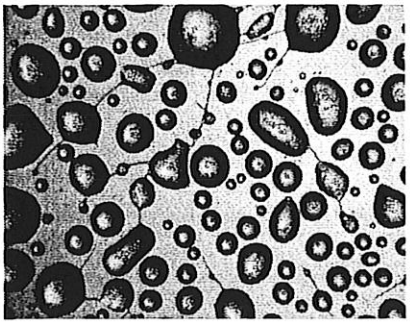
INFECTION & SPREAD: air, water splash

MAJOR DISEASES OF SOUTH-WESTERN FLORA - *Canker*

INFECTION & SPREAD: air,rain



Ascospores germinating in sub millimeter size condensation droplets



MAJOR DISEASES OF SOUTH-WESTERN FLORA - Canker

MANAGEMENT: Hygiene, destroy affected stems
Prevent stress

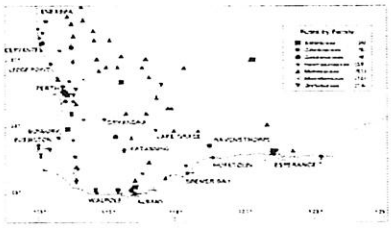
MAJOR DISEASES OF SOUTH-WESTERN FLORA - Other

CAUSAL ORGANISM(s):

Rusts
Leaf spots

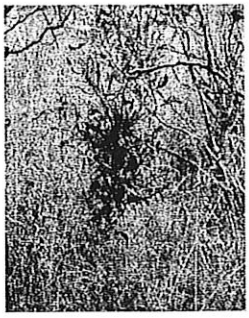
MAJOR DISEASES OF SOUTH-WESTERN FLORA - Rusts

DISTRIBUTION:



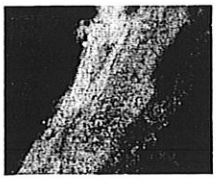
Very widespread, especially wheatbelt and goldfields

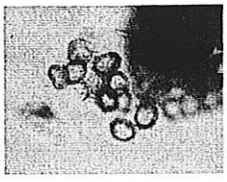
MAJOR DISEASES OF SOUTH-WESTERN FLORA - Rusts



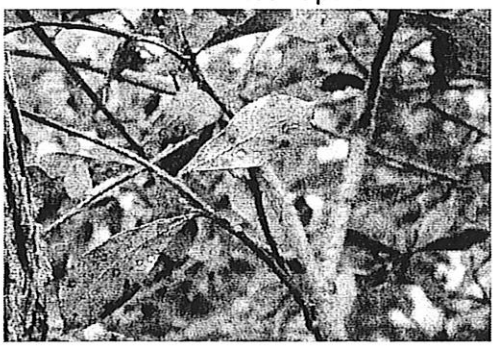
MAJOR DISEASES OF SOUTH-WESTERN FLORA - Rusts

Uromycladium tepperianum





MAJOR DISEASES OF SOUTH-WESTERN FLORA - Leaf Spots



MAJOR DISEASES OF SOUTH-WESTERN FLORA - Other

Sooty molds

MAJOR DISEASES OF SOUTH-WESTERN FLORA - Rusts and Leafspots

Hosts:

- Wide host range
- Threatened flora
- Hosts resistant to *Phytophthora* susceptible to rust or leafspot

SYMPTOMS WITH INSECT DAMAGE

IN SUMMARY

- Plant diseases of south-western Australia mediate plant community distribution and dynamics
- Plant diseases significantly affect biodiversity
- Plant diseases differ in their responses to host and site
- Site management must ensure that changes made do not favour disease

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- Timing of symptoms
  - Sickness or death occurred once – more often abiotic (associated with drought, waterlogging, herbicide) than biotic

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  - Can the outbreak be related to a specific event e.g death due to *P. megasperma* often associated with summer flooding
  - Symptoms linked to discreet community succesional stages ie. expressed at senescence only

4. OBSERVE PATTERNS

- Check for host specificity
  - Plants highly resistant to *Phytophthora cinnamomi* such as most *Acacia* and *Eucalyptus wandoo* are highly susceptible to *Armillaria luteobubalina*

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    - Communities dominated by resistant species – uninterpretable for *P. cinnamomi*

5. ASK QUESTIONS

- What is the history of symptom expression?
- What are predisposing factors?
  - Site characteristics
  - Host susceptibility
- Any inciting factors?
  - What is the disturbance history of the area (altered drainage, roading, herbicide etc)
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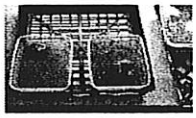
  - Insect attack

6. LABORATORY TESTS

- Role of the Vegetation Health Service

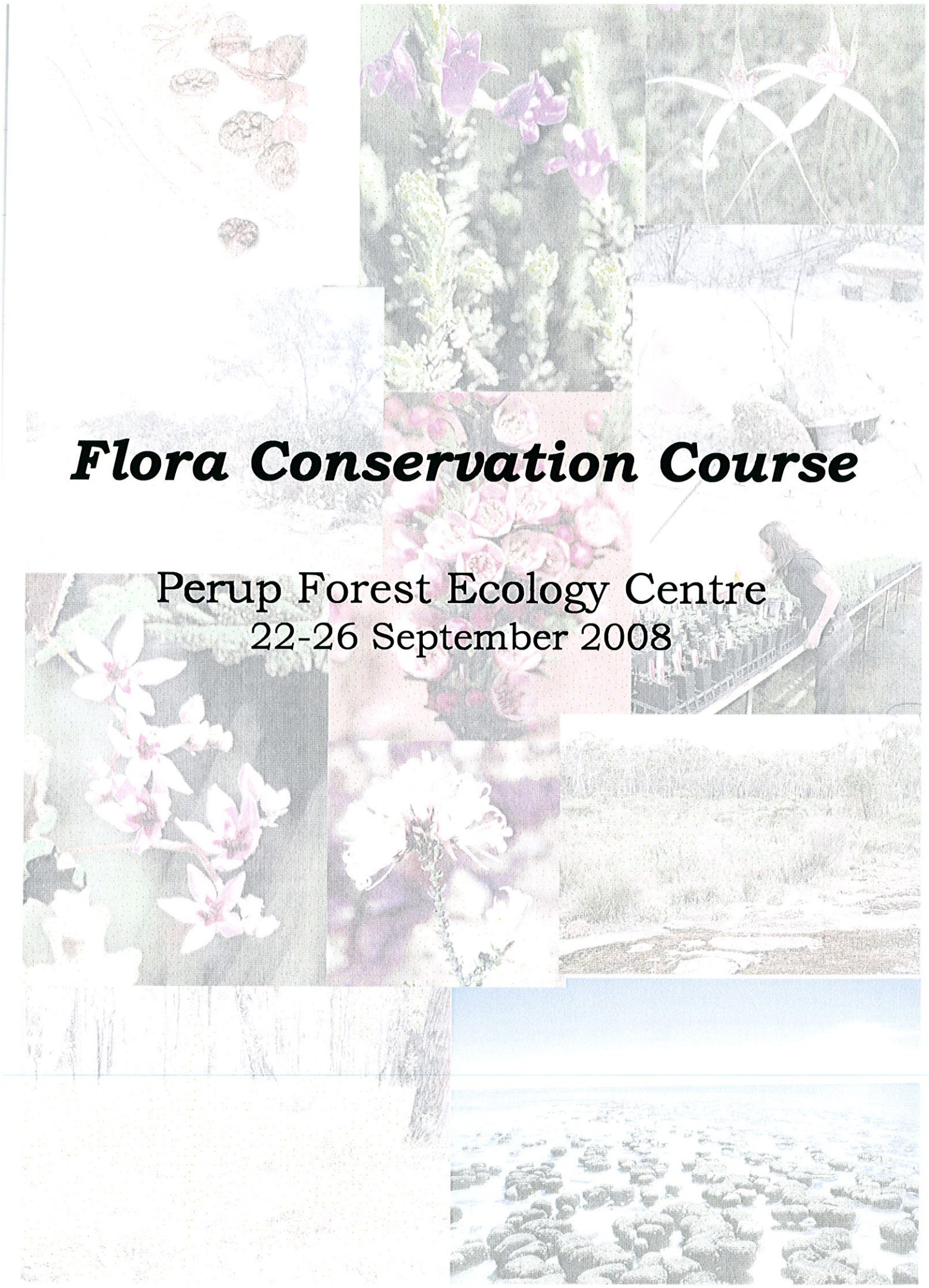
- Sampling
- Baiting



- Plating (see examples)

7. FINAL DIAGNOSIS

- Sample results
- Summary table of major pathogens
- REMEMBER to
  - Be a good detective
  - Keep an open mind until all the facts related to the problem have been collected – recording sheets to help this
  - The possibility of multiple causal factors must also be considered e.g may have *Phytophthora* in wet area but deaths of *Banksia* on sandy upland – may be drought rather than disease
  - Go for help – Disease contacts
    - Chris Dunne, Colin Crane, Richard Robinson – Research
    - Mike Stukely – Vegetation Health Service
    - Mike Pez - DEC interpreters for Phytophthora interpretation & mapping



Flora Conservation Course

Perup Forest Ecology Centre
22-26 September 2008