BIOLOGICAL CONTROL OF INVASIVE ALIEN PLANTS IN THE FYNBOS: AN OVERVIEW

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ARC • LNR

SPES BONA

THE WORKING FOR WATER PROGRAMME

• Species rich, makes up 80% of CFK

• Despite diversity - few plants for food, shelter, fuel and timber

• “Not even a tree to break the monotonous uniformity of the sandstone hills. I have never seen a much less interesting country.”

Charles Darwin

• Exotic trees first introduced into South Africa in late 1600s

• Later (1800s) saw introduction of Australian Acacias, Eucalypts, Hakeas, Myrtle, Sesbania

Initially introduced into botanic & private gardens, many were later widely planted because of their uses

This can happen because plants are introduced without their natural enemies

How can we deal with invasive alien plants?

STEPS IN A BIOLOGICAL CONTROL PROGRAMME

Study of the literature on the taxonomy and distribution of the weed and studies in the field to match plant populations in the native and introduced ranges.

Investigate natural enemies of the plant and survey the native range for potential biological control agents

Where possible, study the biology, host-specificity and ecology of potential agents in the native range.

Select potential biological control agents from the native range and apply for permission to import these into quarantine for further study.

Establish selected agents in quarantine facilities in the country of introduction.

Screen in quarantine to detect any parasitoids and diseases which imported colonies of control agents may contain.

Check the identity and study the biology of introduced agents & carry out rigorous host-specificity tests on closely related and important plant species to ensure the safety of the biocontrol agent.

Application for permission to release in the country of introduction.

Scoping Report

to the Department of Environmental Affairs and Tourism
in support of the

Release from quarantine
of the bud weevil, *Dicomada rufa* (Coleoptera: Curculionidae)
for the biological control of silky hakea (*Hakea sericea*)
in South Africa

APPLICANT

CONSULTANT

REPORT PREPARED BY

Release of the biocontrol agent

Biological control of Fynbos weeds:

Past

***Hypericum perforatum* (1960)**
Sesbania punicea

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Hakea sericea: Australia, invades mtn Fynbos

- One of the longest running biocontrol programmes in the fynbos, initiated in early 1960s
- Inception not influenced by precedents in other countries
- World first for using seed-feeders for a perennial weed

Hakea seed weevil, *Erytenna consputa*

Released in 1970

Larvae destroy 86% of green developing fruits

Hakea seed moth, *Carposina autologa*

Released in 1970

Larvae destroy up to 62.4% of seeds in mature fruits

The stem boring beetle, *Aphanasium australe*
Released 2001

The flower feeding weevil, *Dicomada rufa*
Released in 2006

Colletotrichum acutatum

Targets above ground plant parts (adult trees + seedlings)
Causes gummosis and die back above point of infection

Australian *Acacia* species: coastal & mtn fynbos – not restricted to fynbos

Another long-standing programme – initiated 1970s

Initially hampered by conflicts of interest delays (to 1982)

Conflicts of interest continue to influence choice

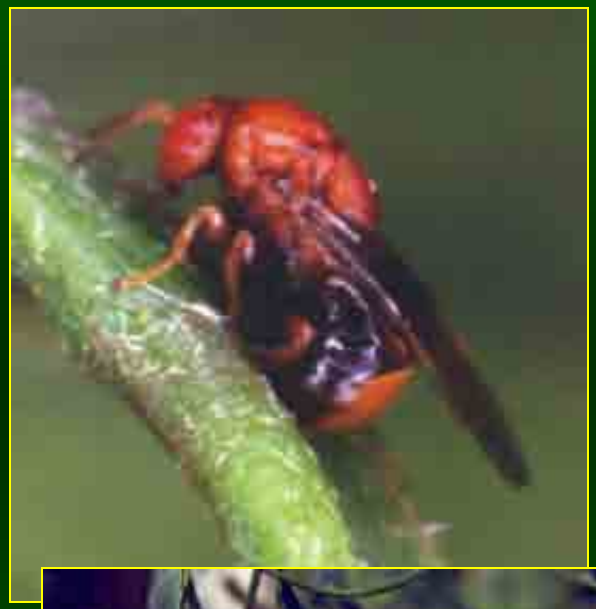
Seed-reducing agents recommended

10 of most invasive acacias currently have bc agents

Acacia longifolia (1982/1985))
Acacia melanoxylon (1986)
Acacia saligna (1987/2001)
Paraserianthes lophantha (1989)
Acacia cyclops (1991/2001)
Acacia pycnantha (1992/2005)
Acacia mearnsii (1994/2002)
Acacia dealbata (1997)
Acacia decurrens (2001)
Acacia baileyana (2006)
Acacia podalyriifolia (2008)

Biocontrol agents to reduce reproductive capacity have been the focus

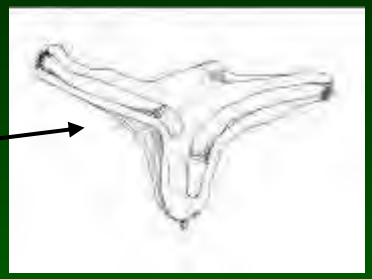
Insect gall-formers:



95% pod reduction overall

Insect gall formers

Dasineura dielsi (2001)

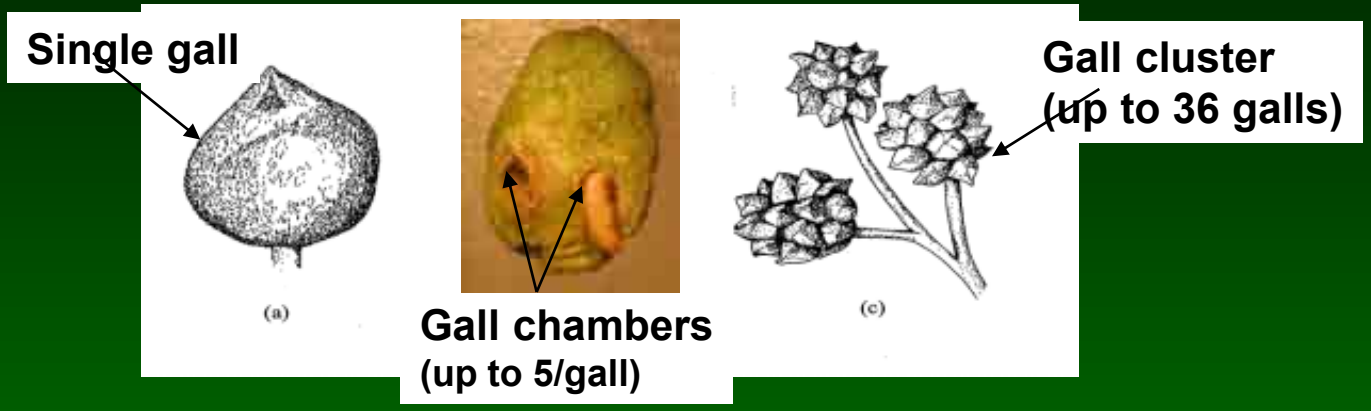


Avg 82% of flowers galled

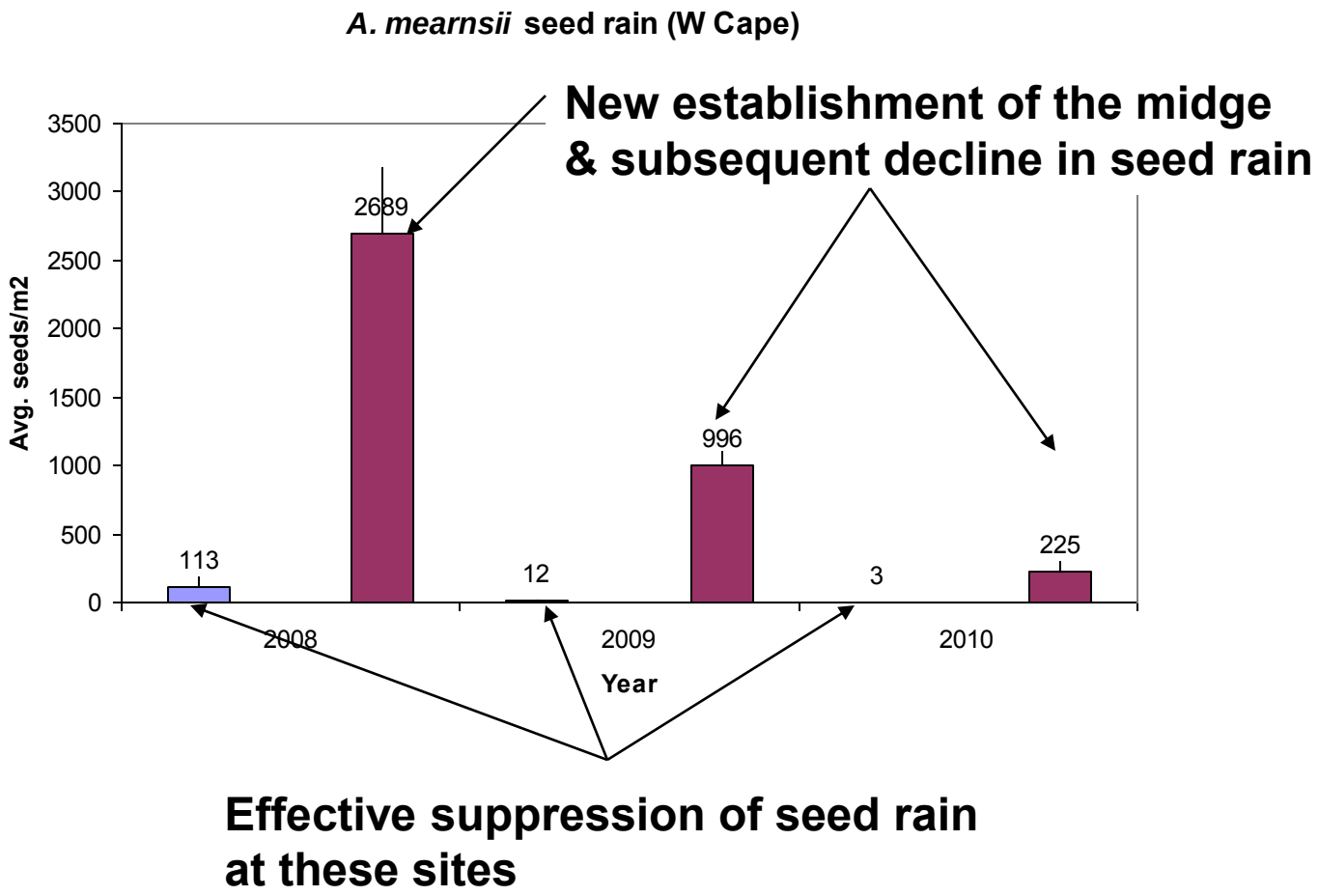
Avg 5 chambers per gall (up to 16)
32 galls per cluster
Multivoltine
Complete development within the gall
Dispersal rapid

Insect gall formers


Dasineura rubiformis



Univoltine, Development in gall and soil, Dispersal relatively slow.


A. mearnsii seed rain (W Cape)
New establishment of the midge & subsequent decline in seed rain
Avg. seeds/m2
3500
3000
2500
2000
1500
1000
500
0
113
2689
12
996
3
225
2008
2009
2010
Year
Effective suppression of seed rain at these sites

Pathogen: Rust fungus gall former

Decreases pop'n densities & effects vegetative + reproductive growth

Seed-feeders:


1) *Melanterius ventralis*

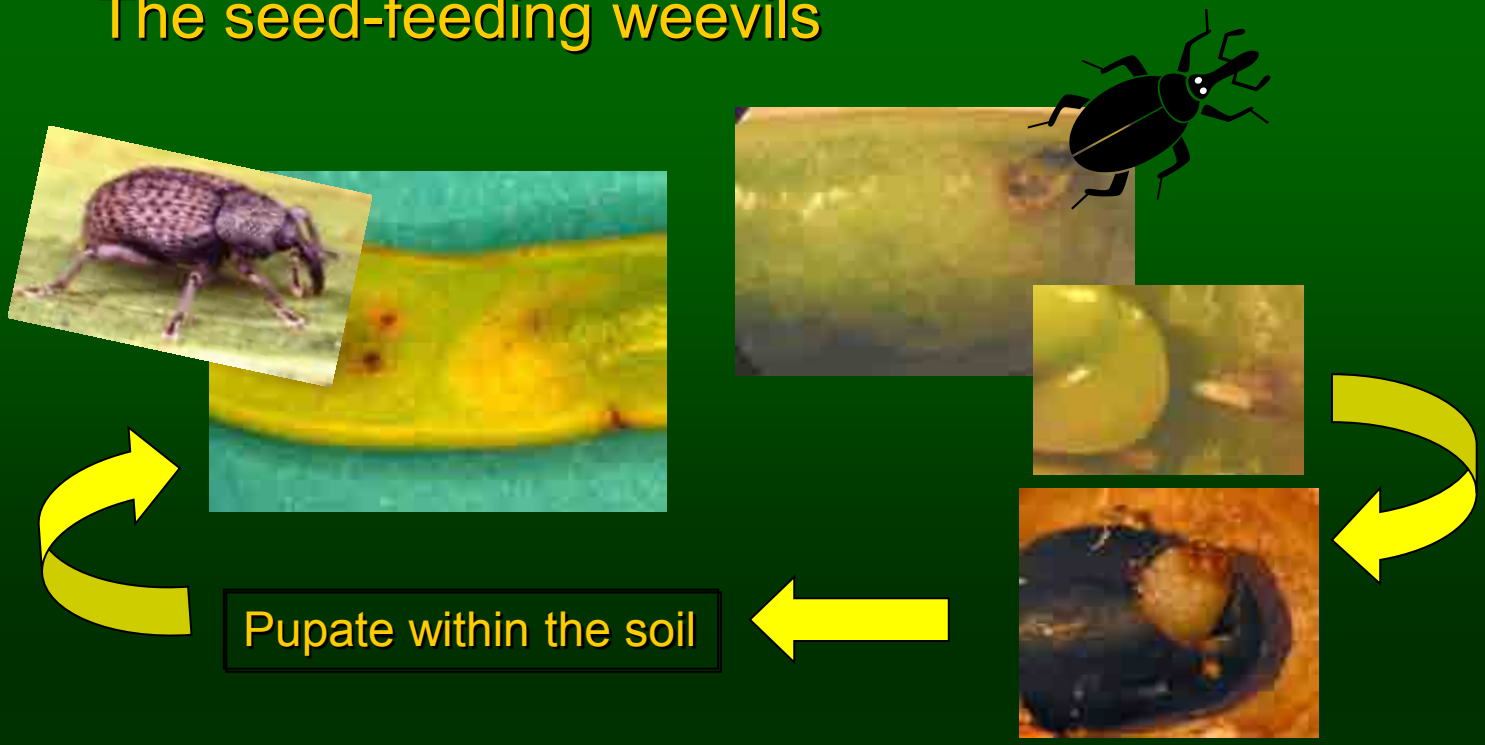

2) *Melanterius acaciae*


3) *Melanterius servulus*


4) *Melanterius maculatus*


5) *Melanterius compactus*

The seed-feeding weevils



- **One generation per year (live 2yrs)**
- **Dispersal +/- 2km/year**
- **Damage levels variable**

Impacts of the weevil are affected by:

- **Site disturbance (clearing/fire)**
- **Plant reproductive phenology (levels of annual pod production)**

Leptospermum laevigatum: Australian, Coastal lowland fynbos

Biocontrol agents

Leaf-mining moth, *Aristaea thalassias*
Introduced in 1996
Impacts negligible

Bud-galling midge, *Dasineura* sp.
Introduced in 1994
Initial reports – very promising (98%)
Can suffer high mortality
Now damage highly variable

Together both agents have highest impact on seedlings

How can biological control be implemented?

- Not all agents need implementing – some disperse readily

Identify potential biocontrol nursery sites
(i.e. accessible, not targetted for clearing/burning)

- Ensure the long-term protection of nursery sites
(Fire breaks, inform landholders, demarcate to prevent clearing)

- Request biocontrol agents via WfW Implementation or receive training in collecting & release procedures

- Check for signs of establishment following release
(not always immediate)

- Once insect populations have built up, the nurseries become sites for collection & re-distribution

In conclusion:

Biocontrol of perennial trees not without complication

- plants fast growing, high seed-producers (ready competition with slow growing fynbos species)
- conflicts of interest have substantially restricted control efforts (Acacias)
- Implementation NB in terms of redistribution of agents
- Selection & Protection of release sites is critical
- Biocontrol is not a “quick-fix” and not always a stand alone remedy (especially using seed-feeders)

Without biocontrol as part of an integrated management approach we have little chance of success against invasive plants