

An integrated pest and disease management extension program for the olive industry (OL17001)

Hort Innovation
Strategic levy investment

AUSTRALIAN OLIVE ASSOCIATION LTD

WESTERN SYDNEY UNIVERSITY

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OLIVE FUND

This project has been funded by Hort Innovation using the olive research and development levy and funds from the Australian Government.
For more information on the fund and strategic levy investment visit horticulture.com.au

PROJECT ACTIVITIES

WP1. Collate and analyse existing information on olive IPDM, with particular reference to Black Scale, OLB and Anthracnose (Year 1)

- Major Literature Surveys,
- Survey of Australian olive growers
- Follow-up survey Year 3

WP2. W**orkshops/field days (Years 1 and 2)**

- IPDM Workshops (9): Covering principles and practices of IPDM; monitoring, biology/ecology/life cycles of Black Scale, Olive Lace Bug, and Anthracnose (with a local focus); conventional and organic management
- Master Classes (2): for consultants, pest monitoring scouts in large groves etc.

WP3. IPDM extension/communications platform for the industry (Years 2 and 3)

- revised Pest and Disease Field Guide
- best practice IPDM manual.
- web-based tutorials
- flyers on IPDM and the three target species

INTEGRATED PEST & DISEASE MANAGEMENT FOR AUSTRALIAN OLIVES

Robert Spooner-Hart & Len Tesoriero

Hort Innovation
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CHARACTERISTICS OF NATURAL ECOSYSTEMS

- Require low levels of inputs
- Have high levels of diversity
- Have a complex series of interactions
- Are highly stable
- Are not highly productive in yield/unit area

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BIODIVERSITY OF ORGANISMS IN A NATURAL ECOSYSTEM

CROP PLANTS/FARM

HERBIVOROUS ANIMALS (inc. insects)

HERBIVOROUS MICROORGANISMS/ PATHOGENS

NON-CROP PLANTS

PESTS

DISEASES

WEEDS

BIODIVERSITY OF ORGANISMS IN A NATURAL ECOSYSTEM

HIGHER LEVEL CONSUMERS

CROP PLANTS/FARM

HYPERPARASITES

PREDATORS

PARASITOIDS AND PARASITES

PATHOGENS

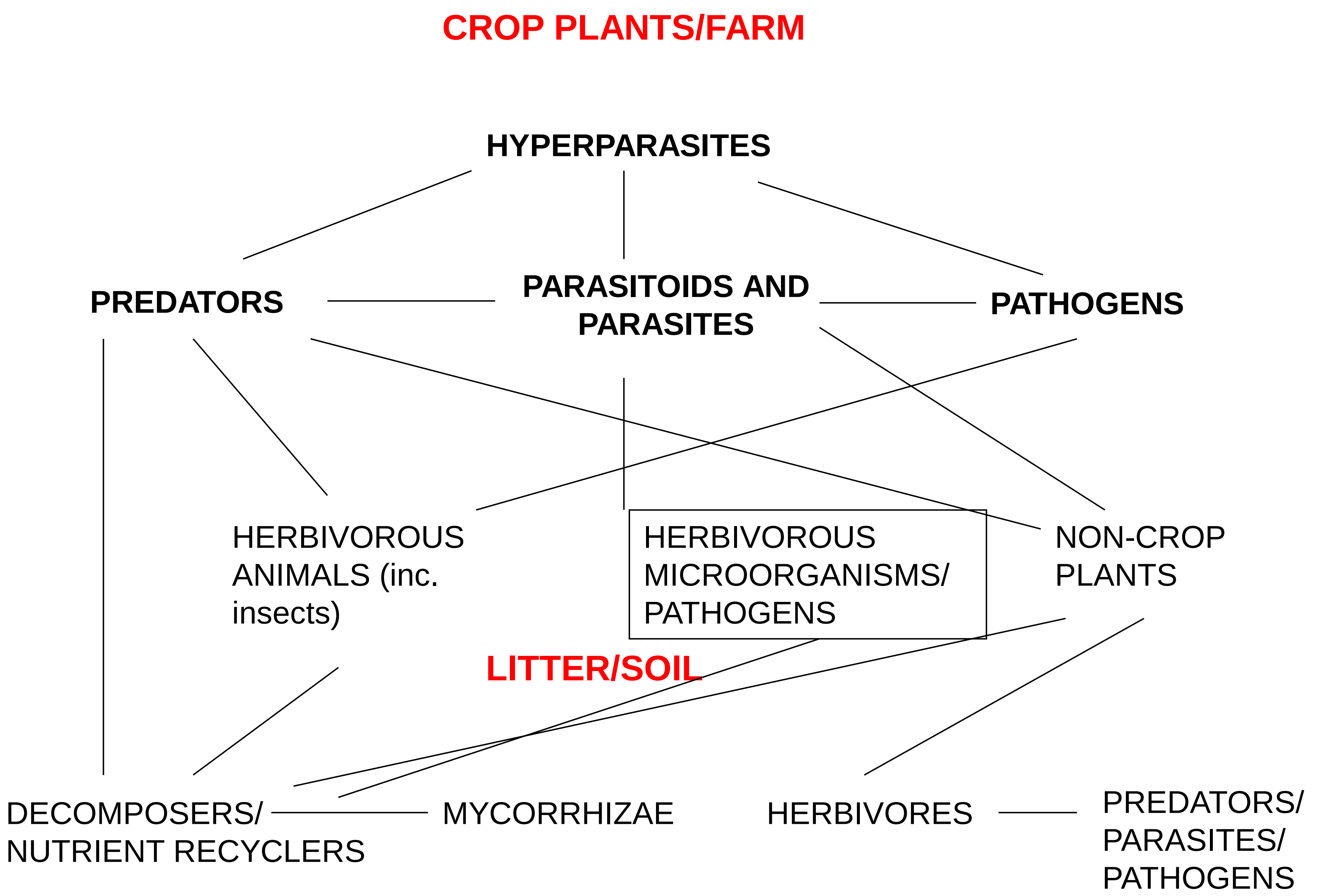
HERBIVOROUS ANIMALS (inc. insects)

HERBIVOROUS MICROORGANISMS/ PATHOGENS

NON-CROP PLANTS

PLANTS

BIODIVERSITY OF ORGANISMS IN A NATURAL ECOSYSTEM



PRODUCTIVE ECOSYSTEMS

- Are more productive or useful
- Require higher levels of inputs
- Have limited diversity
- Have reduced series of interactions
- Are unstable
- Are unsustainable, unless continuously supported

A PEST / PATHOGEN IS...

" ANY UNWANTED ORGANISM WITHIN A PARTICULAR SITUATION"

"Trapped like rodentia!"

IT MAY BE:

A new species or strain (including a more virulent strain)

Native species attacking new crop

Naturalised species attacking a new crop

Exotic species (often without natural controls)

An induced species responding to changed environmental conditions (e.g. monoculture, irrigation and fertilisers, "improved" crop varieties, pesticide use and other pest control measures, climate change)

FOR PESTS OR DISEASES TO CAUSE PROBLEMS IN A GROVE, THE FOLLOWING ARE ALL REQUIRED

1. **A susceptible host** **(including a cultivar, in a susceptible condition of health)**

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FOR PESTS OR DISEASES TO CAUSE PROBLEMS IN A GROVE, THE FOLLOWING ARE ALL REQUIRED

1. **A susceptible host** (including a cultivar, in a susceptible condition of health)

2. **A suitable environment**, including abiotic and biotic conditions in the grove, including the soil

3. **The presence of a virulent strain of pest or pathogen** at a sufficient population pressure

INTEGRATED PEST AND DISEASE MANAGEMENT (IPDM)

A commonsense approach where all methods of control: resistant varieties, planting and harvest time, conservation and manipulation of natural enemies and biological control are all brought into operation in a systemic way to keep pest/pathogen populations and related damage at low levels, with pesticides applied only where absolutely necessary, and in such a way as to interfere least with non-chemical methods

IPDM HAS THE FOLLOWING CHARACTERISTICS

- **Based on ecological principles**
- **Requires correct identification of damage & causal agents**
- **Continuous monitoring of crop health, weather, potential pests/diseases and their damage, as well as their natural enemies, including after application of any treatments**
- **Setting thresholds of pests/disease and/or damage at which action is to take place (this can be difficult)**
- **Integrating a number of strategies in a systemic way**
- **Intervening with selected chemicals only when appropriate, and then with appropriate timing and coverage**

MONITORING

most important component of IPDM

growers, trained employees or pest scouts visual observations in person or by remote (e.g. drone)

based on sampling, assessment of pests, diseases and/or damage

Monitor grove (or block in large groves) at least monthly during the growing season. Monitor priority blocks more frequently

Divide large blocks into sub-blocks. Select several rows within each sub-block. Sample different rows/trees each time, and include more detailed tree inspection

Examine individual trees from all sides and at all heights using a systematic approach

Inspect samples of leaves, twigs, flowers and fruit for the presence of pests, diseases or damage and their stage(s) of development using a 10× hand lens or magnifying glass

If pest or disease is detected, check surrounding trees in the row and adjacent rows to establish the extent of the infestation

Monitoring after an intervention (such as pesticide application) will demonstrate its level of success

STRATEGY 1. CULTURAL MANAGEMENT

- **Maintain good plant health (irrigation, nutrition)**
- **Hygiene, plant sanitatio quarantine, biosecurity**
- **Control alternative hosts for pests and diseases**
- **Change environment to less favour pests and pathogens (e.g. improved tree training systems, open canopy for air/sunlight and spray coverage, selected cover crops)**
- **Change management practices (harvest times, varieties, pruning practices) to minimise pests and diseases and their spread**

Mummified fruit, source of anthracnose pathogen (Sergeeva, Spooner-Hart & Nair 2008)

STRATEGY 2. BIOLOGICAL CONTROL

Use of natural enemies such as predators, parasitoids and pathogens, competitors

Broadly, three forms biological control:

- **Classical**
- **Augmentative/inundative** and
- **Conservation**

ABC australasian biological control

www.goodbugs.org.au

STRATEGY 3. PHYSICAL AND MECHANICAL CONTROL

e.g. Use of mechanical devices and barriers
(e.g. birds, roos, weevils)

Traps

Monitoring or management

Tree barrier to prevent garden weevil movement up olive tree

STRATEGY 4. USE OF SELECTED PESTICIDES

- Natural or organic pesticides (not always least disruptive choice)

- Narrow spectrum (selective) pesticides

- Pesticides which disrupt pest's development or behaviour.

  e.g. pheromones, insect growth regulators, oil sprays

- Timed applications to target pests & diseases

USE OF PESTICIDES IN IPDM

- **Spectrum of activity of pesticide (broad/selective)**
- **Residual activity of pesticides**
- **Spot/selective vs broad applications**
- **Timing and frequency of applications**

DISRUPTION BY PESTICIDES IS A COMBINATION OF THESE FACTORS

STAGES OF IPDM

1. Improved cultural and hygiene practices

   Monitoring of pests/diseases to better time pesticide applications

2. Monitoring of beneficial species, predicting pest and disease populations

   Selection of “softer” pesticides where possible

   Spot and target applications of pesticides

STAGES OF IPDM

3. Environmental modifications to encourage beneficials, and discourage pests

   Releases of mass-reared beneficials/ entomopathogens/ competitors/ antagonists

4. Better design of production systems to minimise pest problems

SOME ISSUES TO CONSIDER WITH ORGANIC OLIVE PEST AND DISEASE CONTROL

- Organic pest and disease management should have a strong scientific base, where monitoring plays a key role

- Some acceptable organic inputs may not be registered for commercial use in olives by APVMA (eg. neem, Eco-Oil)

- Copper is a fungicide under threat of removal, with problems with soil microorganisms, copper toxicity

- Some organic pesticides may be environmentally disruptive (broad spectrum, e.g. pyrethrum)

POSSIBLE SYMPTOMS AND CAUSES ON OLIVE TREES

	COMMON NAME OF		
SYMPTOM	**PEST**	**DISEASE**	**DISORDER**
Leaf yellowing, twig & branch dieback	Black scale Armoured scales Lace bug	Rhizoctonia Verticillium Phytophthora Charcoal rot Wound canker Anthracnose Grey/leaf mould (Cercospora)	Tip death
Leaf spots & damage	Lace bug Weevils Grasshoppers L-B apple moth Rutherglen bug	Peacock spot Leaf mould (Cercospora)	

POSSIBLE SYMPTOMS AND CAUSES ON OLIVE TREES

COMMON NAME OF			
SYMPTOM	**PEST**	**DISEASE**	**DISORDER**
Leaf/branch tip deformation	Olive bud mite Black scale		
Fruit damage & rot	Fruit fly Armoured scale Green vegetable bug	Anthracnose Peacock spot Cercospora (grey mould)	Apical end rot (soft nose)
Flower damage	Thrips (unlikely)	Anthracnose	Dehydration
Stem damage, galls & bumps		Olive knot Crown gall	Sphaeroblasts Oedema

POSSIBLE SYMPTOMS AND CAUSES ON OLIVE TREES

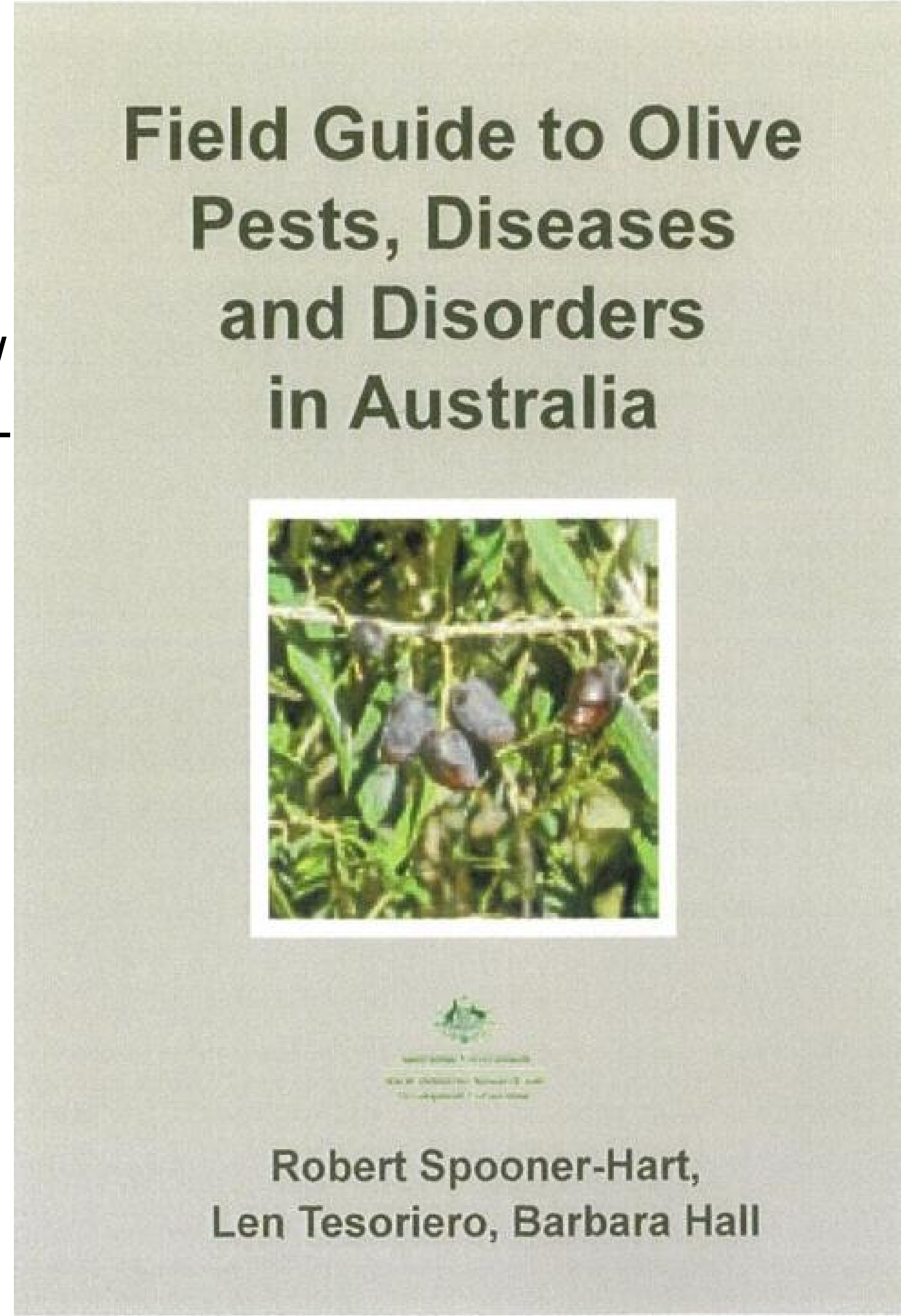
	COMMON NAME OF		
SYMPTOM	**PEST**	**DISEASE**	**DISORDER**
Stem/trunk cankers & death		Phytophthora Verticillium wilt Wound canker Anthracnose	Sunburn
Root rotting & damage	Weevils	Rhizoctonia Phytophthora Verticillium wilt Charcoal rot Nematodes	Clay panning or root plaiting Waterlogging
Tree blackening	Black scale Ants	Sooty mould	

FIELD GUIDE (2007)

Available at

https://www.agrifutures.com.au/publications/field-guide-to-olive-pests-diseases-and-disorders-in-australia/

Updated edition to be undertaken as part of the current project



PROJECT IPDM SURVEY

Conducted June 2018
30 Questions in 5 Sections:


Boundary Bend


Dryland organic farming, https://grampiansoliveco.com.au

- Orchard/grove attributes
- Pests & Diseases in your orchard/grove
- Integrated Pest & Disease Management
- Biosecurity
- Future Extension

130 respondents, >75% of plantings

PEST & DISEASE SURVEY SUMMARY 2018

PEST STATUS	SCORE	KEY STATES
1. Black scale/ Ants	602	All
2. Olive lace bug	211	NSW, Qld, WA, Vic (SA, Tas)
3.Weevil/ Curculio beetle	49	WA, SA, Vic
4. Others: Grasshoppers, Rutherglen bug, Fruit fly		Qld

PEST & DISEASE SURVEY SUMMARY 2018

DISEASE STATUS	SCORE	KEY STATES
1. Anthracnose	267	All except Tas
2. Peacock spot	139	Tas, NSW,SA, Vic
3. Dieback	102	Qld, NSW, WA
4. Phytophthora/ Verticillium wilt	62 60	NSW, Vic, SA, WA
5. Others: Cercospora/ Grey mould, Olive knot		Vic, NSW, SA

OTHER PESTS

Birds (cockatoos, parrots, rosellas, starlings)

Kangaroos/wallabies

Rabbits/hares

Deer

Kangaroos in the Hunter photo R. Spooner-Hart

IMPORTANCE OF PESTICIDES	% Growers
Very important- main control	34
Quite important	32
Relatively unimportant	16
Not used at all	15

CAUTION

KEEP OUT OF REACH OF CHILDREN
READ SAFETY DIRECTIONS BEFORE OPENING OR USING

Infopest Verified

APVMA RLP Approved

Admiral®

INSECT GROWTH REGULATOR

ACTIVE CONSTITUENT: 100 g/L PYRIPROXYFEN
SOLVENT: 450 g/L LIQUID HYDROCARBONS

GROUP	7C	INSECTICIDE

For the control of silverleaf whitefly (*Bemisia tabaci* Biotype B) in cotton, rockmelon and capsicum, the control of silverleaf whitefly (*Bemisia tabaci* Biotype B) and greenhouse whitefly in tomatoes, and the control of various scale in citrus, mangoes and olives.

IMPORTANT: READ THE ATTACHED LEAFLET BEFORE USING THIS PRODUCT.

CONTENTS: 1L, 5L, 20 L, 200 L

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BIOSECURITY MEASURES	% Growers
Grove machinery wash down facilities	50.8
Farm biosecurity preparedness plan	17.7
Read current version of Biosecurity Plan for Olive industry	12.3

Other issues raised:

Olive harvesters

Olive processors (for and by)

Overseas travellers (both ways)

Black Scale

Robert Spooner-Hart
Andrew Beattie
Phuong Sa

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BLACK SCALE *Saissetia oleae* (Coccidae)

- Cosmopolitan, range of hosts, major ones olive and citrus

- One of the 2 most important and the most widespread olive insect pest in Australia

- 2-3 generations/year. Overlapping, particularly in Queensland, Nth NSW. Behaves differently on olives than on citrus.

- Until recently, limited details of black scale biology on olives in Australia

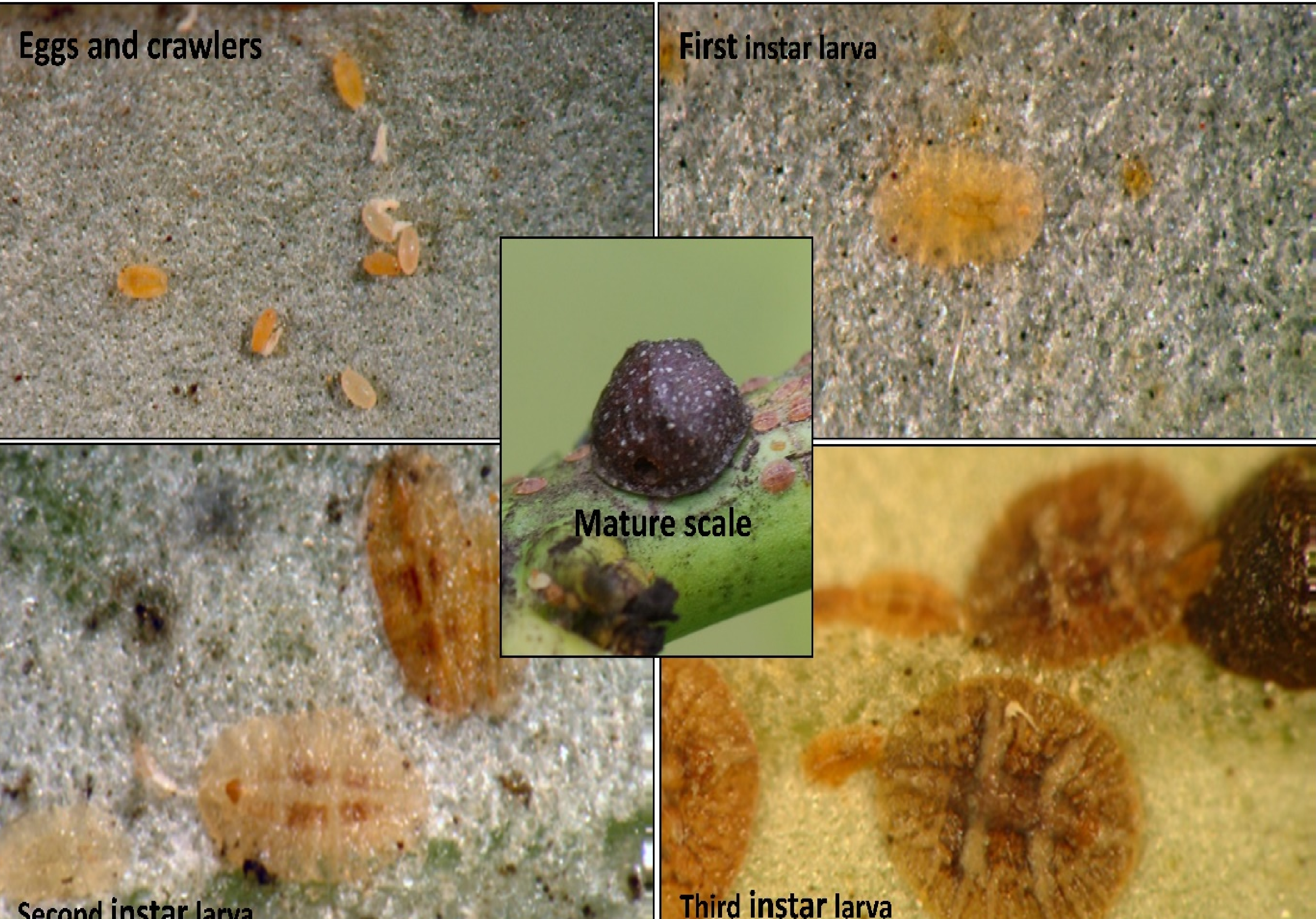
DAMAGE

Suck sap from leaves (mid-vein) and twigs

Produce honeydew, and associated ants and sooty mould

Heavy infestations cause reduced tree vigour, twig dieback, reduced flowering, even for following season

LIFE STAGES OF BLACK SCALE (Broughton and Beattie)

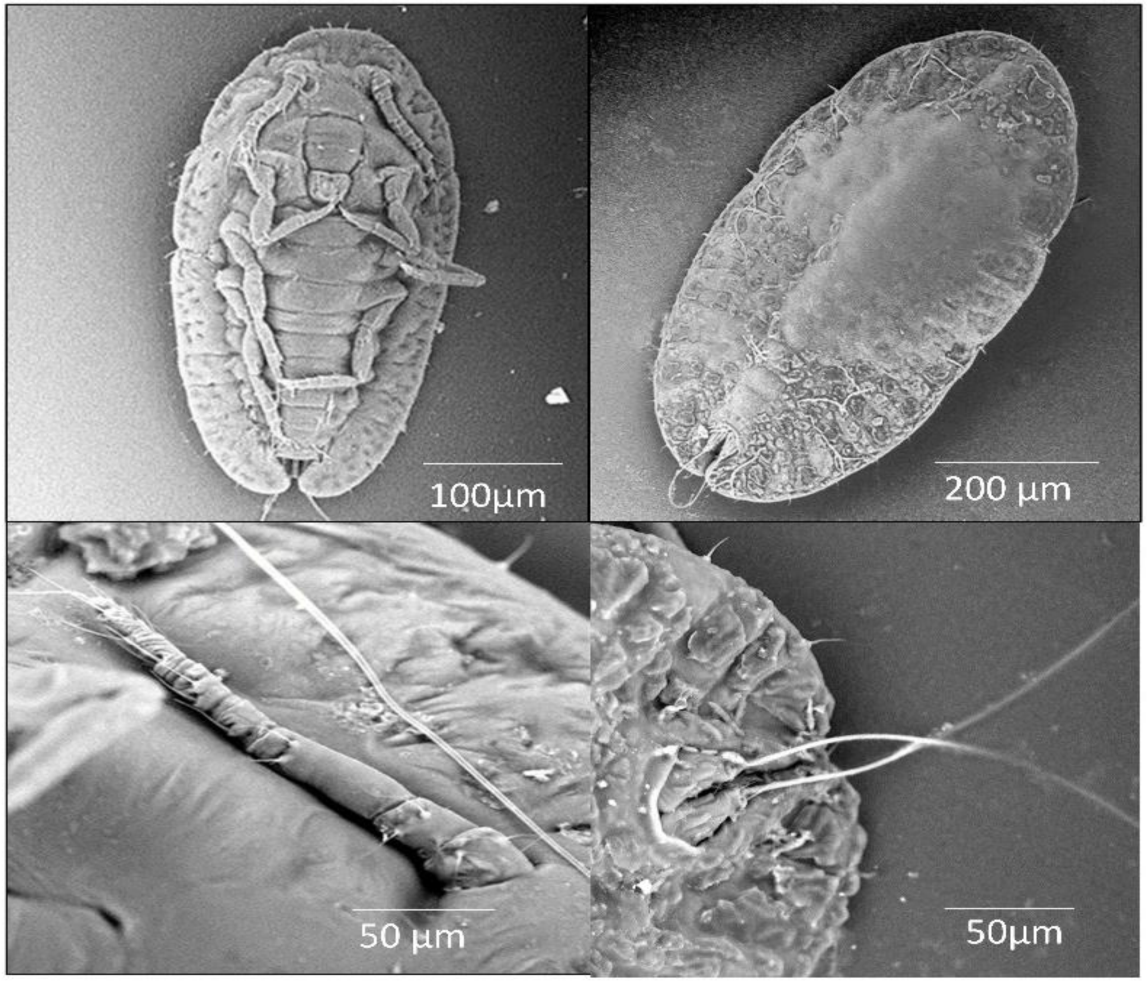


A Mature black scale female with eggs

B Black scale adults and crawlers (*Scutellista caerulea* on right)

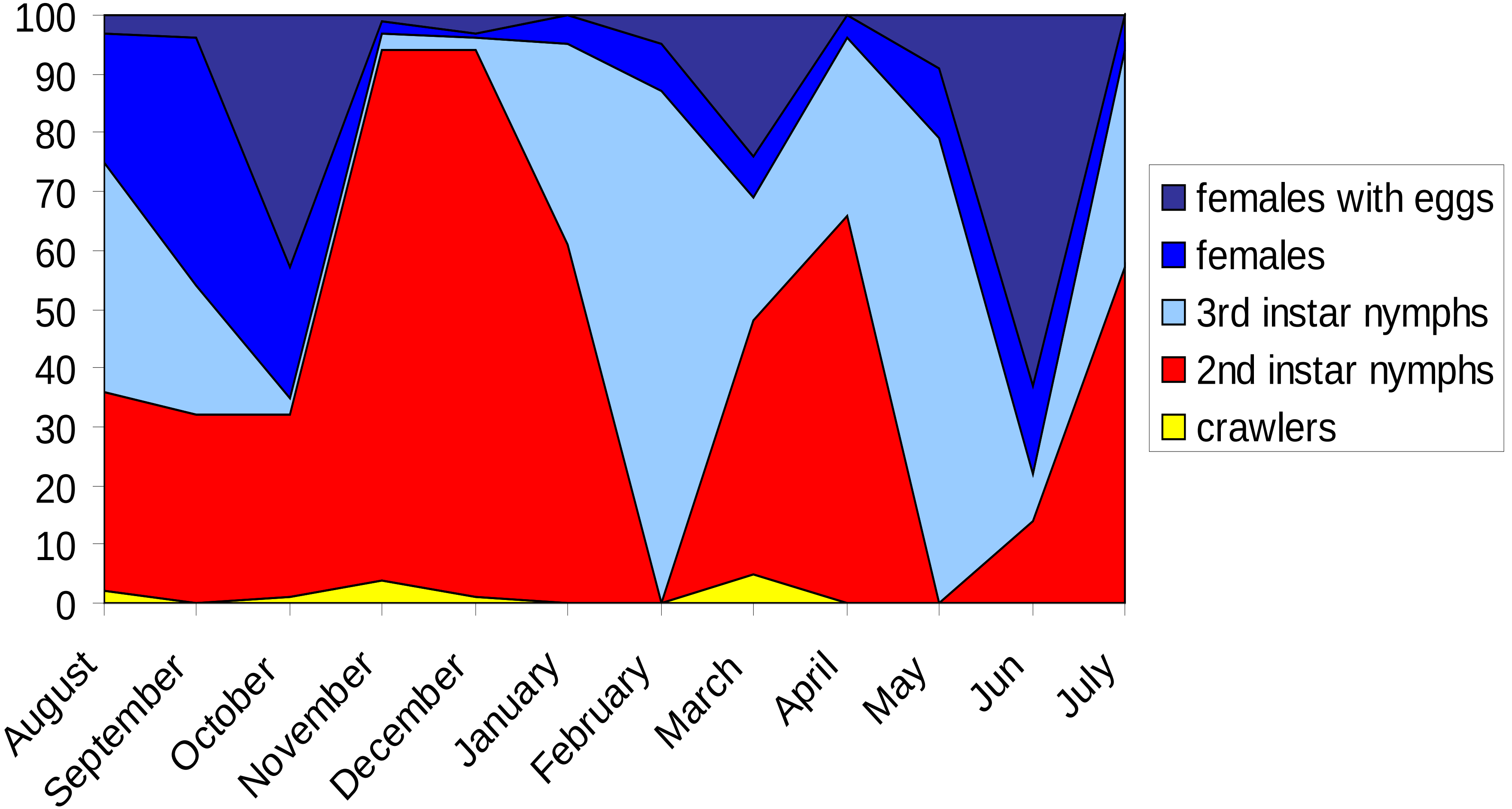
C 3rd instar and female black scales

SCANNING ELECTRON MICROSCOPE IMAGE OF 1ST INSTAR BLACK SCALE (Phuong Sa)



Crawlers are most susceptible stage to hot, dry weather

Black scale population stage composition Southern Queensland



NATURAL ENEMIES

>24 species of beneficial insects, including 22 parasitoid spp. released

15 parasitoid species recorded in association with black scale in Australia. Most common are *Scutellista caerulea* and *Metaphycus* spp.

Attempts made to mass rear and release 2 *Metaphycus* spp. in olive groves in WA, SA and Vic had limited success

***M. helvolus* (L)**

***M. bartletti* (R)**

Scutellista caerulea (egg predator and scale parasite) most common in NSW, Qld, Vic, also present in WA

Other natural enemies include ladybirds and scale-eating caterpillar, but are not generally as effective as parasitoids

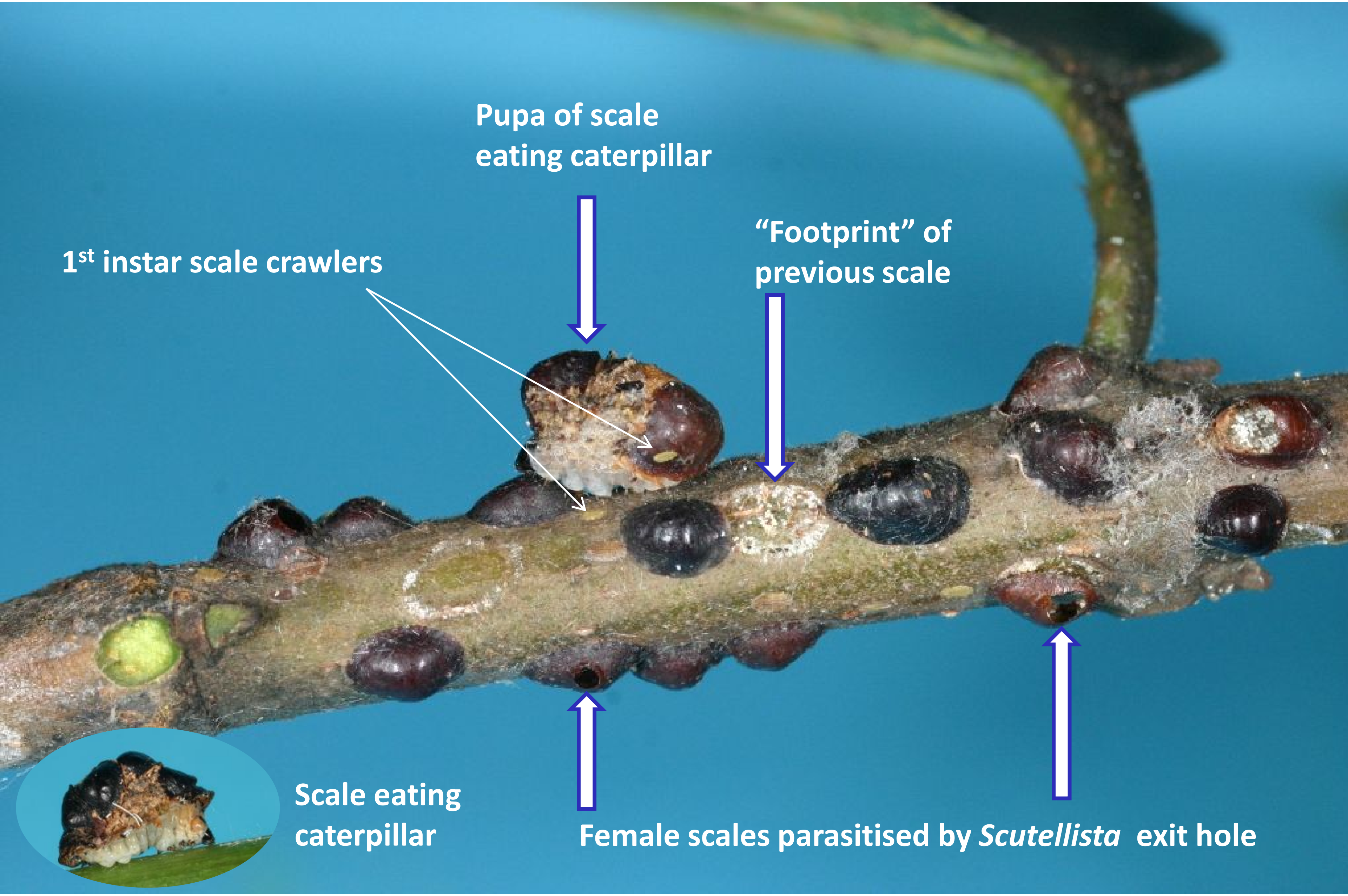
o protect your privacy, PowerPoint has blocked automatic download of this picture.

Ants in association with black scale are a key factor negatively impacting biological control. Hence, managing ants is an important part of scale management.

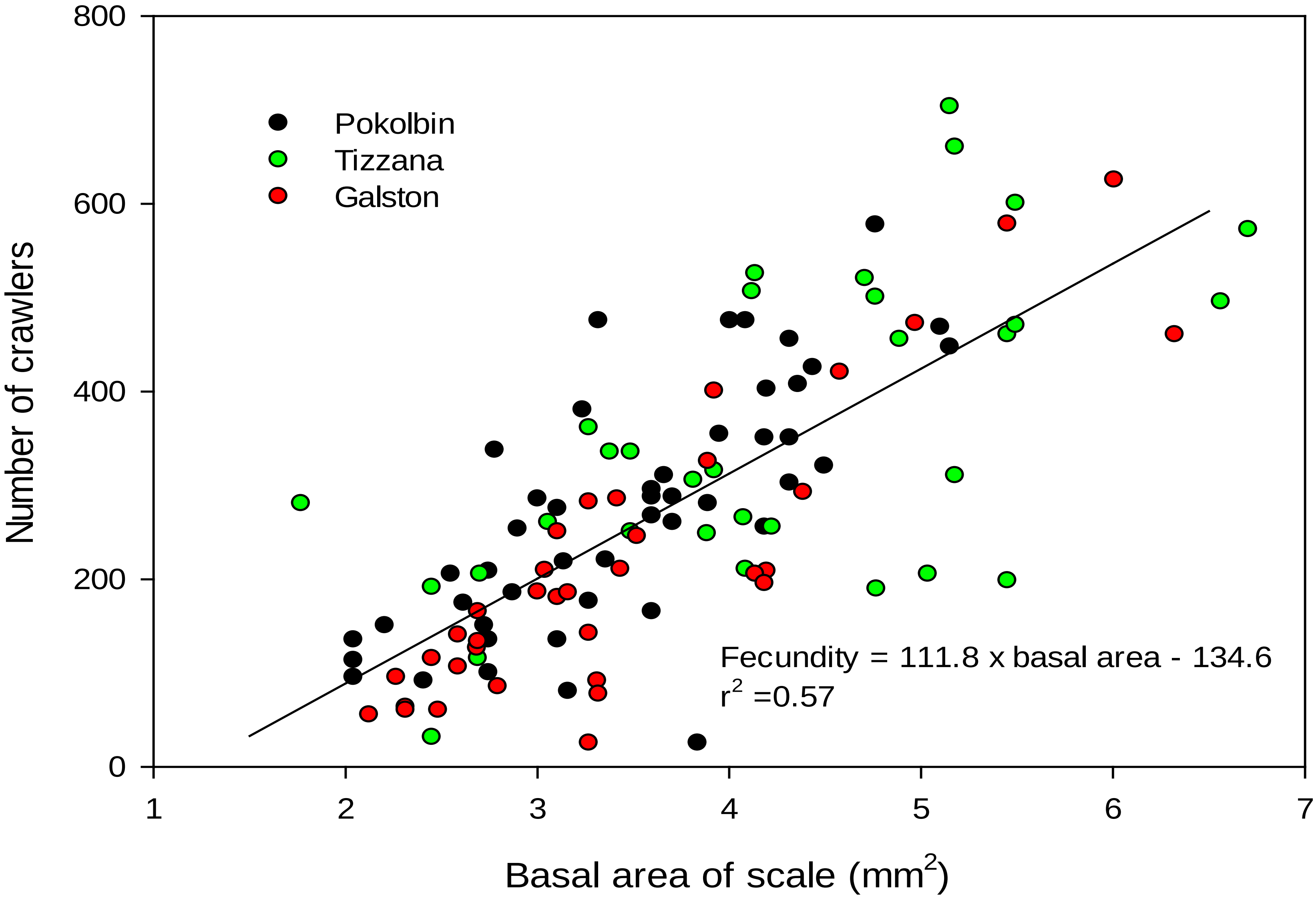
For all olive sites in NSW, average parasitism of black scale adults by *Scutellista caerulea* was 63% (range 48–75%), and average number of eggs and crawlers recorded from scales parasitised by a single *S. caerulea* was 89% (range 81–98%) fewer than for unparasitised scales

Larva (grub) of *S. caerulea* among black scale eggs

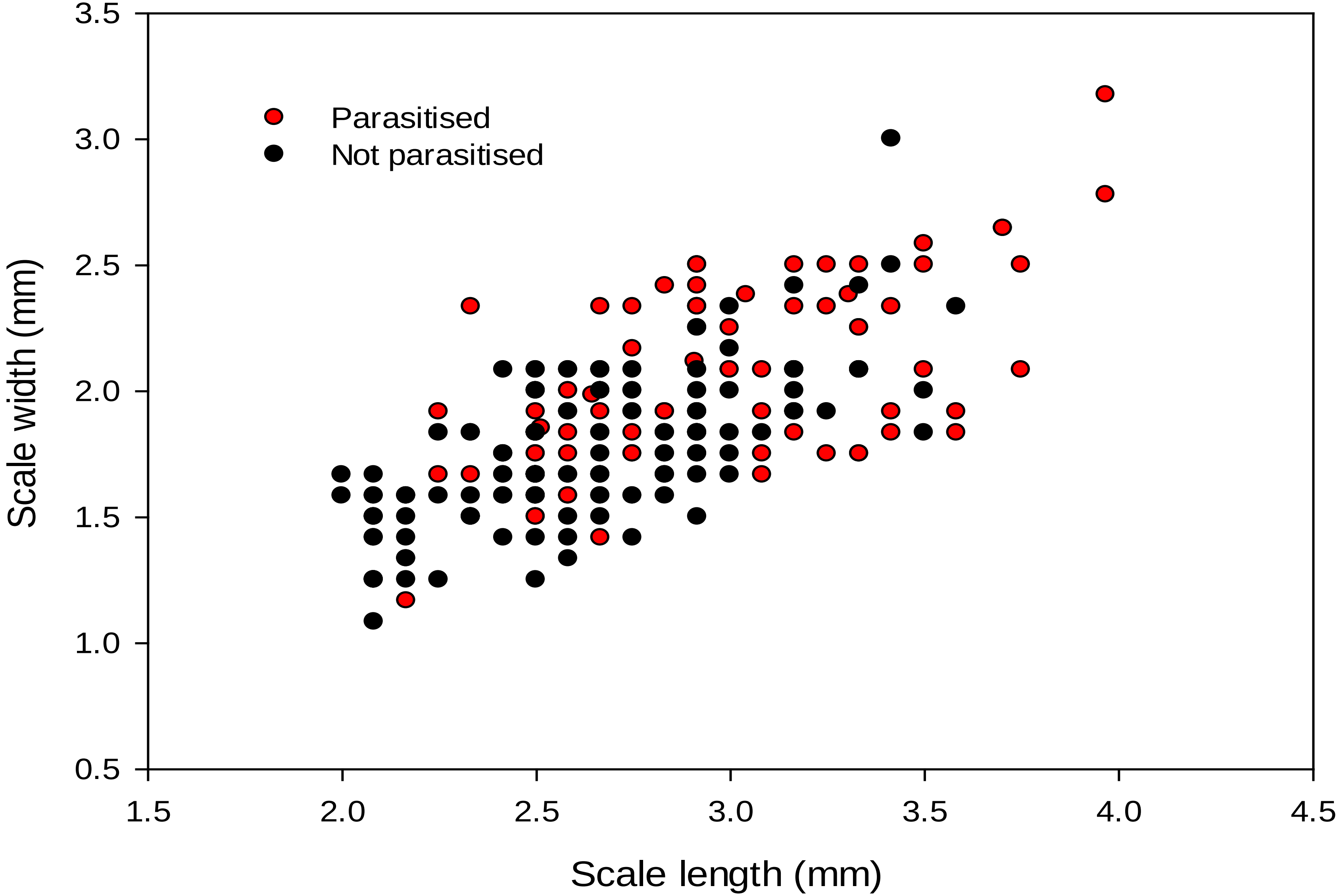
BLACK SCALE POPULATION SHOWING NATURAL ENEMIES



For non-parasitised black scale, as host size increased so did fecundity



Parasitised scales tended to be larger than non-parasitised scales

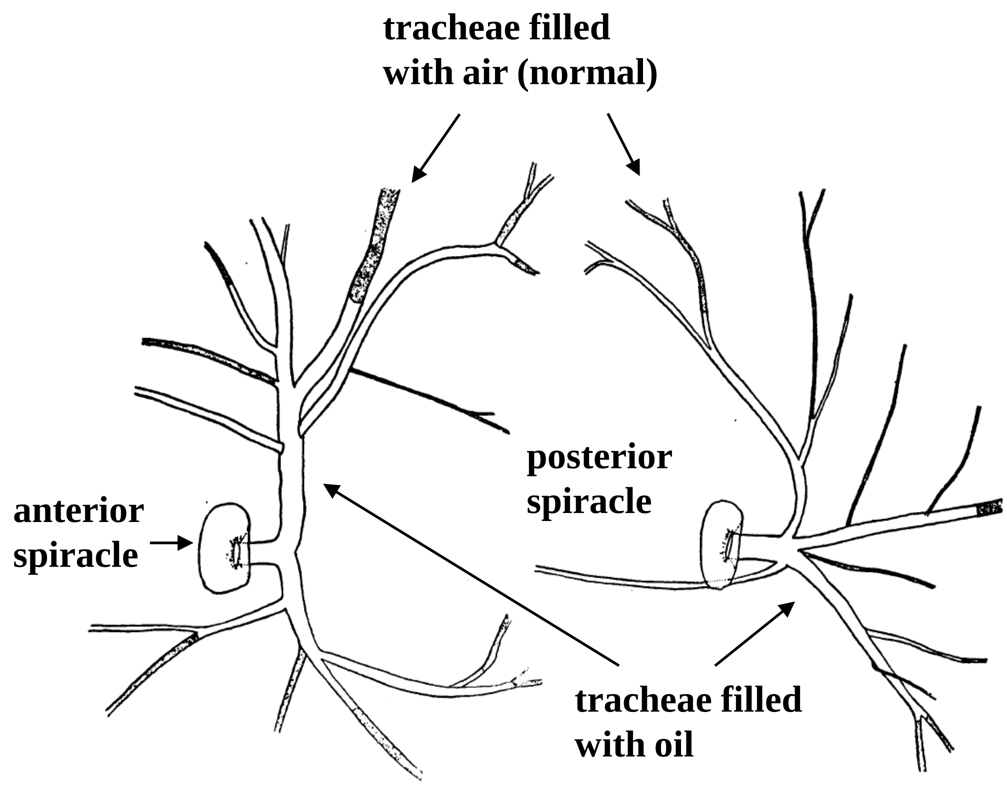


CHEMICALS REGISTERED OR PERMITTED FOR USE AGAINST BLACK SCALE & ANTS as at 24/10/2018

TARGET PEST	PRODUCT	REGISTERED OR PERMIT	CONDITIONS OF USE
Black scale	Emulsifiable Botanical Oil (ECO-OIL® MITICIDE/INSECTICIDE BOTANICAL OIL CONCENTRATE)	Registered	Home garden use only
	Petroleum spray oil (TRUMP®, SACOA BIOPEST®)	Registered	WHP 1 day
	Pyriproxyfen (ADMIRAL®, LASCAR®, PICTUS®, PYXAL®, AC PENRHYN®)	Registered	Apply no more than 2 times /season. WHP 7 days
	Fenoxycarb (INSEGAR® WG INSECT GROWTH REGULATOR)	PER82184	Until December 2018 Apply no more than 2 times /season WHP 60 days
Ants	Pyriproxyfen (DISTANCE PLUS ANT BAIT®)	Registered	No more than 3 times/year
	Chlorpyrifos (various)	PER14575	Until March 2019 Apply no more than 2 times /season. (Ground, Butt treatments only). No WHP, but no grazing

OIL SPRAYS

- Death of susceptible pests mostly related to suffocation (anoxia) movement of oil spiracles into respiratory system of small sessile insects and mites as spray deposits dry
- Also behavioural impacts, such as inhibition of feeding, settling, oviposition are related to oil deposits that may persist for several days or more on plant surfaces



De Ong et al.

INSECT GROWTH REGULATORS (IGRs)

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Admiral Insect Growth Regulator *7 September 2011* *Page 1 of 5*

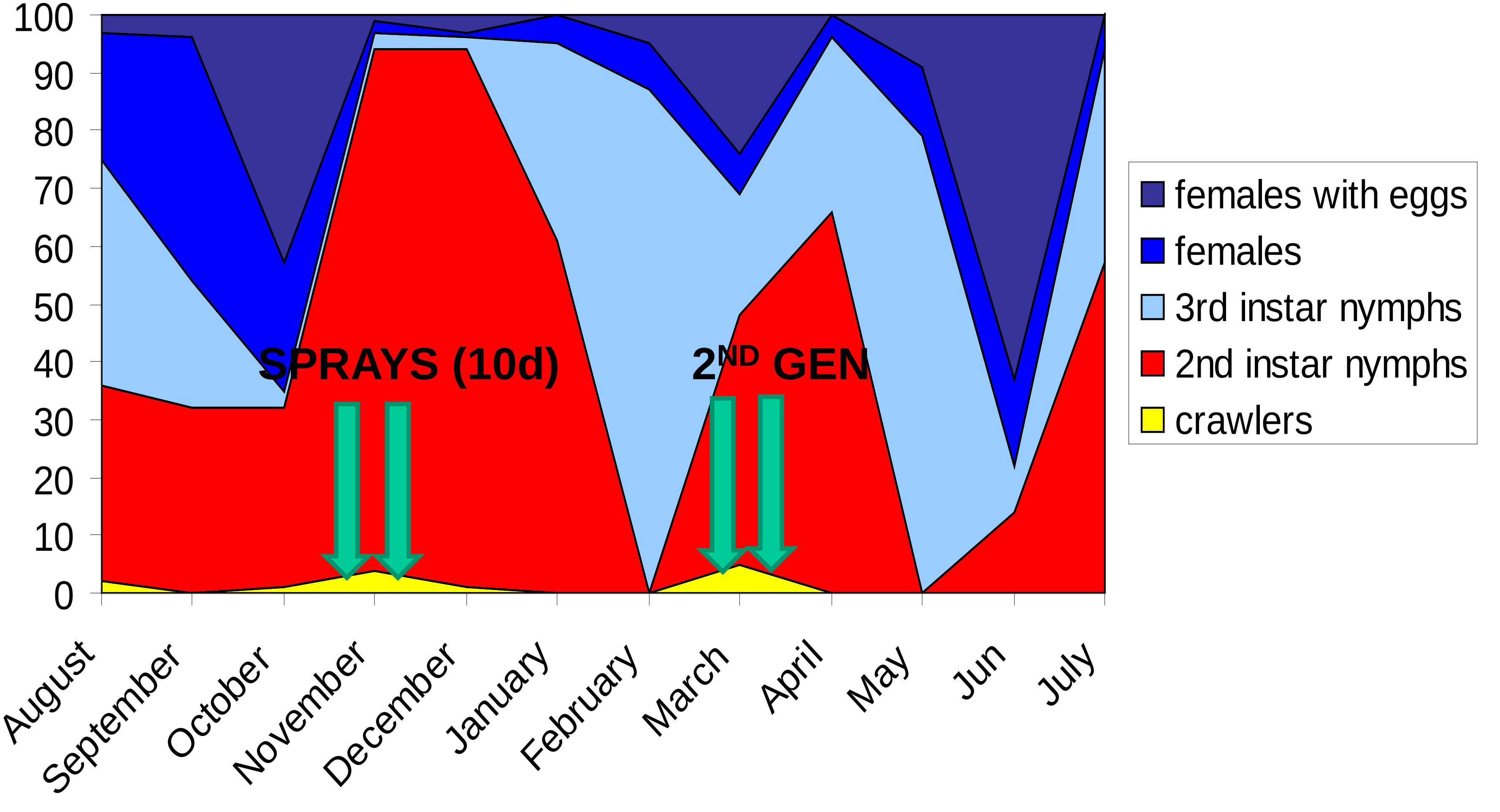
(Some are Juvenile hormone mimics)

Work best at egg hatch–young nymphs, but also pupae–adult, so timing critical. Not systemic

Admiral® (pyriproxyfen) (REGISTERED against black scale in olives)

Admiral ideally should be applied at the time of crawler release for best effect but can be applied to later scale instars.

Black scale population stage % composition and spray timing



Trials conducted against crawlers and immature black scale after 2nd spray: field trial Southern Queensland

TREATMENT	MEAN NUMBER SCALE/LEAF	SE
Water	11.12 **a**	3.41
1% PSO	2.95 **b**	0.98
1.8% PSO	2.11 **b**	1.06

Trials conducted against crawlers and immature black scale after 2nd spray: field trial central NSW

TREATMENT	MEAN NUMBER SCALE/LEAF	SE
Water	0.82 **a**	0.29
1% PSO	0.20 **b**	0.10
1.8% PSO	0.05 **b**	0.02

KEY TAKE HOME MESSAGES

- Monitoring for emergence of crawlers is critical for timing of applications of allowable conventional or organic products

- Parasitoids, especially *Scutellista caerulea* and *Metaphycus* spp. can play an important role in black scale management, by substantially reducing the number of emerging scale crawlers

- Effective ant control is an important aspect of managing black scale

- Timing and effective spray coverage is critical for successful organic and conventional chemical management

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Olive Lace Bug

Robert Spooner-Hart

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OLIVE LACE BUG, *Froggatia olivinia* (Hemiptera: Tingidae)

- **Native Australian species**
- **Original reported host *Notelaea* spp. (native olive)**
- **Normally 3+ generations/yr**
- **Recorded in NSW, Qld, Vic, SA, WA (2002, 2006), reported in Tas**
- **1st generation infestations occur in spring in north first**
- **5 nymphal instars**

KEY OLB QUESTIONS

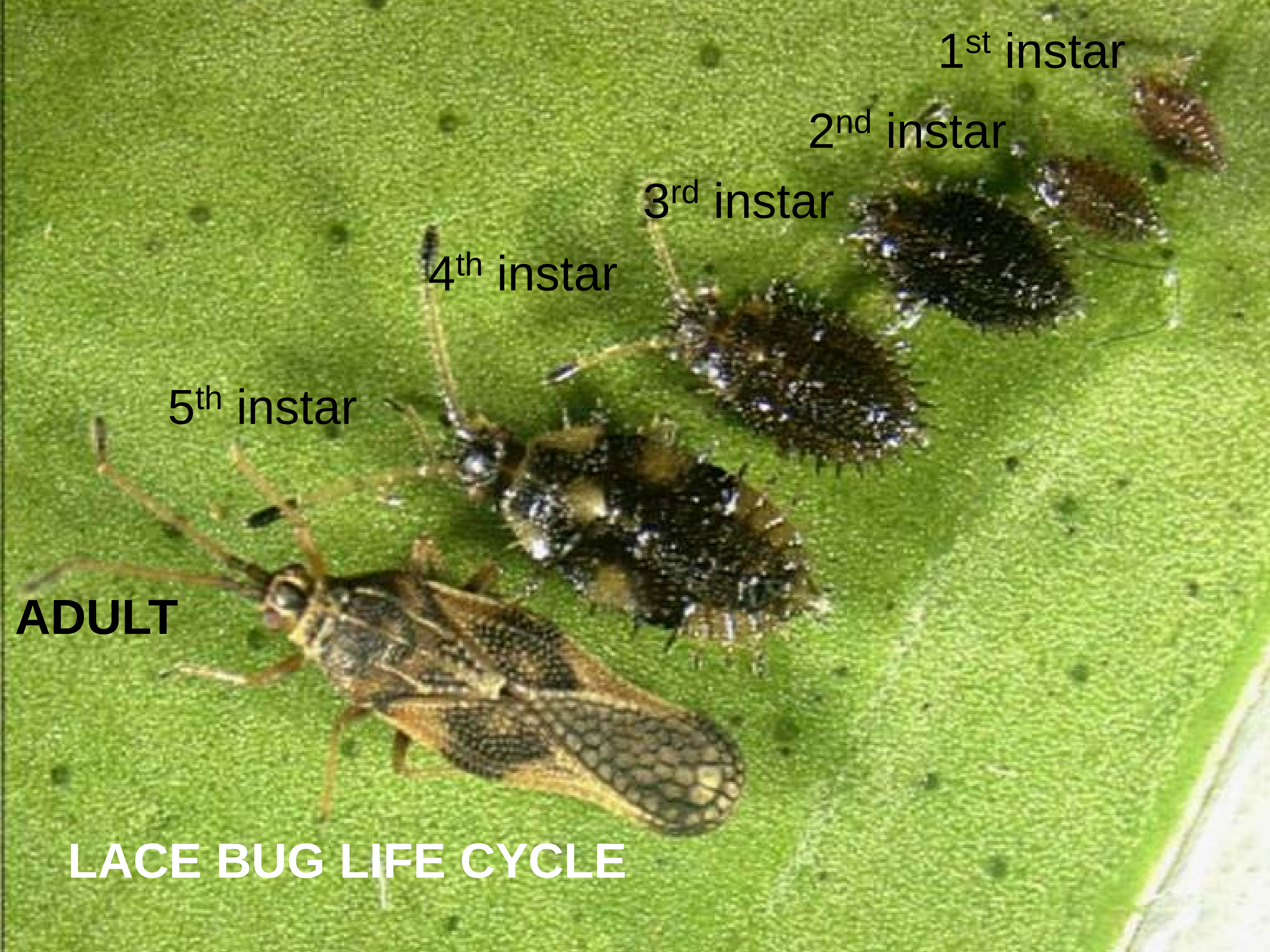
- Where do they come from into my grove? How do they sometimes just appear? And what can I do about it?

- How do they spread? How did they get into the state/district? How can we restrict their spread?

- What are their natural enemies and how can I encourage them?

- What are their hosts other than olives?

- What impact does tree health and nutrition have on these pests and their natural enemies?


1st instar
2nd instar
3rd instar
4th instar
5th instar
ADULT
LACE BUG LIFE CYCLE


Female ovipositing near
midvein


Hatching nymphs of
F. olivinia

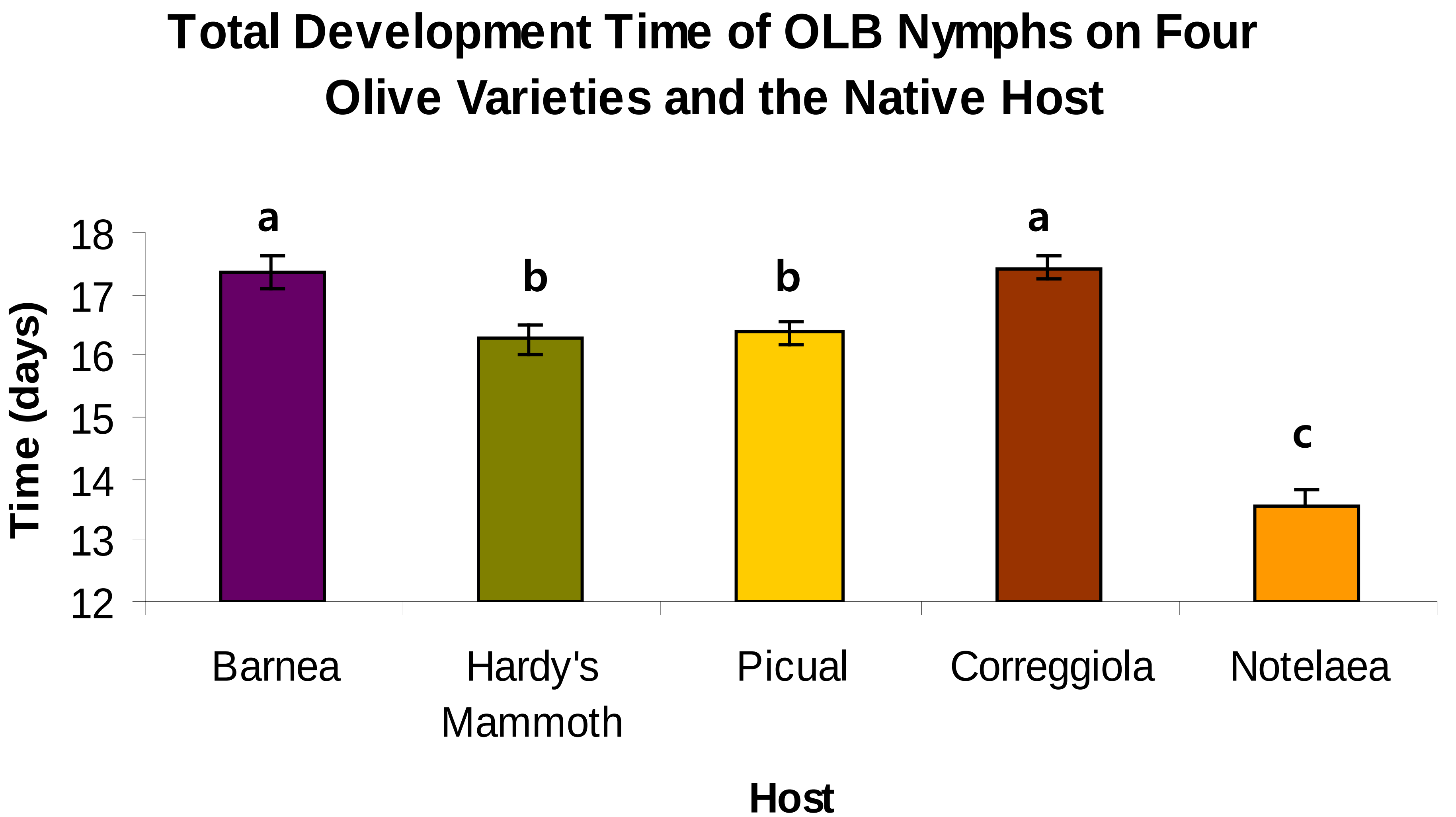
Newly emerged nymph, egg operculum (O) visible

Mixed nymphal instars of *F. olivinia*


4TH AND 5TH INSTAR NYMPHS, EXOSKELETONS
AND SECRETIONS

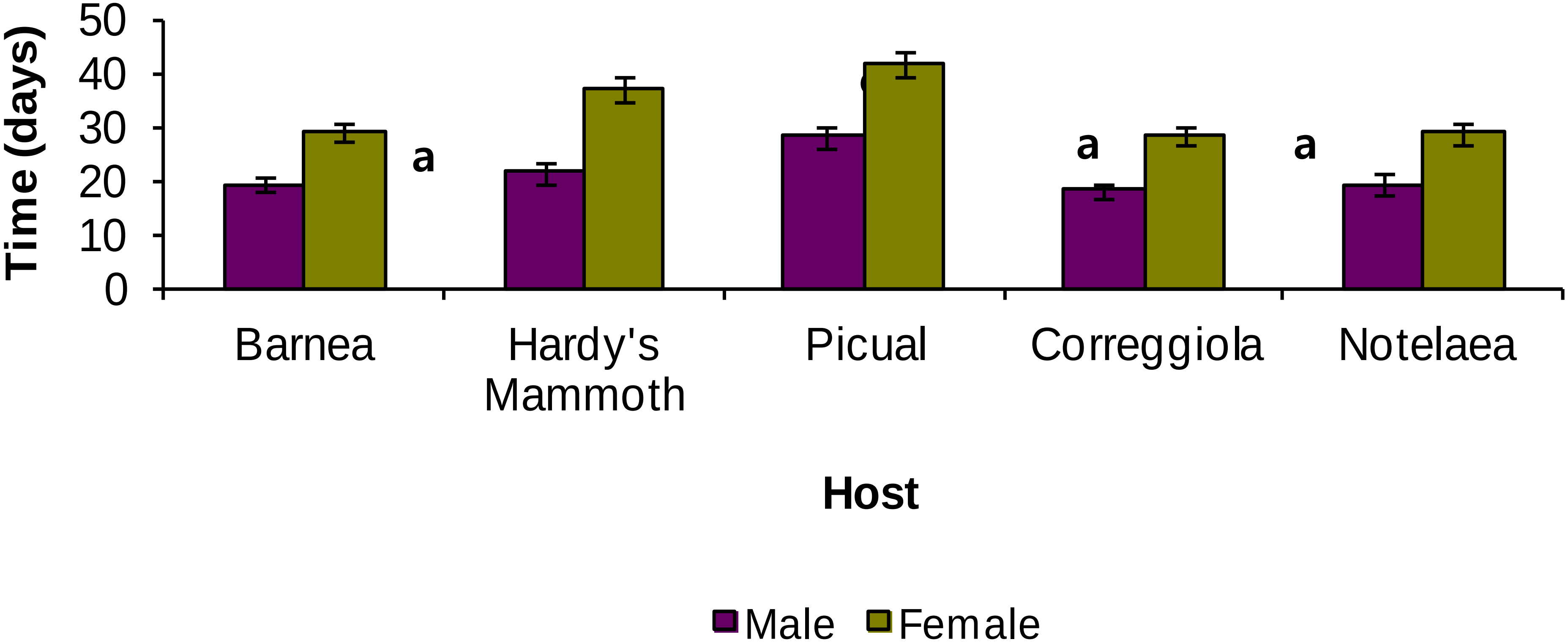
OLB NYMPHAL DEVELOPMENT AT 27°C

OLB develops at different rates on different olive varieties



EFFECT OF VARIETY ON OLB MALE AND FEMALE LONGEVITY AT 27°C

Longevity of OLB Male and Females on Four Olive Varieties and the Native Host`



• Nymphal stages clustered on undersides of leaves

• Adults less clustered, fly short distances

• First generation is usually discrete, later can have overlapping generations

• Eggs, a few adults and occasional nymphal clusters overwinter

OLIVE LACE BUG (OLB) DAMAGE

All motile stages have piercing and sucking mouthparts

Mostly feed on undersides of leaves, but adults also found on upper surface

OLB on its natural host *Notolaea longifolia*

OLB can infest groves

• from forests, and possibly vice versa
• from within a grove
• from nearby groves
• on equipment or people
• from nurseries/plant movement

We are unclear about the extent of these movements in different locations

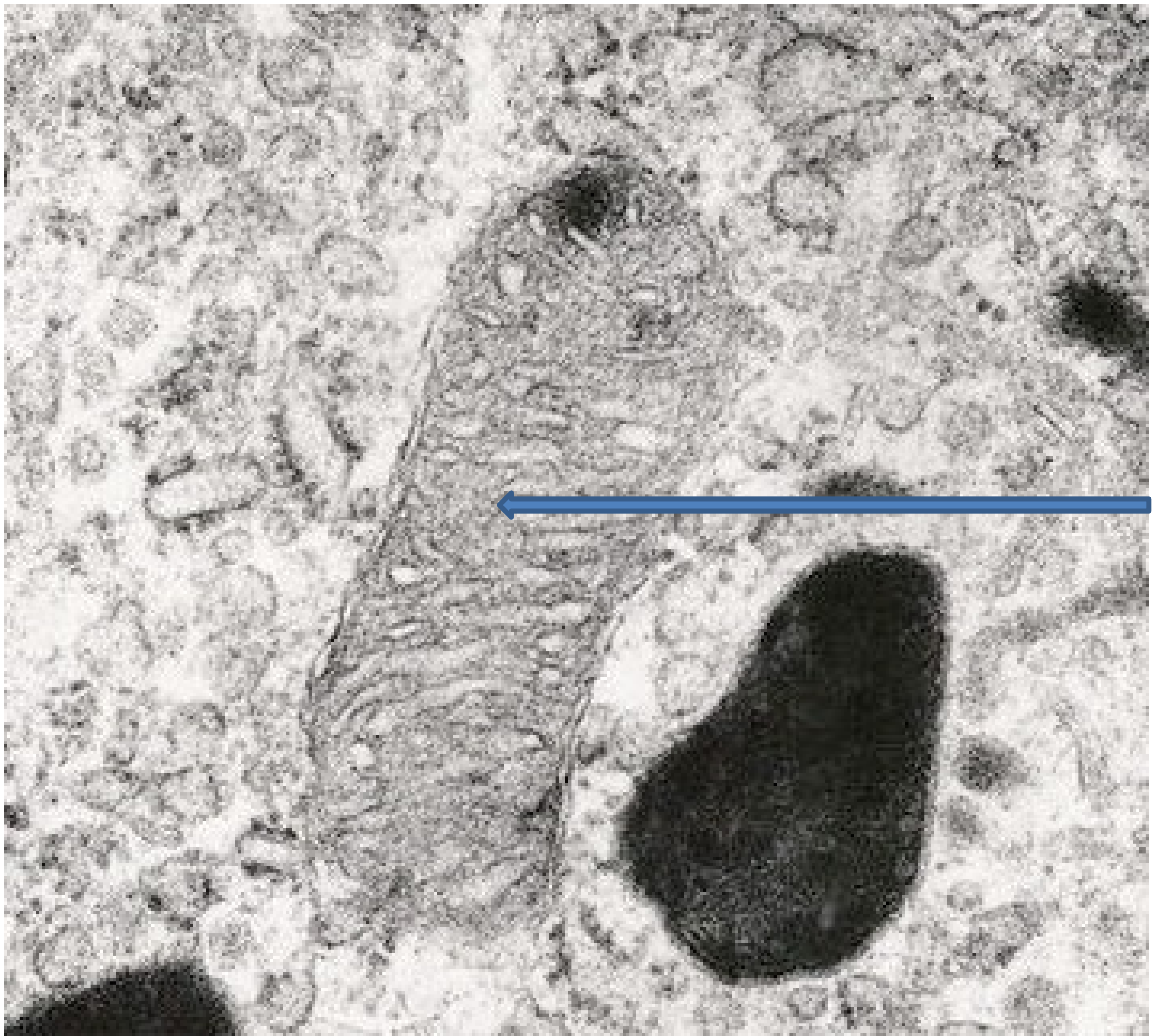
OLB may have some other hosts in OLEACEAE, e.g. Claret ash (*Fraxinus angustifolia*), green olive tree (*Phyllyrea latifolia*), osmanthus (*Osmanthus fragrans*)

Street olive tree infested with OLB, Busselton WA

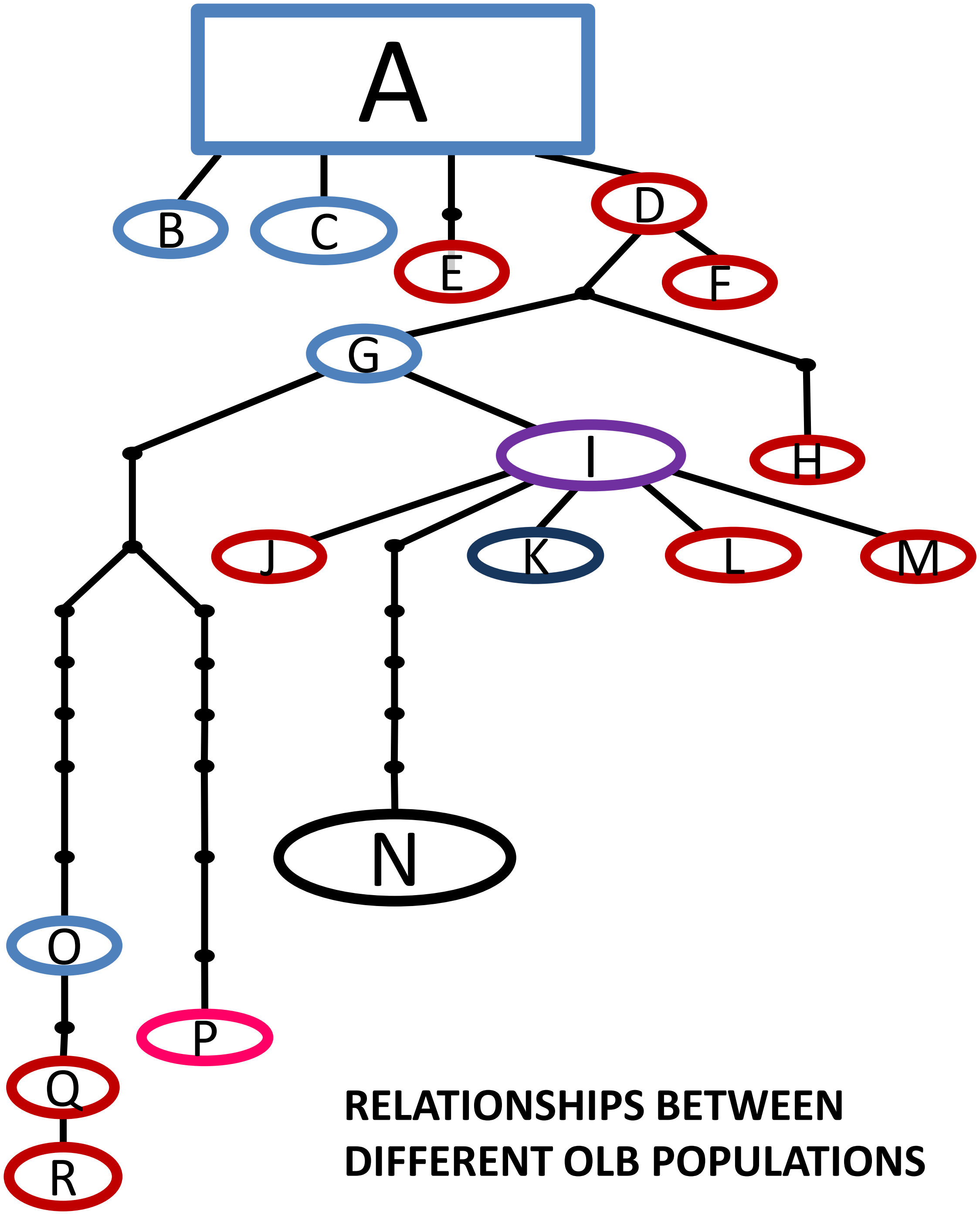
WHERE DO INFESTATIONS COME FROM?

- **Investigating population genetics of olive lace bug**
- **The more different they are, the more likely they have come from different origins, and vice-versa**
- **25 populations across Australia , including from olives, and non-olive hosts *Notolaea* and Osmanthus were examined**
- **Comparison of sequences of the mitochondrial cytochrome oxidase I (COI) gene**

To answer a number of these questions posed, we used DNA technology from cell mitochondria (mtDNA), the respiration energy powerhouse organelles



Mitochondrion in cell, showing cristae (Transmission Electron Microscopy)



RELATIONSHIPS BETWEEN DIFFERENT OLB POPULATIONS

Key to haplotype groups:

A: Hunter Valley, NSW (12)
Sydney Basin, NSW (6)
Mudgee, NSW (3),
Richmond, NSW, *O. europea*) (2)
Richmond, NSW, *Osmanthus* (3)
Canberra, ACT (1)
B: Sydney Basin (1)
C: Richmond, NSW, *N. longifolia* (3)
Richmond, NSW, *O. europea* (1)
D: SE QLD (1)
E: SE QLD (1)
F: SE QLD (1)
G: Sydney Basin, NSW (1)
Canberra, ACT (1)
H: SE QLD (1)
I: SE QLD (6)
Sydney Basin (1)
Richmond, NSW, *Osmanthus* (1)
J: SE QLD (1)
K: Boort, VIC (3)
L: SE QLD (3)
M: SE QLD (1)
N: SW WA (9)
Sydney Basin (2)
Canberra, ACT (1)
O: Sydney Basin (1)
P: Coonalpyn, SA (3)
Q: SE QLD (5)
R: SE QLD (1)

Our key initial findings indicate:

- **a SA population is likely to have originated from NSW Sydney Basin/ Mudgee**

- **WA populations point towards a likely origin of SE QLD**

- **More variation between specimens from locations in SE QLD than from NSW and ACT. No variation found between specimens from the Hunter Valley.**

- **Limited variation between specimens collected from olives and *Notolaea* and *Osmanthus*. Suggests that maternal migration between the three plant hosts is likely to occur when they are in close proximity.**

GROVE MANAGEMENT FOR OLB

1. Monitoring from spring to after harvest/overwintering esp. for egg hatch

2. Infestations can come from infested new trees, from within the grove, from nearby groves, from implements/machinery and bins from other groves/processors

3. Stressed trees appear to be more attractive to lace bug: Why? Are they more closely related (size, chemistry) to the native hosts?

4. Young nymphs susceptible to desiccation by hot, dry weather, so opening up healthy trees by pruning may reduce lace bug problems in hot, dry environments

5. Important to target first generation and nymphs as this is the most vulnerable stage for most pesticide (especially organic) options

NON-CHEMICAL OPTIONS FOR OLB

e.g. biological control (green lace wings, spiders, ants, entomopathogens), behavioural control?

Green lacewings (*Mallada signata*) available commercially, used by several growers with some reported success

Some foliar fertilisers (e.g. potassium carbonate) may also suppress OLB populations, but not scientifically validated

CHEMICALS REGISTERED OR PERMITTED FOR USE AGAINST OLIVE LACE BUG as at 24/10/2018

PRODUCT	REGISTERED OR PERMIT	CONDITIONS OF USE
Clothianidin (SUMITOMO SAMURAI ®)	PER14897	Until March 2023 1 application/season WHP 56 days
Esfenvalerate (SUMI-ALPHA FLEX®, etc.	PER81949	Until November 2021 WHP 14 days
Dimethoate (various)	PER13999	Until March 2019 Not on table olives Max 4 applications/season WHP 6 weeks
Potassium soap (NATRASOAP)	PER14414	Until Sept 2023 No WHP Organically acceptable input
Pyrethrum (PYGANIC etc.)	PER81870	Until Oct 2019 Max 6 applications /season, rotate with other insecticide group after 2 applics. WHP 1 day. organically acceptable

TAKE HOME MESSAGES

Native species, spreading, difficult to manage organically

Non-chemical management restricting new infestations from nearby forests or groves, including equipment, try to avoid stressing trees

Best to target immature stages in first generation.
Some chemical options e.g. pyrethrum, synthetic pyrethroids, neonicotinoids are broad-spectrum and IPM-disruptive, but can be used effectively against adults or mixed populations

Green lacewings may be of some use in suppressing populations

Hort Innovation Strategic levy investment | OLIVE FUND

This project has been funded by Hort Innovation using the olive research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Managing key olive diseases

Len Tesoriero

Crop Doc Consulting Pty Ltd

Peacock Spot

Fusicladium oleaginum (Spilocaea oleaginea)

Biology & life cycle

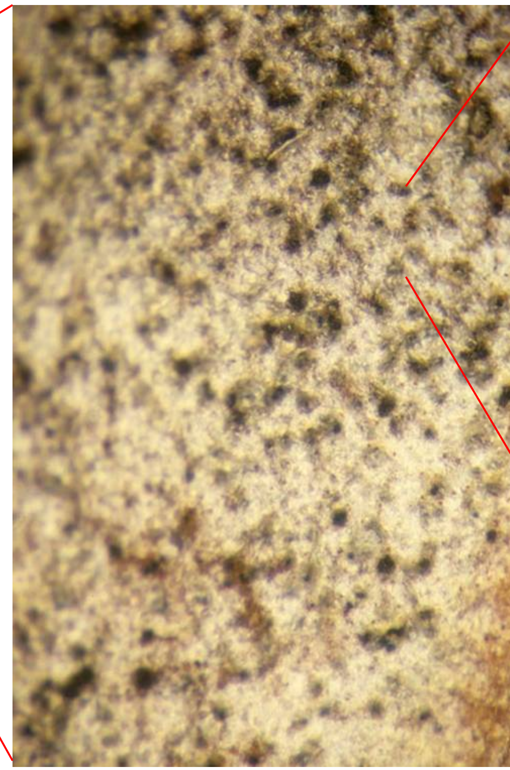
- Infection of leaves mostly in winter & spring (optimum temperature 21^{o}C)
- Requires water for spread and infection
- Infections dormant until autumn – lesions develop and conidia (spores) form
- Spread with water splash
- Differential susceptibility of olives varieties

Management options

- Removal or cover dropped leaves with compost
- Pruning to open up canopy to air/sun
- Fungicide applications copper– timing important (winter & spring)

Cercospora Leaf Mould

Pseudocercospora cladosporioides



x10

x100

Cercosporiosis

- Not well studied – slow degenerative disease
- Leaf infection can cause leaf drop
- Cause of fruit infection or secondary invader?
- Requires moisture for infection
- Prefers milder temperatures (similar to peacock spot)
- Controlled by fungicides
- Recent research in Europe – *Bacillus subtilis*

Undetermined Leaf Spots

Anthracnose

Colletotrichum acutatum, C. gloeosporioides, C simmondsii

Anthracnose infection of flower


(Sergeeva, Spooner-Hart & Nair 2008)

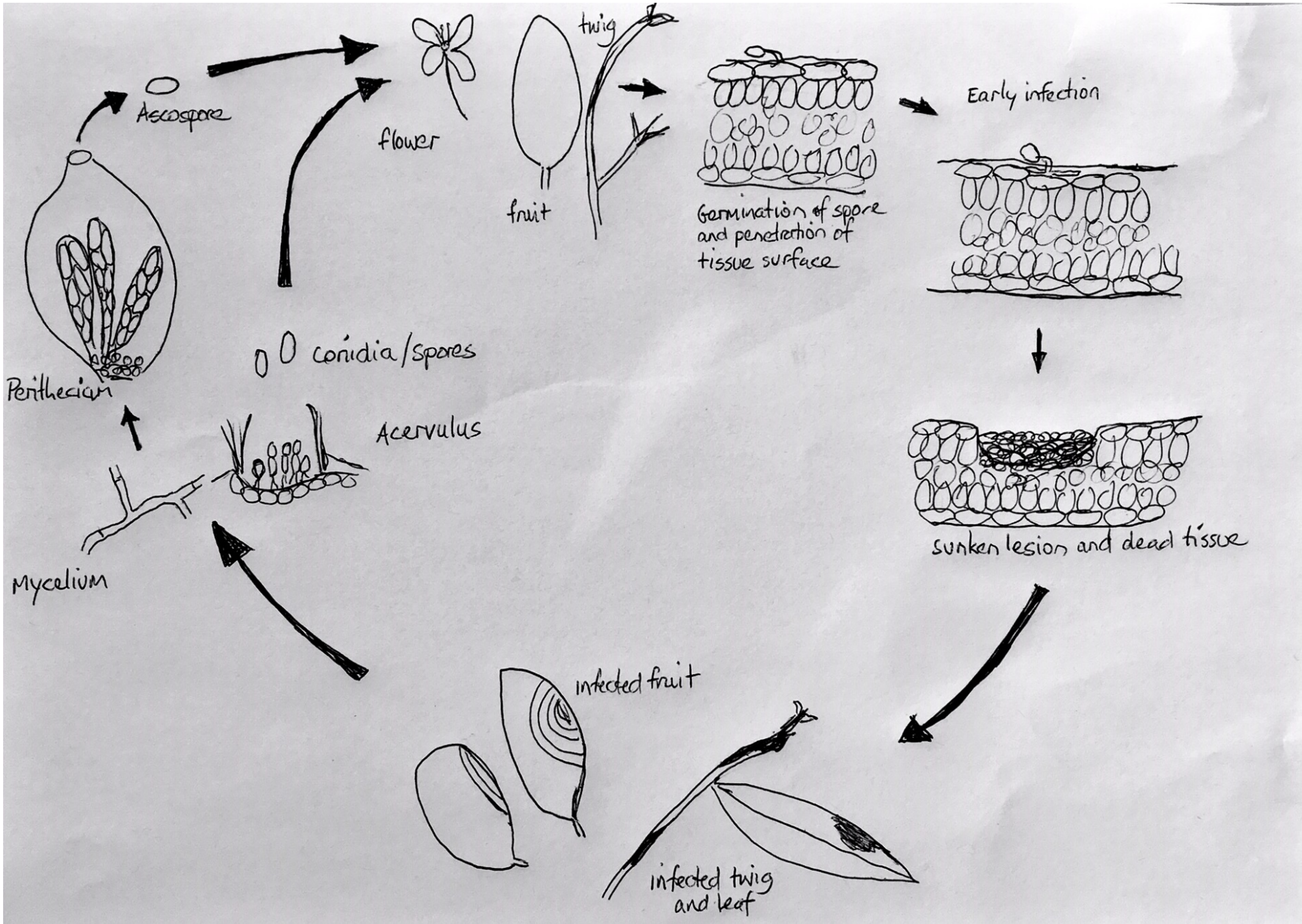
Mummified fruit – source of infection

(Sergeeva, Spooner-Hart & Nair 2008)

Colletotrichum spp. biology

- 3 species found on olives in Australia – Melbourne University student currently reviewing species – similar biology?
- Spread with water
- Initial fruit infection at flowering, dormant until fruit begin to ripen
- Secondary infection during summer after wet weather

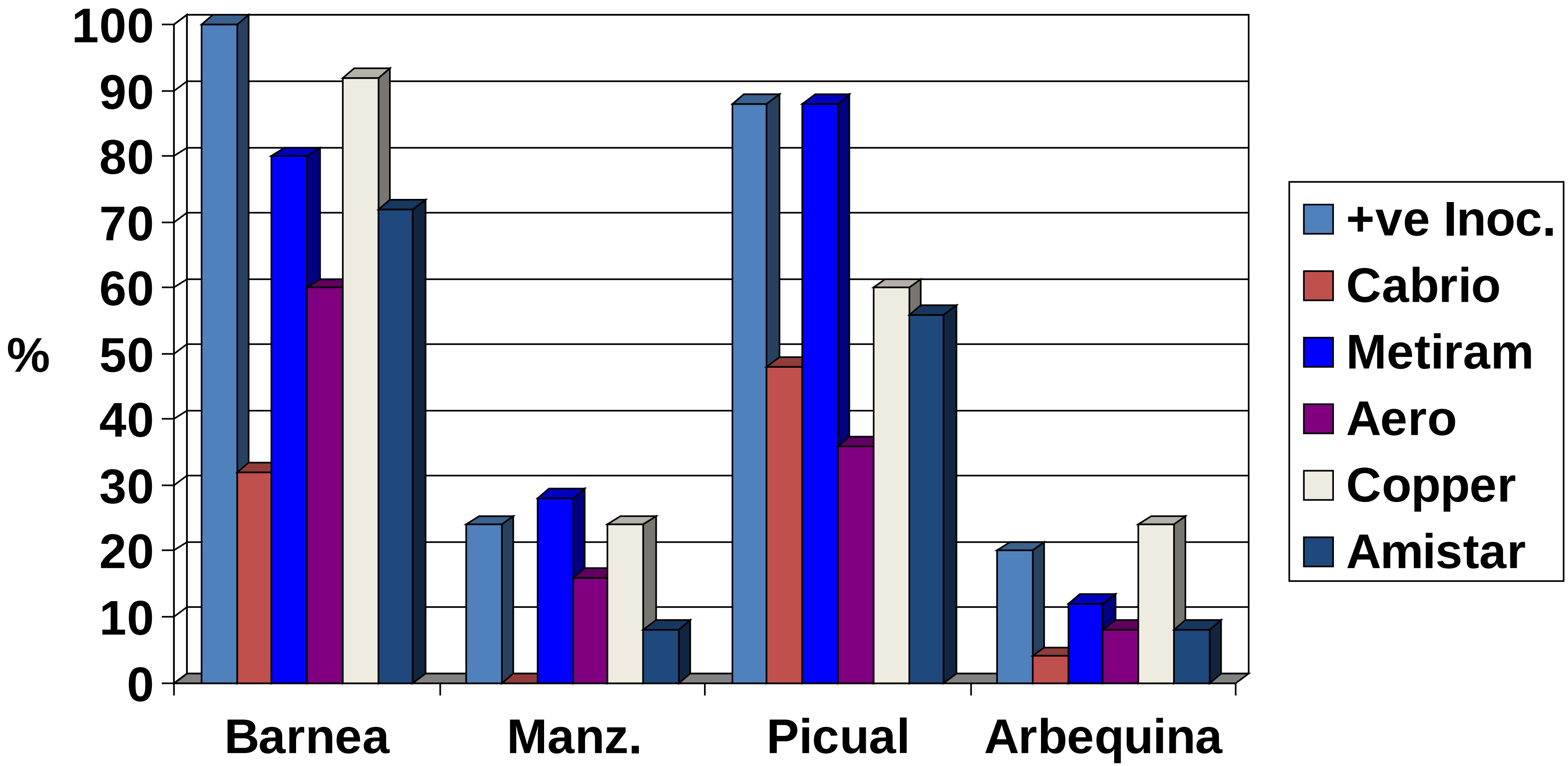
Colletotrichum life cycle



Chemical x variety bioassays

- Fruit sprayed with *C. acutatum* spores +/- fungicides and humidified

Percent Anthracnose infection of fruit - 14 days post inoculation



Note varietal difference in susceptibility

Management options

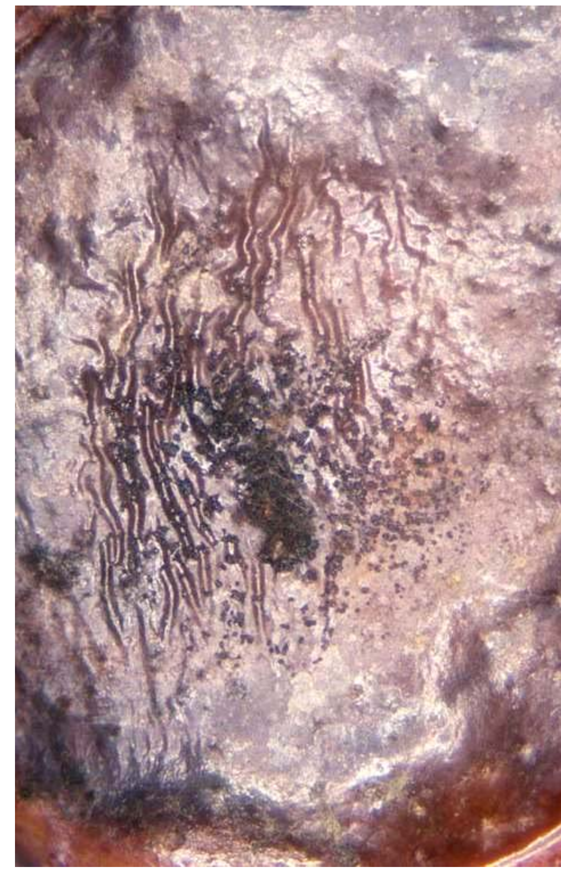
- Timing of chemical controls is critical – strobilurin fungicides pre-flowering + protectants at veraison (depending on weather)
- No microbial biocontrols registered in Australia for olives but some interesting results from Europe with *Bacillus subtilis*

Soft Nose

a physiological disorder often mistaken for Anthracnose – water stress + Ca deficiency

Fruit Rots

Alternaria sp., *Coleophoma oleae* and other fungal fruit rots



Botryosphaeria dothidea causes fruit rot in Europe

Verticillium wilt

Defoliating strain
in California

Now shown to be in Australia

Verticillium wilt - Moree

What causes lumps and galls on olive stems?

A

B

C

Olive Knot

Pseudomonas savastanoi

Restricted distribution in Australia
South Australia & Victoria

Leaf Scorch & Dieback

Olive quick decline syndrome (OQDS)

Photos: David Monteleone, NY Times

Olive quick decline syndrome (OQDS)

Photo: Pier Paolo Cito

Removal of affected trees

Photo: Rex Featires

Photo: Pier Paolo Cito

Spread 20km from front in 2015

Current understanding of OQDS

- OQDS caused by *X. fastidiosa* subsp. *pauca* called CoDiRO strain
- = Sequence Type 53 strain known in Costa Rica
- Thought to have arrived in Italy on an ornamental plant
- Spittlebug vector (*Philaenus spumarius*) in Italy
- 25 alternative hosts for CoDiRO strain identified
- CoDiRO strain does not infect grapes or citrus
- CoDiRO strain causes leaf scorch on oleander, cherry & almonds, and infects the weed *Polygona myrtifolia* (myrtle leaf milkwort)
- Leccino variety much less affected

Fungi & bacterial infections are associated with dieback & stem cankers

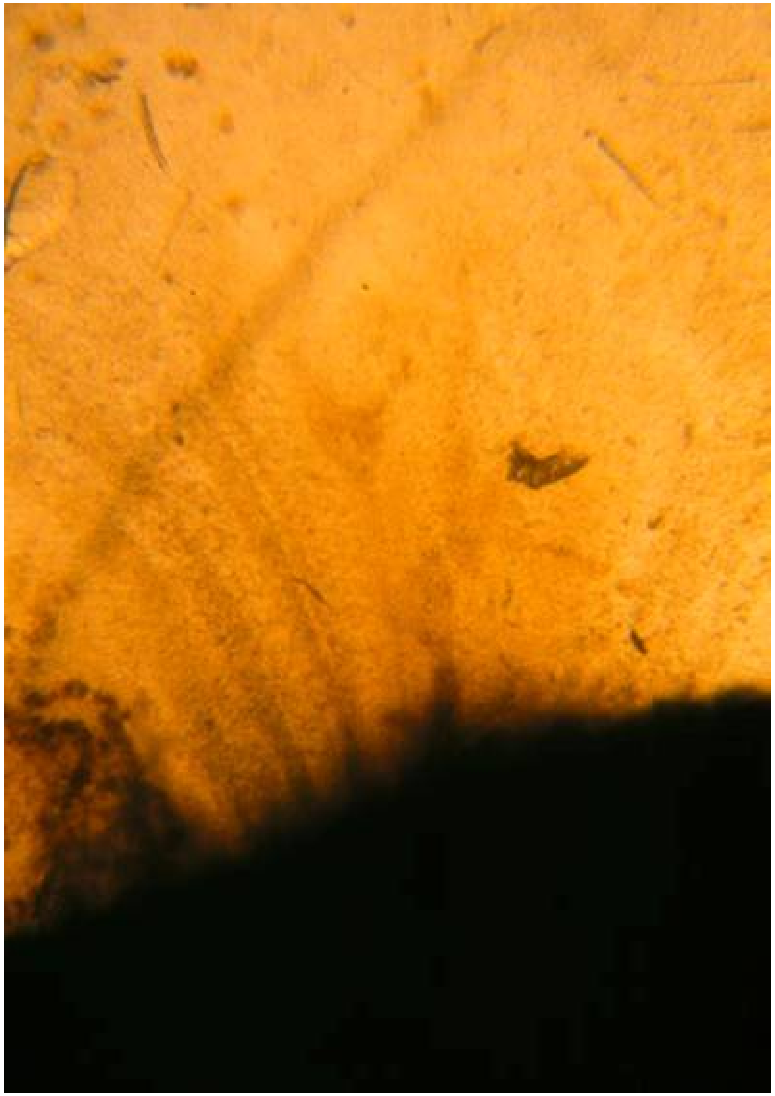
Here's a few from Australian olives

Opportunistic infections associated with trunk damage

Vascular browning
& Stem Cankers
Pseudomonas syringae

Bacterial Wilt

Ralstonia solanacearum



Vascular browning

Sunscald/Cold/Frost associations

Fungal Root Rots

Fusarium , *Pythium, Macrophomina* & *Rhizoctonia* spp.

Summary

- New integrated management options are being developed for key olive diseases overseas – including biological controls
- Many of these options are suitable for organic producers
- These strategies need to be validated in Australia
- There are several biosecurity threats for olives which require vigilance, surveillance & preparedness

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WE LOOK FORWARD TO YOUR FURTHER PARTICIPATION IN THE PROJECT

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