Earwigs

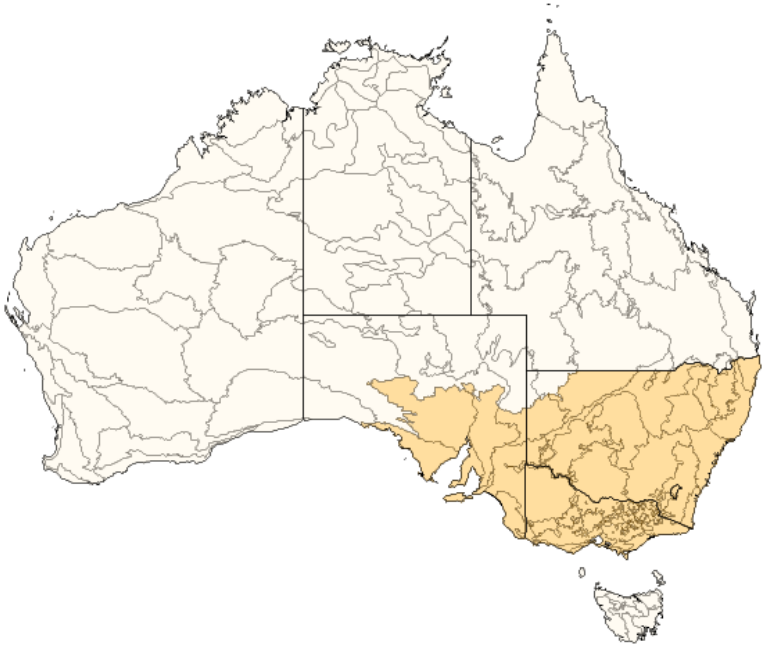
Michael Nash

To manage we must understand.
To understand, science counts.
First we must identify.
Together we can make science count!

European earwig

Forficula auricularia L. 1758

- 12 synonymous names



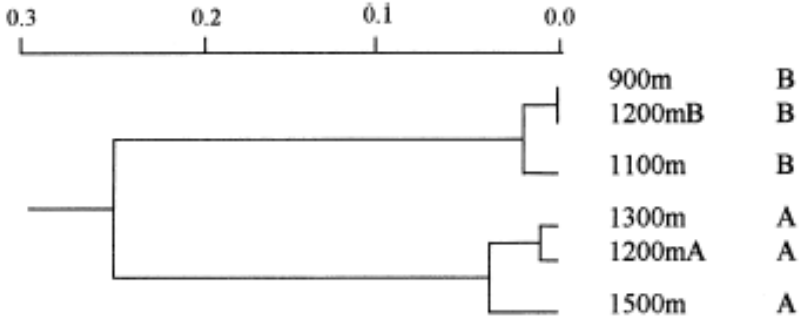


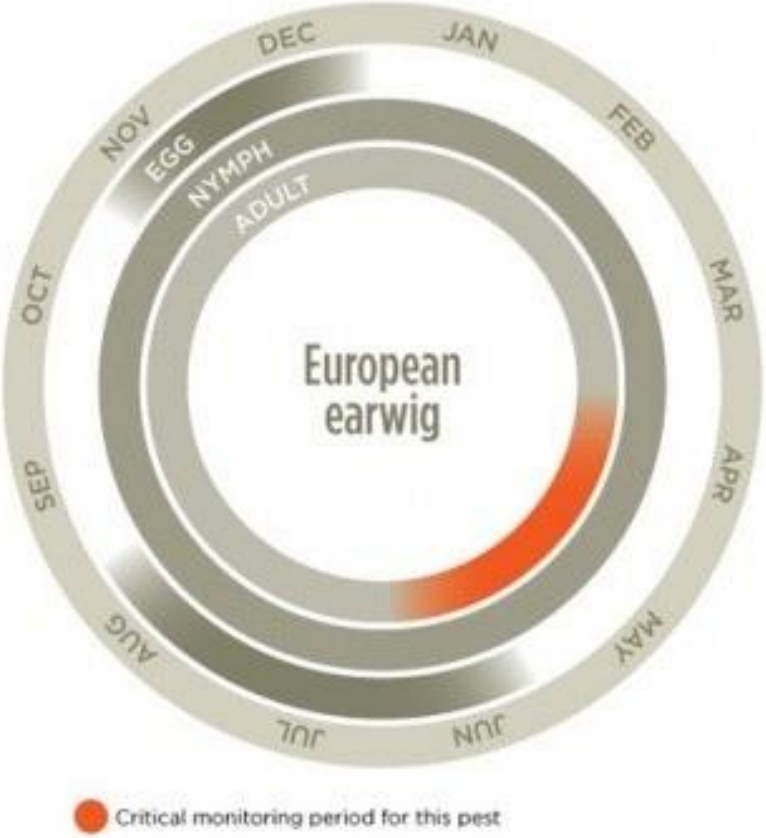
Fig. 2 UPGMA based on F_{ST}-values obtained for the four enzymatic loci.

Guillet et al. Heredity 85 (2000) 444-9

http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Forficula_auricularia

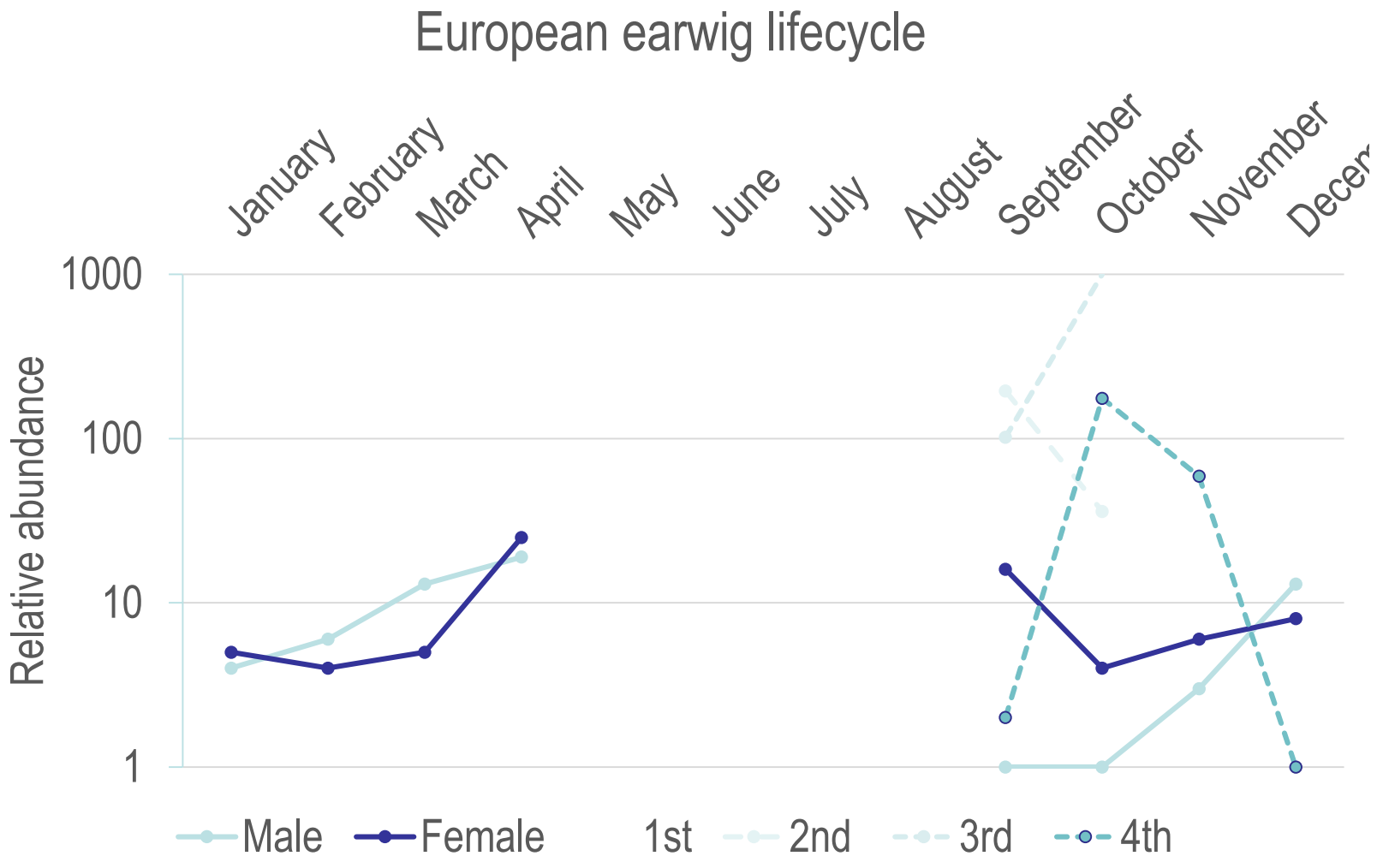
European earwig lifecycle

10 weeks egg to Adult 25°C
Eggs hatch 2-3 weeks
4 instars prior to Adults



Lifecycle, critical monitoring and management periods for the European earwigs (Source:

cesar and QDAFF)

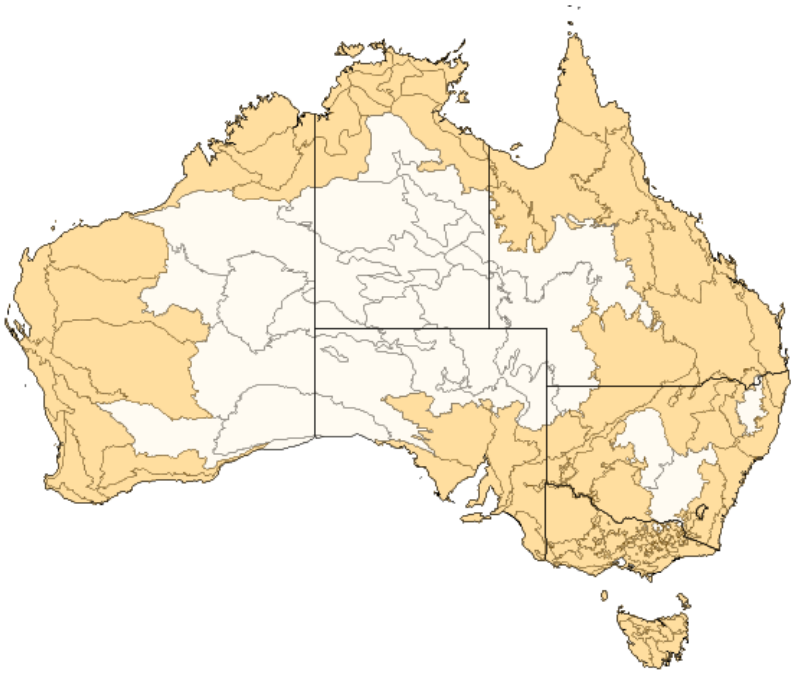


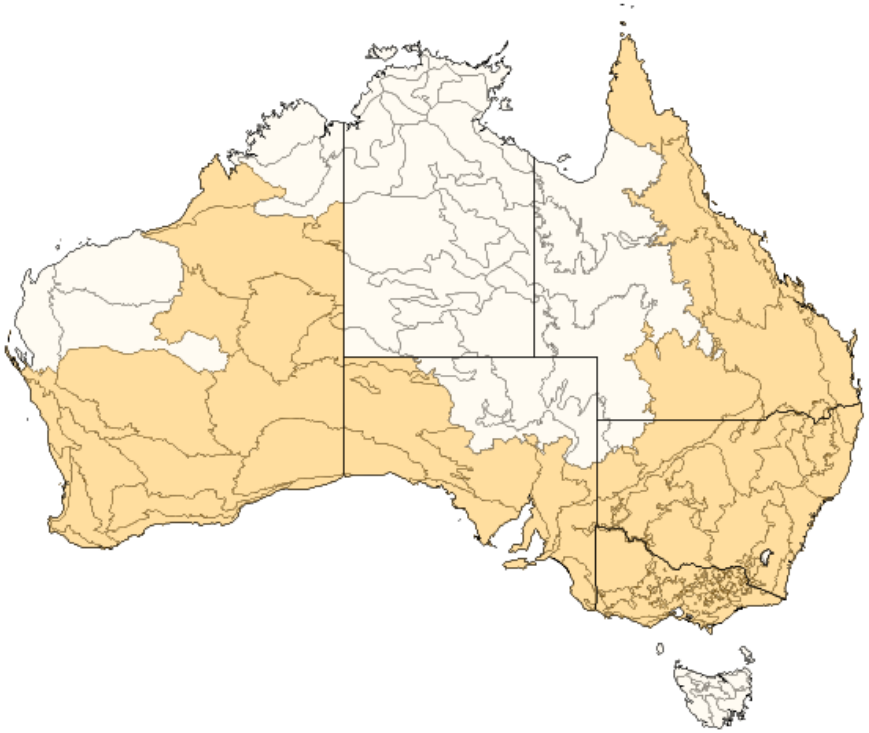
Matt Binns "New knowledge to improve the timing of pest management decisions in grain crops" CSE00059.

Labidura riparia (Pallas, 1773) or *truncata* Kirby, 1903 (Labiduridae) Common Brown Earwig

58 synonymous names for *L. riparia,*

which includes *L. truncata* (Steinmann 1989)





http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa (accessed 1 Oct 2009)

"The complex synonymy …. remains contentious (discrepancies between Sakai's and Steinmann's classifications derive from differences in this synonymy)" AFD

- Re-erection based on karyotype ♂ = 10[4AA + XY], 2n♀ = 10 [4AA + XX]) (Giles and Webb 1972)
- Karyotype characters have not solved family relationships, due to chromosome counts being highly variable (Jarvis et al. 2005).
- Two male morphs from central Queensland populations (Simpson and Mayer 1990)

Omnivore function in agriculture

- Pest e.g. Vine buds and bunches
  - Canola seedlings

- Predator e.g. Light Brown Apple Moth (Frank et. al. 2007)
  - woolly aphid under apple IPM (Nicholas et.al 2005)
  - *Labidura* sp. feeds on Tenebrionidae, pupae of *Heliocoverpa* spp. (Donaldson and Ironside 1982), aphids, cutworms and armyworms (Allsopp and Lloyd 1982), *Teleogryllus commodus* nymphs and *Phthorimaea operculella* (Horne and Edward 1995).

How can the predatory potential be harnessed

Natural enemies

Pest	predators						
	predatory mites	lacewings	ladybirds	Carabids	Staphylinids	spiders	parasitoids
lbam		X	X	X	X	X	~28
scale		X	X	X	X	X	~12
mealybugs		X	X	X		X	~6
mites	X	X	X	X	X		-

International Organisation for Biological Control

Pesticide Side Effect Database

Expert acceptance of data on lethal and sub lethal effects (Reduction in beneficial capacity)

- **Harmless** < 25% reduction
- **Slightly harmful** 25 - 50% reduction
- **Moderately harmful** 50 - 75% reduction
- **Very harmful** >75% reduction

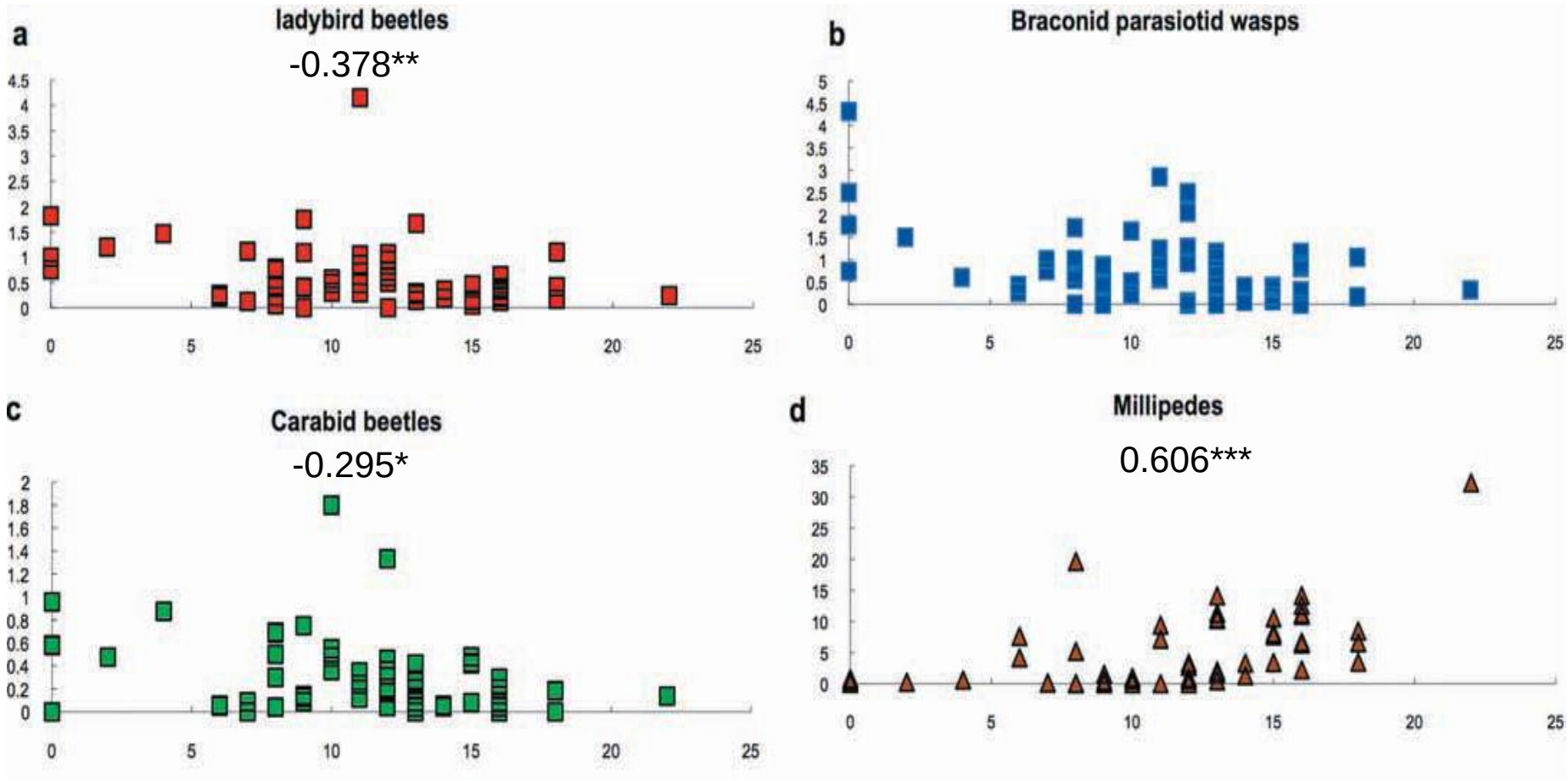
1
2
3
4

https://www.iobc-wprs.org/ip_ipm/IOBC_Pesticide_Side_Effect_Database.html

Chemical assessment e.g.

Fungicide	Active ingredient	Formulation (e.g.)	Toxicity	Modified Toxicity
	sulphur	200 g/100L	1	0
	sulphur	600 g/100L	4	3
	calcium polysulfide	lime sulphur	4	3
	chlorothanlonil	Bravo	1	0
	mancozeb	Various	2	1
	pyraclostrobin	Flint	1	0
	Captan	Captan	1	0
	pyrimethanil	Scala	1	0

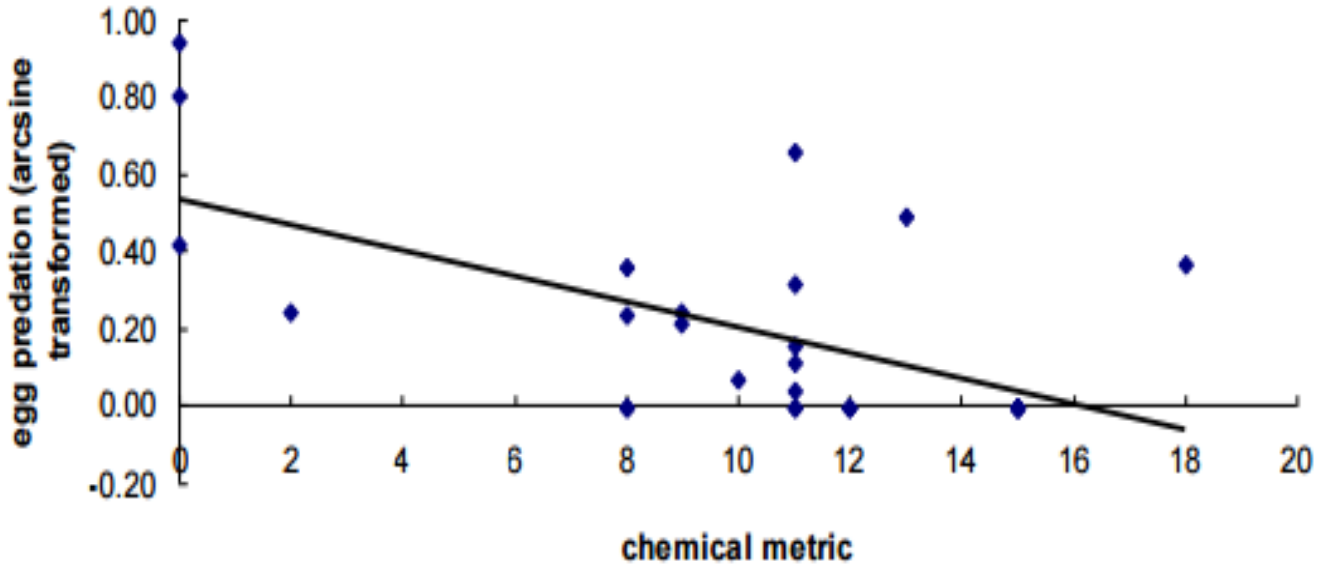
Results 61 sites from SA Nash *et.al.* 2010



Increasing chemical 'score' →

Increasing chemical 'score' →

Predation of light brown apple moth eggs tested from 30 of the 61 sites from SA



Increasing chemical 'score'

High ratings > 15 have been linked to reduced natural enemies in vineyards

Low ratings < 4 have been linked to higher numbers

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Biological Control 39 (2006) 507–515

Biological Control

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Field validation of laboratory-derived IOBC toxicity ratings for natural enemies in commercial vineyards

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Received 7 April 2006; accepted 23 June 2006
Available online 4 July 2006

Ecological Applications, 00(0), 0000, pp. 000–000

Identifying signature of chemical applications on indigenous and invasive nontarget arthropod communities in vineyards

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Product		Modified rating	
Movento	Harmless	0	limited data
Appluad	Slightly Harmful	1	esp. to lady beetles
Chlorpyrifos	Very Harmful	3	esp. at higher rates
Chlorpyrifos + Oil	" "	3	" "
Mineral oil & Paraffinic oil	Slightly Harmful	1	esp. to lady beetles
Samarai			

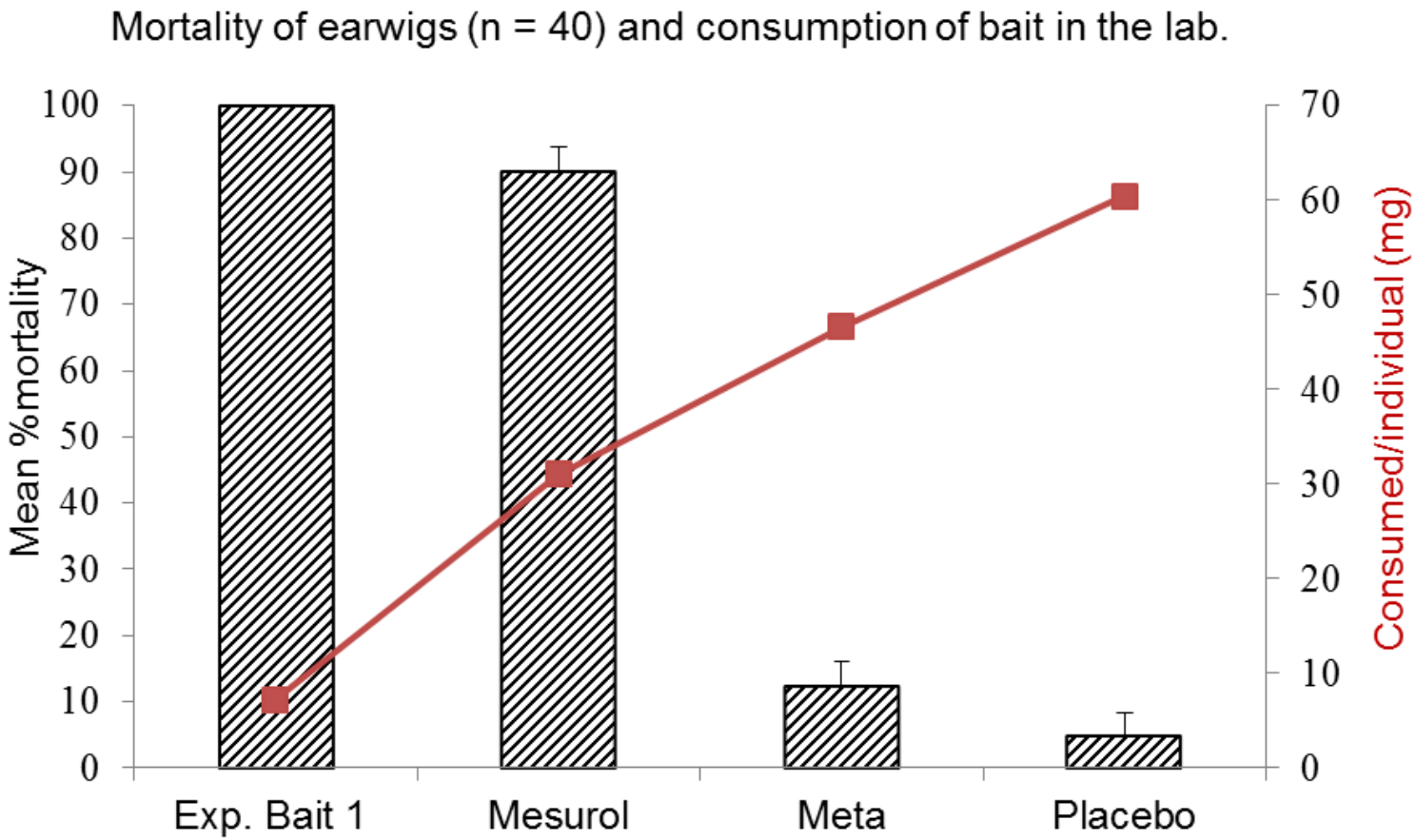
active ingredient	Source	beetles	bugs	mites	Spider	Wasp	Lace	Bees
Clothianidin	IOBC							HT
at 50 g a.i.	Cotton	VH	M		M	M	H	

Baits for other pests

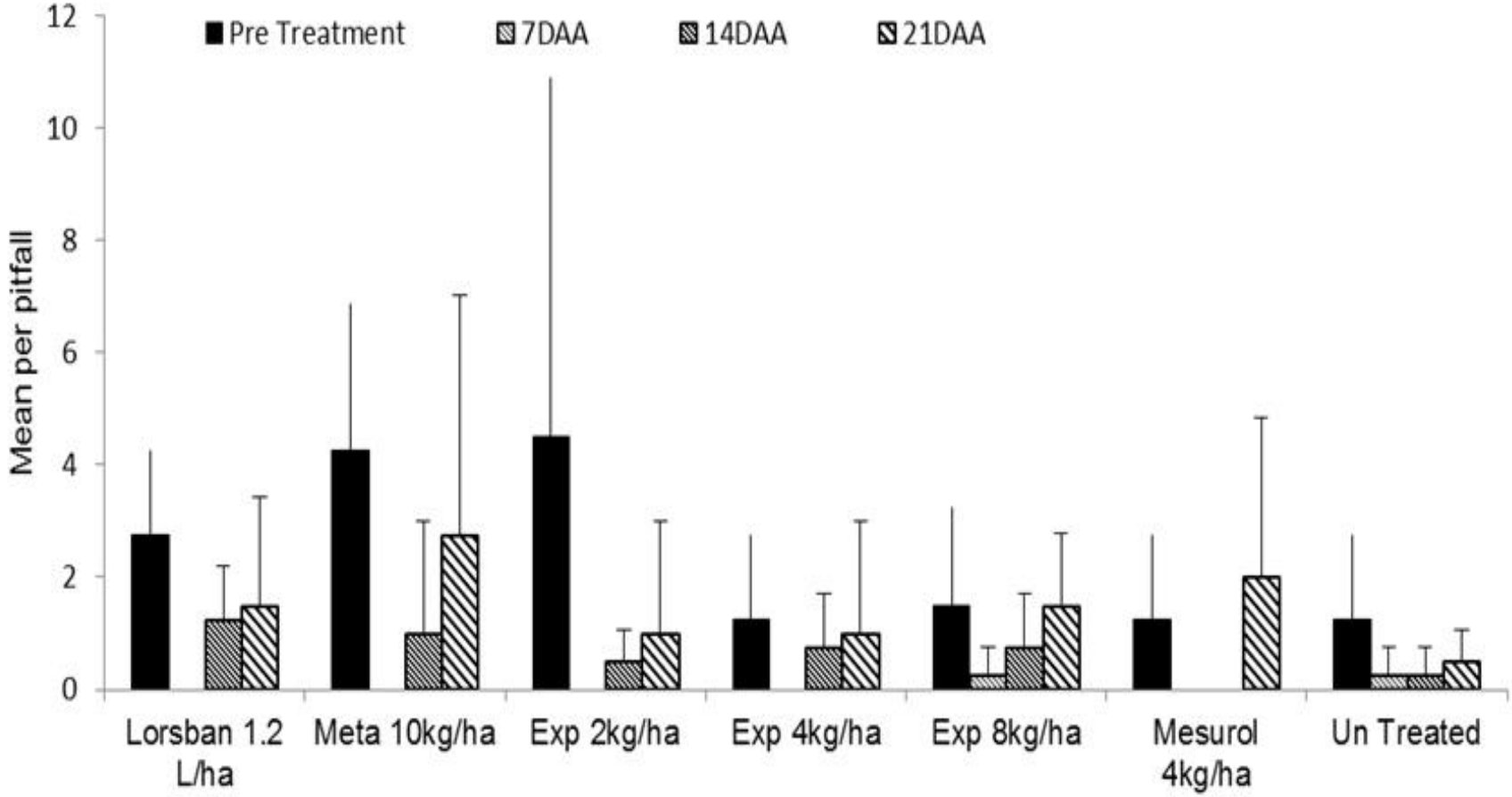
ACTIVE CONSTITUENT: 500 g/L MALDISON
(an anticholinesterase compound)
SOLVENT: 394 g/L LIQUID HYDROCARBONS

Field crickets *(Teleogryllus commodus)*	Vic, Tas, SA, WA only	BAIT 250 mL/10 kg kibbled grain/ha

- Chlorpyrifos baits available in Argentina for pill bugs & home made baits for earwigs in Aust.
- Alternative to foliar applied Lorsban that creates more pest flares (e.g. Nash et al 2010)
- Targeted response to difficult to target resident pests

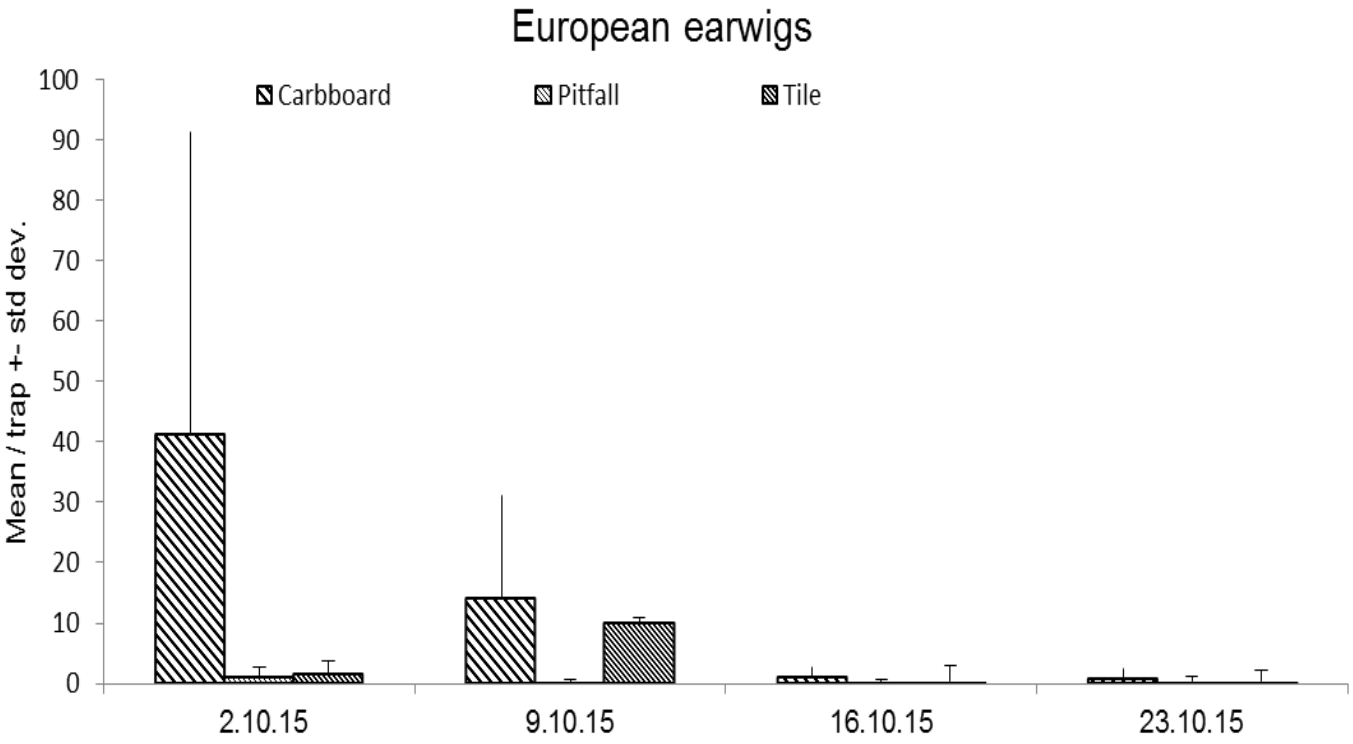

Mortality of earwigs (n = 40) and consumption of bait in the lab.
Mean %mortality
Consumed/individual (mg)
100
90
80
70
60
50
40
30
20
10
0
70
60
50
40
30
20
10
0
Exp. Bait 1
Mesurol
Meta
Placebo

b/ European earwigs pitfall



European earwig mean abundance caught in pitfalls in response to various treatments applied to 10 by 10 m plots (N=28). Errors bars represent standard deviation.

Methods for quantifying earwigs etc.



Cultural control

Remove under-vine mulch?

- *Labidura* did not differ (P = 0.66)

Thomson & Hoffmann 2007. Agric. for Entomol. 9, 173-179.

- European earwigs mulch > control

Addison, Baauw & Groenewald 2013. Sth. Afr. J. of Enol. and Vit., 34, 266-271.

"higher arthropod diversity and fewer pest species were found in the mulched plots than in the control plots"

Identify problem
– need to understand the pest ecology

Monitor both pest and natural enemies

Use chemicals as a last resort
- considering impacts on natural enemies