Decision Making
for Insect Management
in Grain Crops

Natural Enemies

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Natural Enemies

the blues and the maroons!

Natural Enemies

"Don't take us for granted"

"There are a lot of things you don't know that you don't know"! - the Rumsfeld factor

Yellow swarming fly - *larvae feed on root aphids*

Natural Enemies

Decision Making for Insect Management in Grain Crops

- **ALL pests have natural enemies**
- **There are 3 types of natural enemy:**
  - **Predators** e.g. lady beetles, lacewings, damsel bugs, hoverflies, spiders, etc
  - **Parasitoids** e.g. various wasps, flies
  - **Pathogens** e.g. various bacteria, fungi, viruses, nematodes

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Natural Enemies

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Generalists – attack many different prey species

Bigeyed bug

- e.g. predatory bugs, predatory beetles, spiders, lacewings, ants
- But some focus on preferred species – e.g. ladybirds on aphids and whitefly

Specialists – very selective in their prey choice

- e.g. parasitic wasps such as *Trichogramma* which parasitize eggs of several moth species

- *Diadegma* wasps which only parasitize DBM larvae

The Natural Enemy Zoo

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These target on-plant Pests

Ladybird adult

Green lacewing larva

Brown lacewing adult

Damsel bug

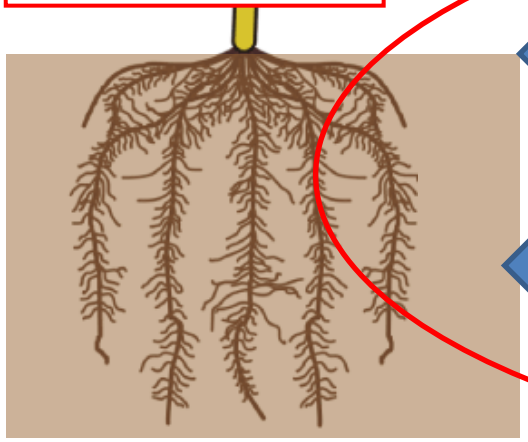
Canopy searching

Trichogramma wasp

Hover fly larva

Aphid parasitoid

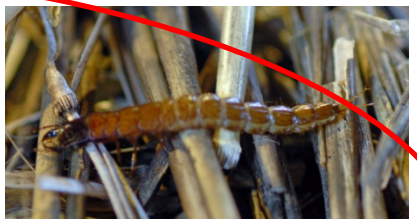
These target Establishment Pests



Ground foraging

Wolf spider

Carabid adult



Carabid larva

Below ground

Rove beetle

Predatory mites

Sweep Net Sampling

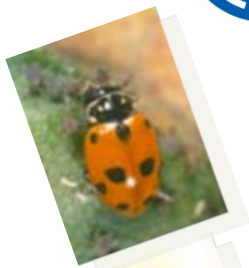
good for monitoring parasitic wasps and flies

Natural Enemies for Grain Crop Pests

- There are very few 'pre-packaged' natural enemies for Australian grain pests
- **Exceptions are the biopesticides**
- Bt (bacteria) – e.g. Dipel
- NPV (virus) products e.g. VivusMax, Gemstar

NPV infected helicoverpa

Natural Enemies for Grain Crop Pests



Conserving natural enemies is therefore the main tactic available to grain growers

- Use of selective insecticides
- Judicious use of broad-spectrums
  e.g. border, spot or barrier sprays, reduced rates,
  e.g. optimal spray timing, seed treatments
- Adherence to thresholds – the no spray option
- Habitat preservation, e.g. native veg

Go Soft Early

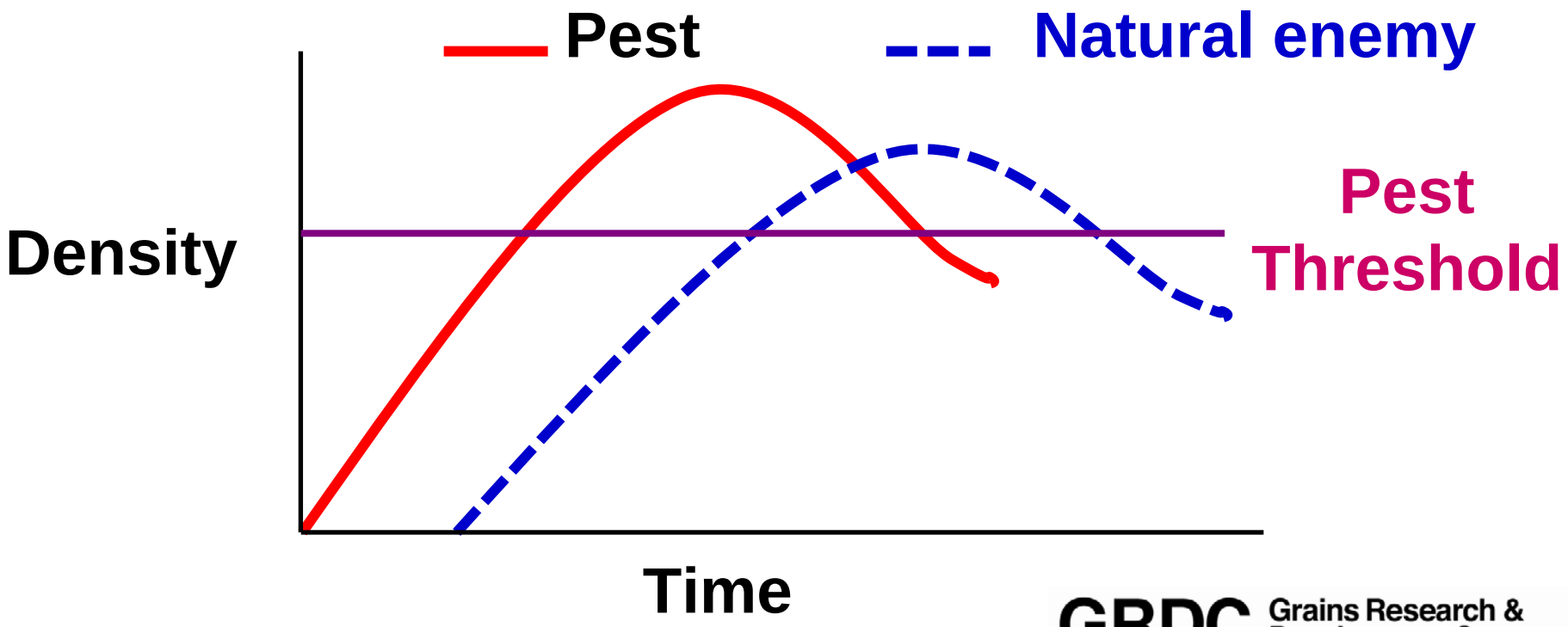
What Makes for a Successful Natural Enemy?

Hoverfly larva Aphid predator

- High reproductive rate
- Good searching ability
- Adaptability to different environmental conditions
- Mobility
- Synchronization with its host pest
- Exploiting of prey on other crop/weed hosts

The Achilles heel of many Natural Enemies: poor synchronization with the host pest

Too big a lag between the arrival/build-up of the pest and the response from the natural enemy

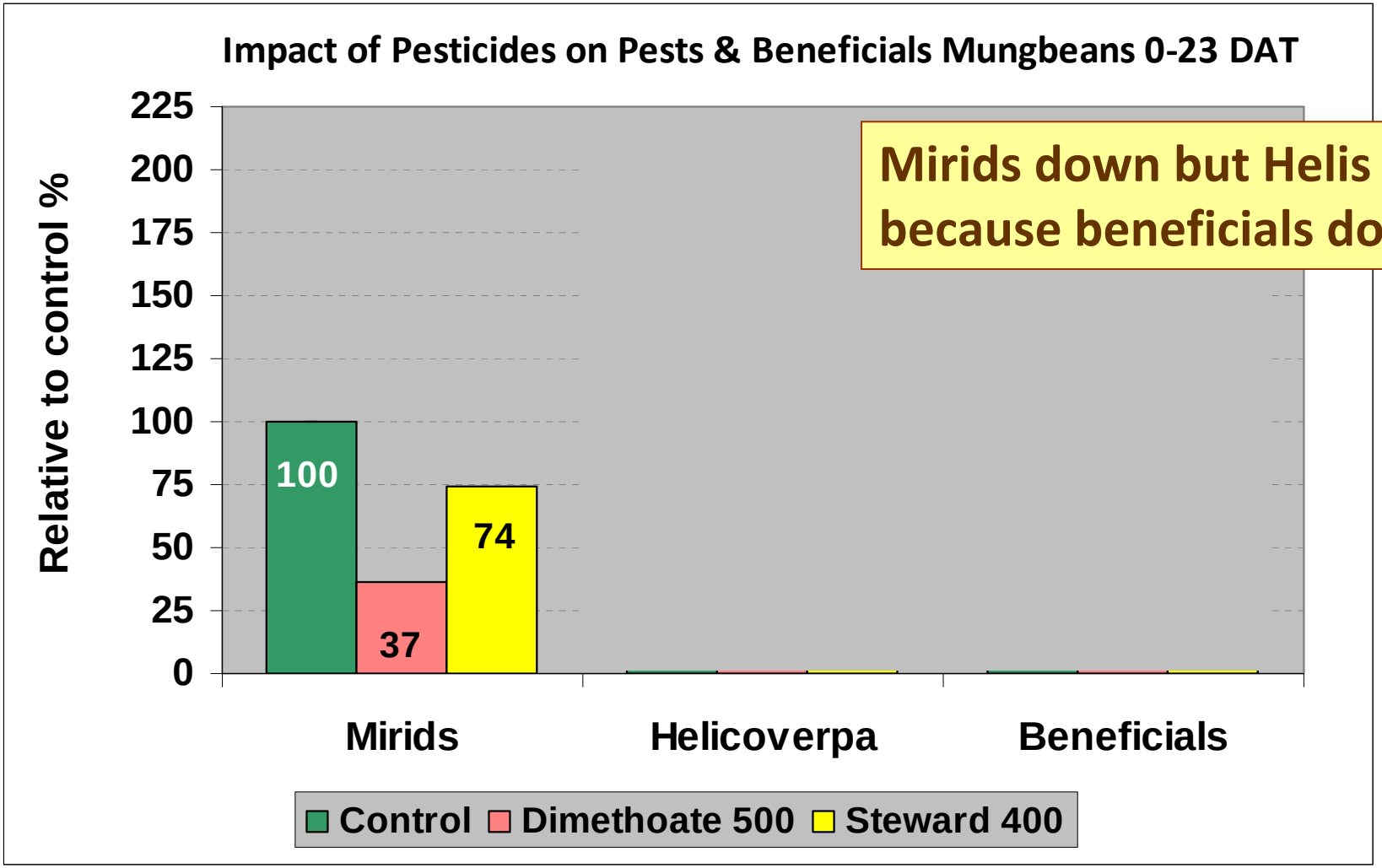



But some predators detect
their prey before we do!

How might we avoid the lag?

- Tolerate sub-threshold pest activity
- Particularly of lesser pests
- To breed up beneficials in advance
- Beneficial refuges - crops or native veg

Example of consequences of disrupting natural enemies in mungbeans



Why integrate pest management practices?

IPM Programs based on natural enemies are more RESILIENT

They recover following disturbances

Integration for robust pest management

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Two hypothetical scenarios:

1. **SP insecticide at 95% mortality**

   versus

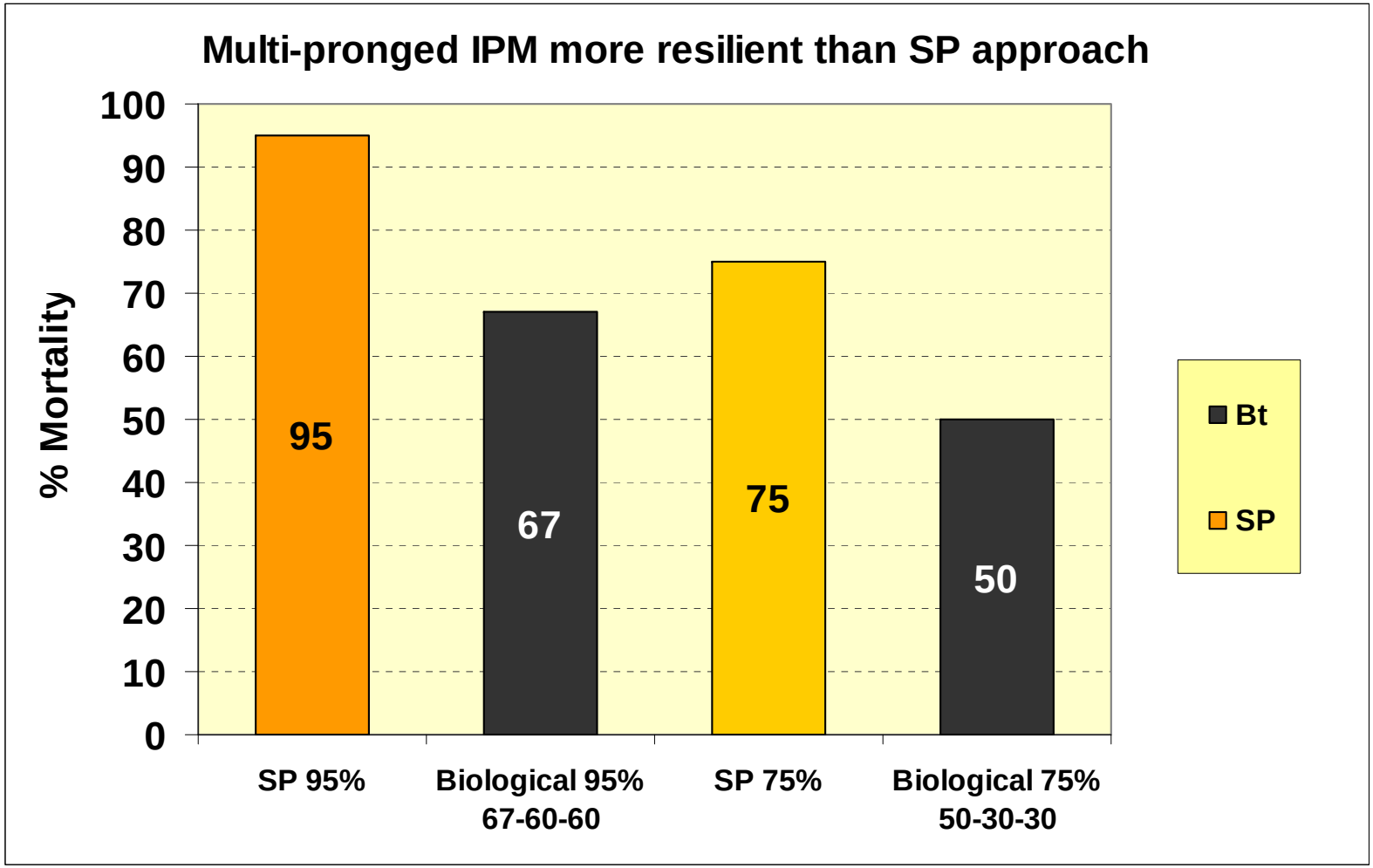
   Bt at 67% mortality + predators & parasites each @ 60% mortality

2. **SP insecticide at 75% mortality**

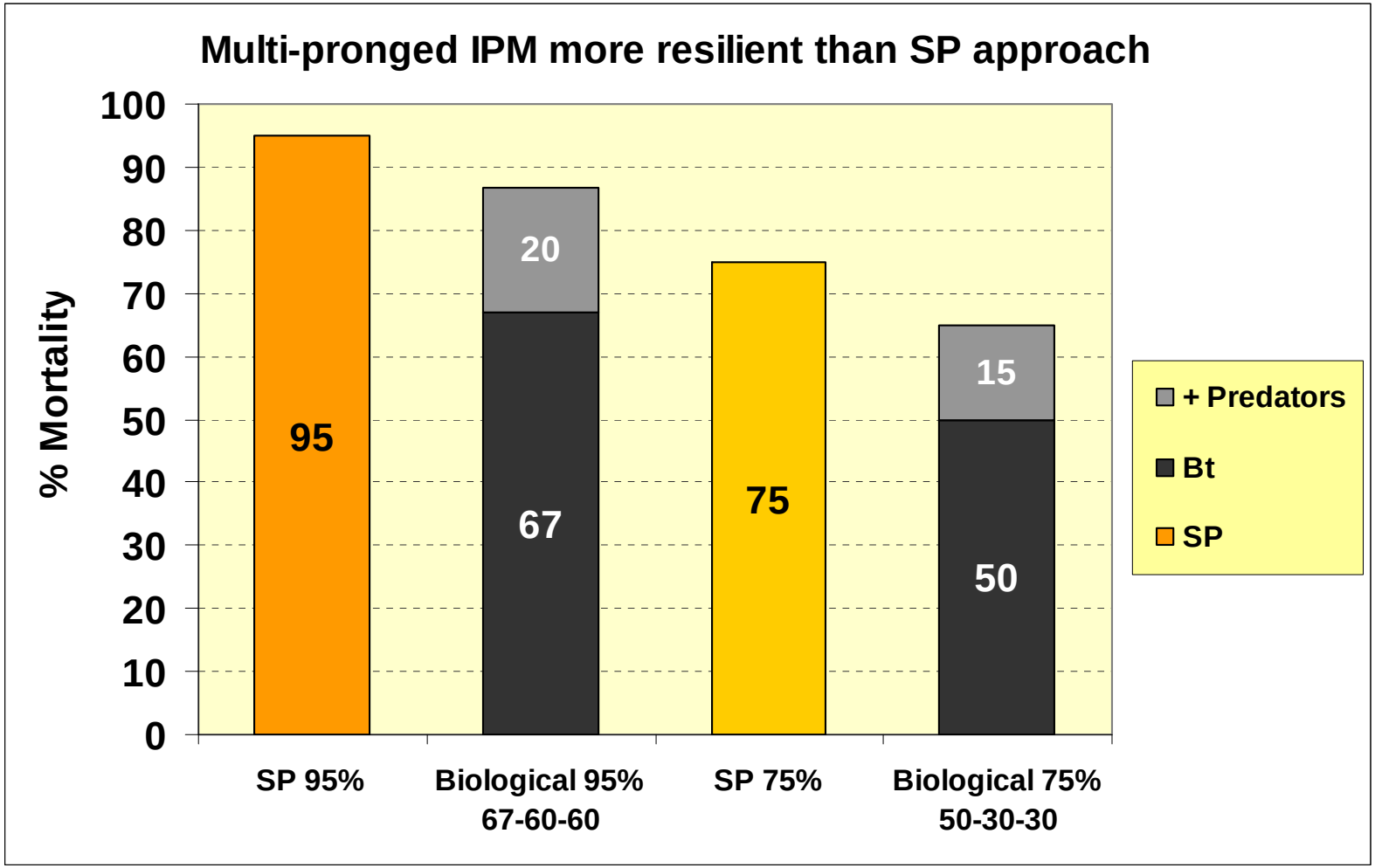
   versus

   Bt at 50% mortality + predators & parasites each @ 30% mortality

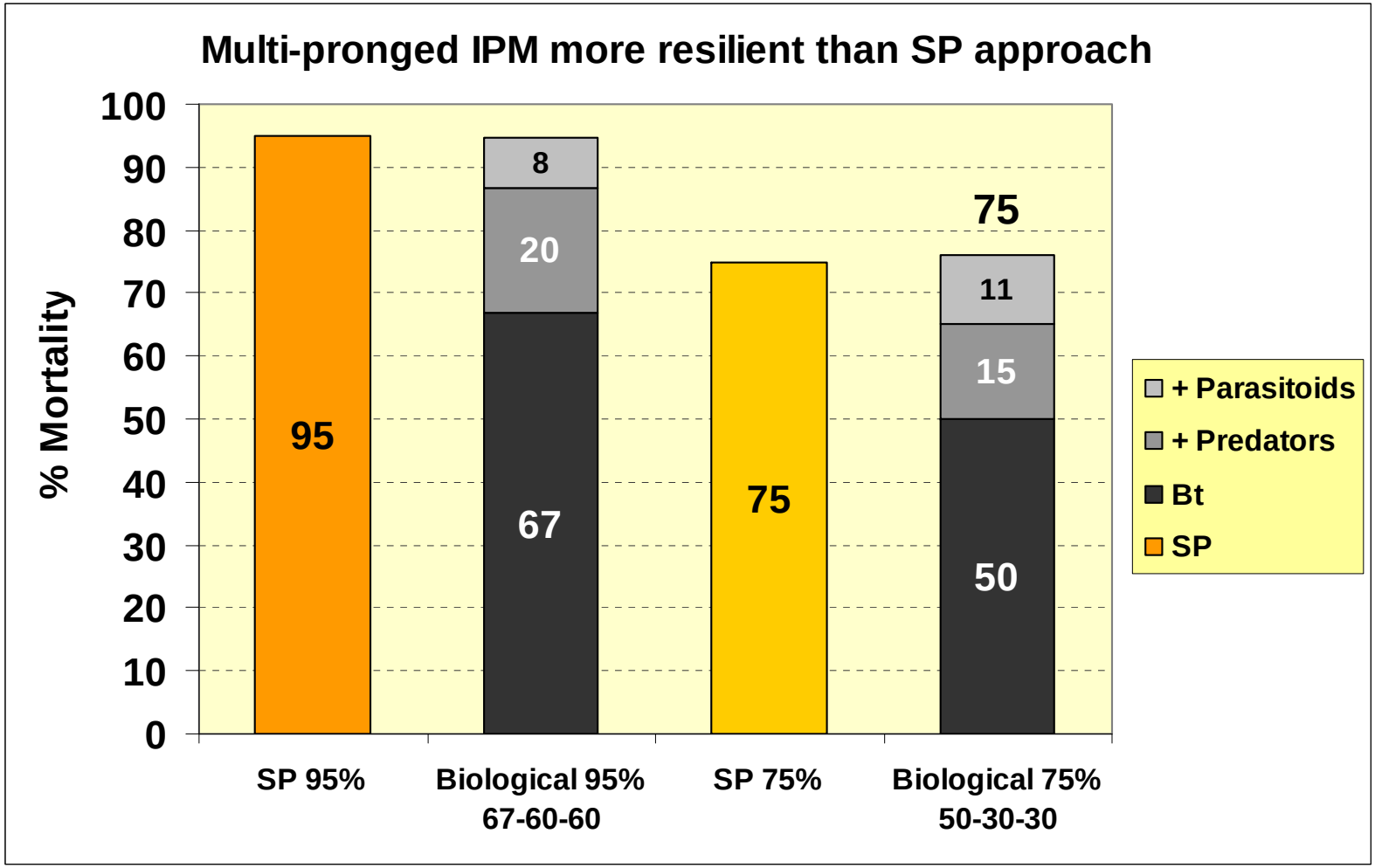
Integrated pest management - Cumulative impact of more than one factor



Integrated pest management - Cumulative impact of more than one factor



Integrated pest management - Cumulative impact of more than one factor



Warning about integration …
…some practices may not be compatible

- Some plant varieties & natural enemies - chick peas
- Some insecticides and natural enemies - SPs!!

- **Some insecticides soft on some beneficials and hard on others – indoxacarb on ladybirds**

THUD!

Many Insecticides (especially older chemistries) are more toxic to natural enemies than they are to insect pests

Insecticide IPM impact chart –
showing one size does not fit all

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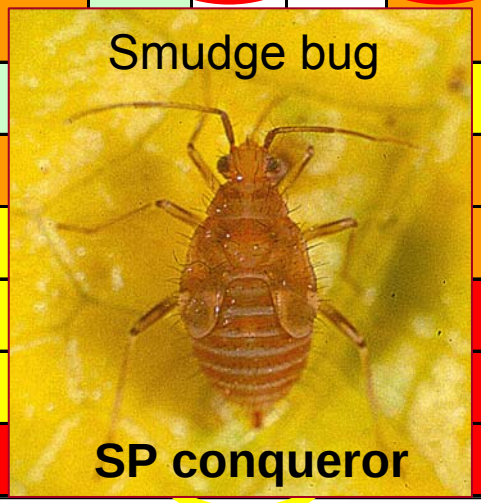
INSECTICIDE VS IPM IMPACT		BEETLE PREDATORS		BUG PREDATORS					Misc. Predators		WASP PARASITES	
Insecticide	product/ ha	R&B beetle	Lady bird	Damsel bug	Big-eyed bug	Smudge bug	Pred shield bugs	Apple dimpling bug	Lace-wing adults	Spiders	Erot-mocerus	Tricho-gramma
Bt		VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL
NPV		VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL
pirimicarb	300			L	M	–	VL	VL	VL	VL	M	M
Gp28	X	L?	VL	VL	VL	VL	VL	VL	H?	VL	?	?
Steward	400	L	M-H	L	–	VL	–	H	M	VL	L?	VL
abamectin	300	M	VL						M	M	H	M
Dimetloate (low)+salt	200	L	H						M	L	–	M
Dimethoate	500	M	H						VH	M	H	H
Shield (clothionidin)	250	VL	VH						H	M	VH	H
Electra (methomyl)	1500	M	VH						H	H	VH	H
Larvin (thiodicarb)	750	M	VH						VL	M	–	M
SP's (deltamethrin)	500	VH	VH						VH	VH	VH	VH



Adapted from Lewis Wilson et. al. Cotton Pest management Guide

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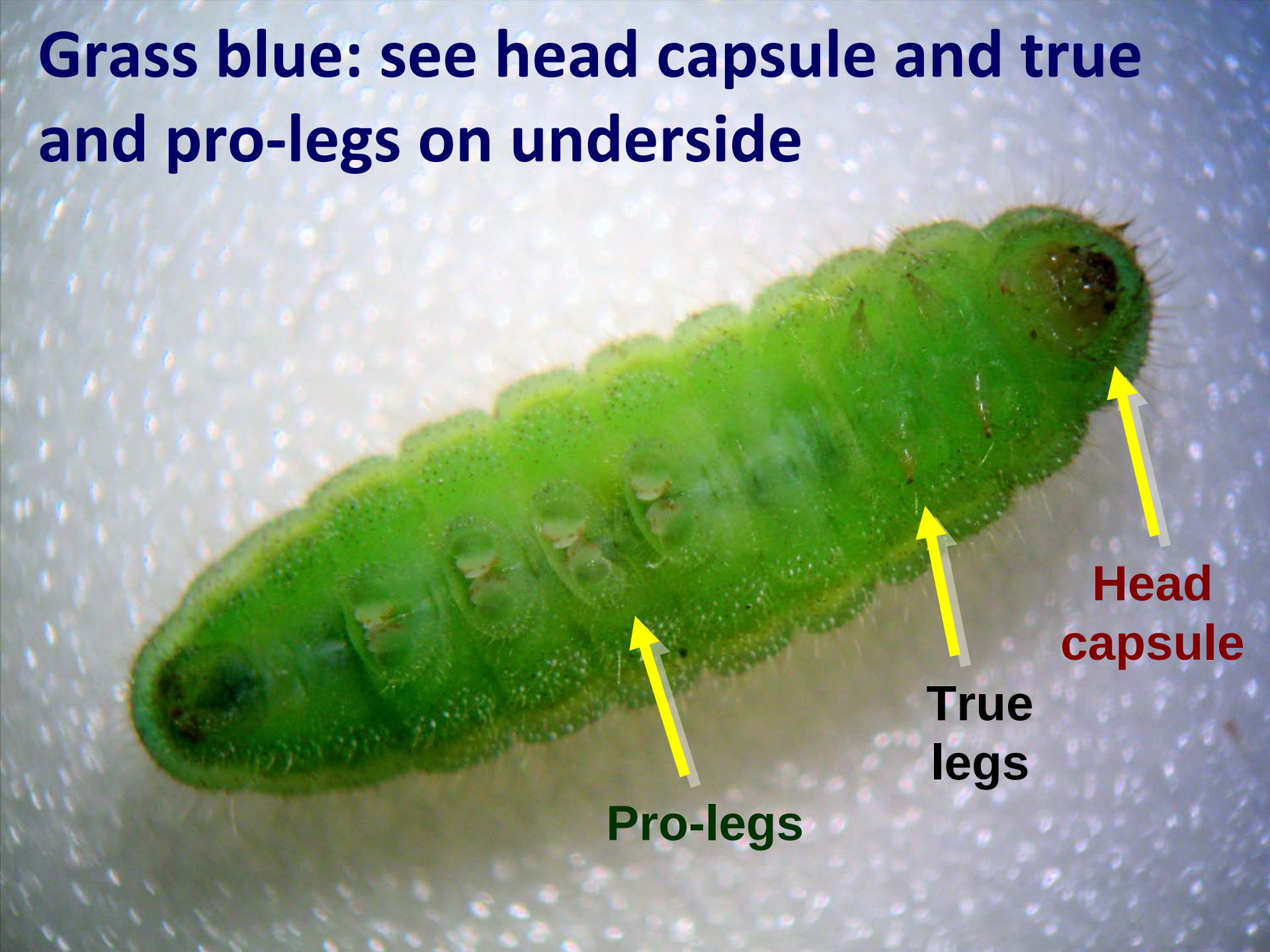
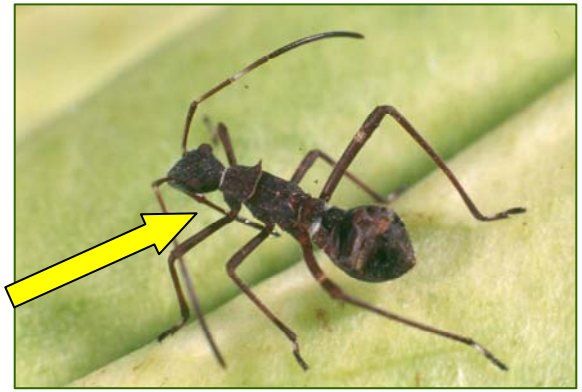
Some beneficials look like pests

Grass blue: see head capsule and true and pro-legs on underside

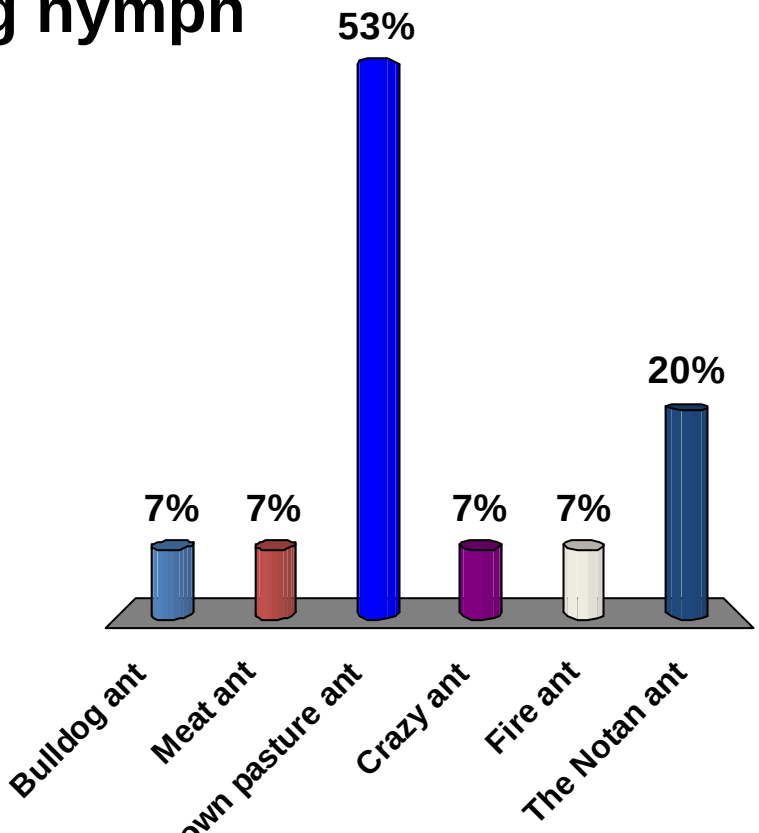


What type of ant is this?



Bean bug nymph

1. Bulldog ant
2. Meat ant
3. Brown pasture ant
4. Crazy ant
5. Fire ant
6. The Notan ant



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