

Integrated Pest Management (IPM) in vegetables

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The Team

- Joint project NT Farmers and DPIR
- DPIR staff
 - Dr Brian Thistleton, Principal Entomologist
 - Dr Mary Finlay-Doney, Research Entomologist
 - Haidee Brown, Technical Officer
 - Michael Neal, Technical Officer
 - Lanni Zhang, Technical Officer
- NT Farmers
 - Greg Owens, A/CEO
 - Samantha Tocknell, IDO

Assistance from TNRM, Jacob Bethros *et al*



Integrated Pest Management (IPM)

- **Biological Control**

- Predators kill and feed on their prey
- Parasitoids lay their eggs in or on other insects and their young stages develop inside the hosts eventually killing them
- Insect pathogens cause diseases inside the insect and kill them – fungi, bacteria, viruses
- Naturally occurring plus releases when required

- **Cultural Control**

- **Chemical control**

- Soft chemicals only when needed

- **Management decisions based on monitoring**

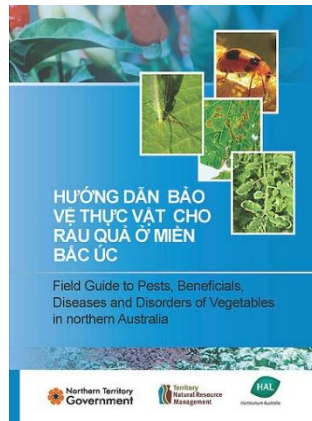
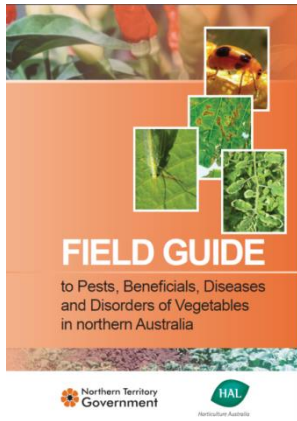
IPM demonstration plots at CPRS



- Okra and snake bean, planted at end of April
- **IPM plot**
 - manage insect pests by biological control with naturally occurring and released beneficials
 - spray only when necessary and use soft and specific insecticides (no sprays to date – except for beanfly just after planting)
- **Conventional plot**
 - spray regularly with usual hard chemicals

Monitoring

- Important to know what pests and beneficials are present and how many -
 - Decisions on what beneficials to introduce
 - Decisions on when and what to spray



Corn earworm and native budworm

Corn earworm, *Helioverpa armigera* (Family Noctuidae)
Native budworm, *Helioverpa punctigera* (Family Noctuidae)

Host plants:
 Both species are polyphagous.
 Corn earworm: Cabbage, tomato, sweet corn, maize, pumpkin, zucchini, other vegetables, field crops, ornamentals, weeds and a wide range of other plants (hosts include dicotyledonous and monocotyledonous plants).
 Native budworm: Tomato, field crops and a wide range of cultivated and native plants (hosts are mainly dicotyledonous plants although cereals are occasionally attacked).

Description:
 Egg: Round, ribbed and pale/cream white in colour when first laid, turning light brown as they mature and finally black just before hatching. Size: 0.5 mm in diameter.
 Immatures: Newly emerged larvae are hairy, cream-coloured and have a dark brown head. Older larvae vary in colour, they are generally green, pink, light brown or dark brown with markings. There are sparse hairs on the body. To distinguish between species, check mature larvae for the colour of the webber below the head and the colour of the legs. Corn earworm has light coloured webber with dark coloured legs and native budworm has black webber with light coloured legs. Size: About 40 mm in length when mature.
 Adults: Both species have light brown wings with dark brown markings and the hind wings have a broad dark brown band around the edge. On the hindwing of the corn earworm this band has a pale matching whorl on the native budworm the band is uniform dark brown. Size: Wingspan up to 41 mm.

Life cycle and biology:
 Eggs are laid singly or in groups of 2-3 on leaves, flowers, fruit and growing tips. These eggs usually hatch within 1-2 days, in the Tropics, larval development takes about 10-14 days and there are five or six instars. When mature the larvae move into the soil and pupate. Pupal development takes about 10 days. Adults live for up to 10 days and females can produce about 1000 eggs in a lifetime.

Damage:
 Larvae feed by chewing on leaves, flowers and developing fruit. Damage to the crop especially during flowering and fruiting can be extensive and this may result in a decreased yield.

Monitoring and pest management:
 Monitor the crop once a week during early establishment and then twice a week from flowering to harvest. Inspect the growing tips and flowers for eggs or larvae. A small amount of damage to the vegetative shoots can be tolerated but if the flowers and developing fruit are being attacked, control should be considered.
 Corn earworm has been more consistently associated with agricultural crops and therefore has had exposure to pesticide selection (and has developed resistance to many chemical pesticides). The native budworm is not known to have resistance to pesticides. Therefore it is important to identify the species on the crop.
 Since paper is found within the top 10 cm of the soil, ploughing the soil within this region will generally destroy the pupae. Reproductives such as *metoprolol* (*metoprolol*) and *diclorfen* (*diclorfen*) may be useful in controlling infestations.

PESTS - Caterpillars

Natural enemies:
 Predatory bugs such as the spined predatory bug, six-eyed bug and assassin bugs attack the eggs and larvae. Other predators that attack the immature stages are ants and lacewing larvae.
 Parasitic wasps attack the eggs, larvae and pupae. Parasitic flies (Chlorobasid) attack the larvae.

Corn earworm, *Helioverpa armigera* with a pale marking on the brown band of the hind wing.

Native budworm, *Helioverpa punctigera* without a pale marking on the brown band of the hind wing.

Corn earworm, *Helioverpa armigera* larva feeding on sweet corn.

Weekly Pest and Beneficial Monitoring Sheet - CPHRS

Date Sampled: 27/06/2017

Plot: Conventional

Sampling period (time): 09:30 am

Name of sampler: Haidee Brown & Michael Neal

Weather: Sunny

Row Number	Sample	Crop	PESTS										BENEFICIALS										
			Beanflies	Aphids	Mites	Whiteflies	Caterpillars	Looper caterpillars	Caterpillar eggs	Green Vege Bugs	Other bugs	Flaids	Thrips	Arts	Spiders	Predatory beetles	Predatory bugs	Lacewings	Syrphidae larvae	Native Bees	Wasps	Flies	
1	1	Bean	D																				
	2		D					1															
	3		D		5+																		
	4		D							1		1											
	5		D									1											
	6		1D																				
	7		D									1											
	8		D		5+			1															
	9		D																				
	10		D																				
2	1	Bean	1D						1														
	2		1D									1											
	3		1D 10+																				
	4		D					1															
	5		1D		5+																		
	6		D		5+							2											
	7		D																				
	8		D																				
	9		D 10+																				
	10		1D 10+																				

Notes: R1S3 Graliclava; R1S6 Oechalia shellenbergi; R1S7 Chilocorus

Pests

Caterpillars

Spodoptera



Helicoverpa



Loopers



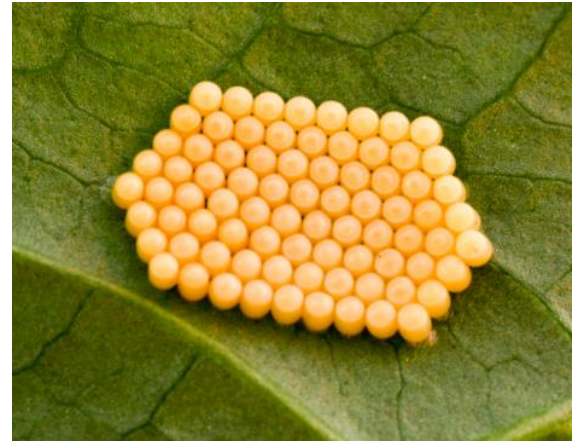
Beanfly



Aphids



Green vegetable bug



Spider mites



Two spotted mite, *Tetranychus urticae* adult and egg.



Two spotted mites, *Tetranychus urticae* on watermelon leaf showing feeding damage.

Predators

Spiders



Spined predatory shield bug



Ladybirds



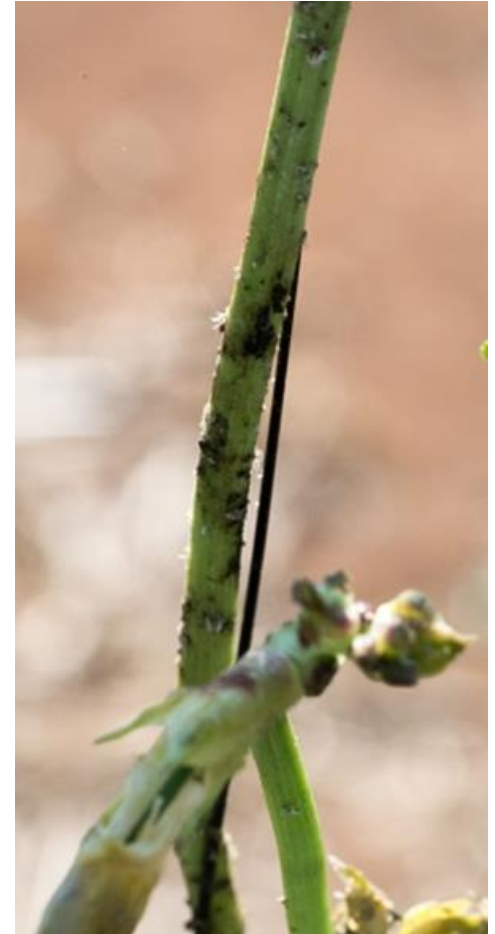
Hoverflies (syrphids)



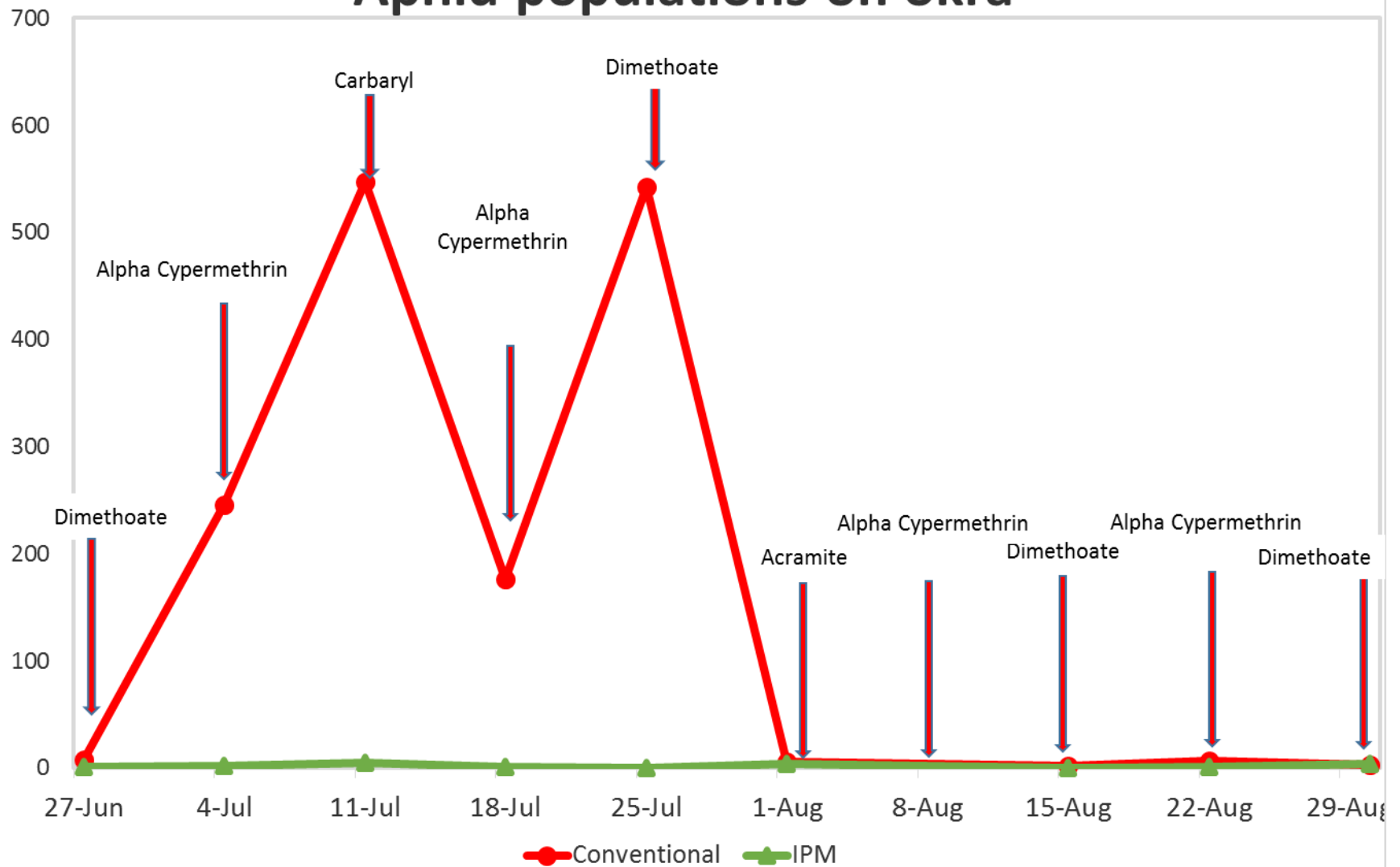
Lacewings



Aphids control



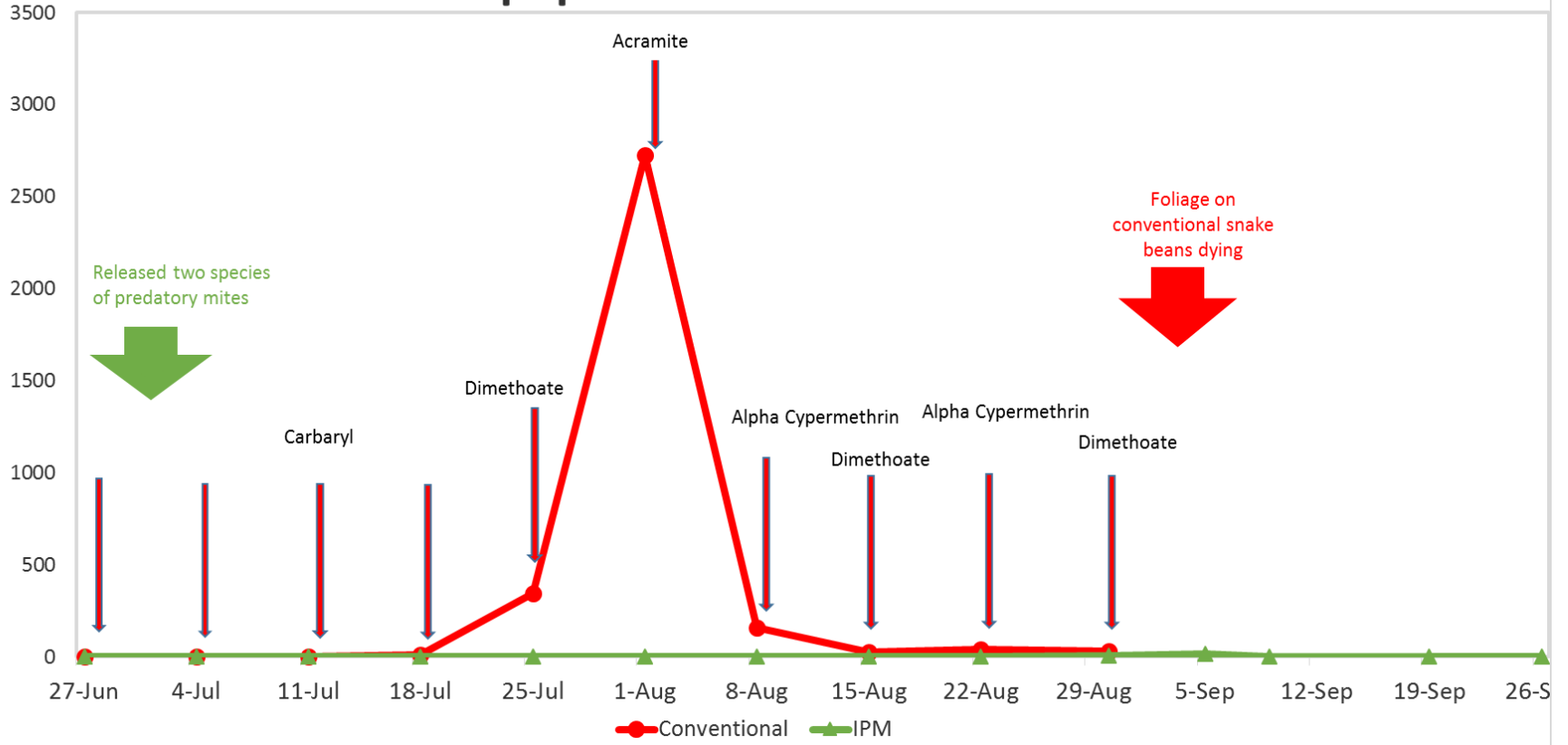
Aphid populations on okra



Two-spotted mite and release of predatory mites (2 spp.)



Mite populations on beans



Conventional beans
09/9/17

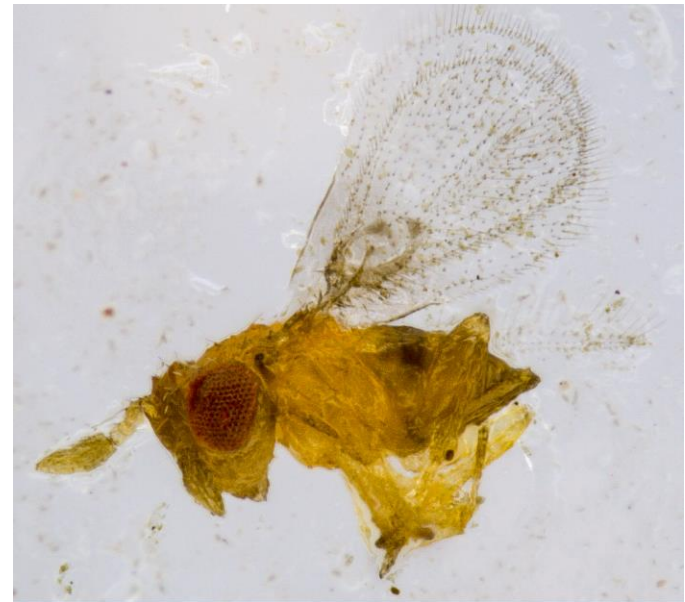


IPM beans
09/9/17

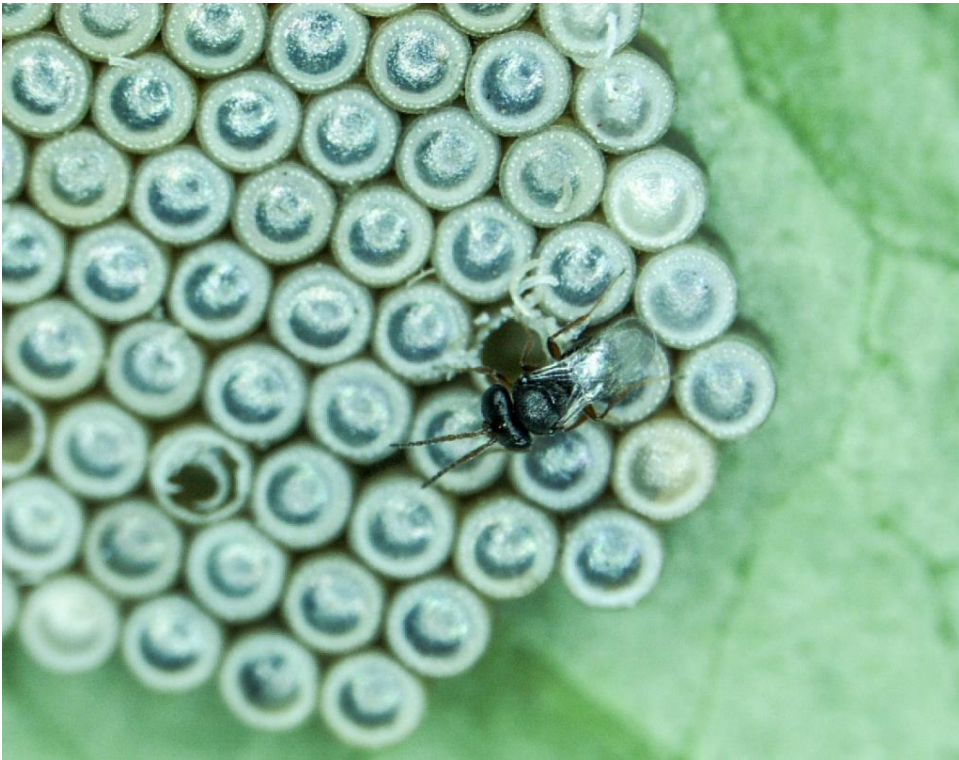


Parasitoids

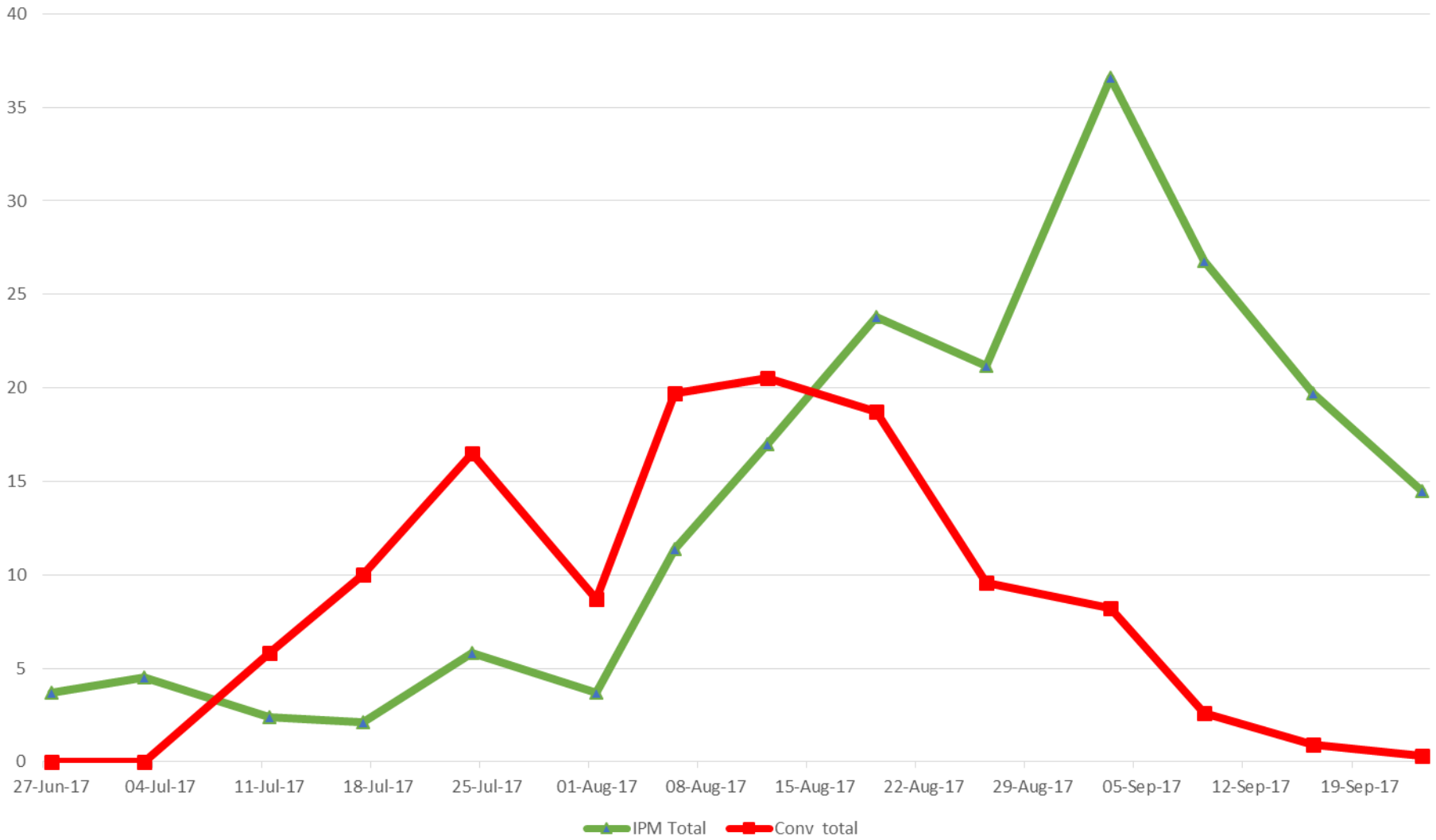
Helicoverpa eggs, caterpillar and *Trichogramma*.



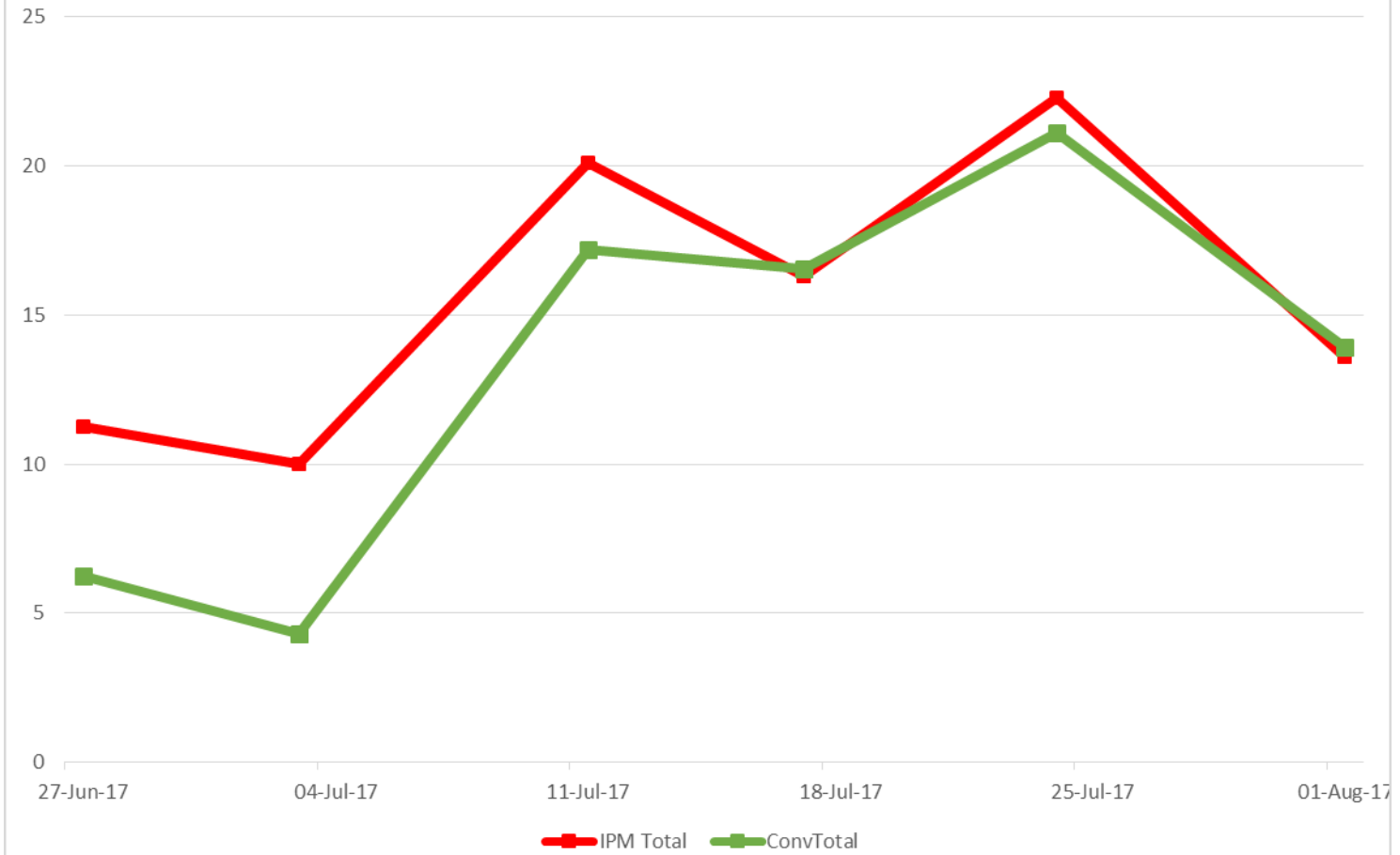
**Green vegetable bug eggs
parasitised by *Trissolcus* sp.**



Snake Bean Harvest 2017



Okra Harvest 2017



Major Outcomes

- **Growers could see IPM management in action.**
- **A list of pests and beneficials occurring on okra and snakebeans in the Top End.**
- **Effective aphid and mite control in the IPM plot was achieved with no chemical application.**
- **Significant damage by bean fly in IPM block and an IPM compatible control measure is required.**
- **The IPM plot had higher yields than the conventional plot.**

Thank you