Key insects and mite pests of Australian cotton

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This chapter is presented as a guide to assist growers in planning their Integrated Pest Management (IPM) programs. This section provides specific management information for each of the key insect and mite pests of Australian cotton. For each pest, information is provided under the sub-headings of:

- Damage symptoms
- Sampling
- Thresholds
- Key beneficial insects
- Selecting an insecticide/miticide
- Resistance status
- Overwintering habits
- Alternative hosts

Damage symptoms indicate that a pest could be influencing crop development and possibly yield potential. In some instances, damage symptoms will be observed without the pest. This may mean that the pest is there but cannot be observed or that the pest has caused the damage but since left the crop. In other instances, the pest will be observed but there will be no symptoms of damage to the crop. Knowledge of the pests and beneficials present and crop damage should be used in combination to make pest management decisions.

Sampling is the process of collecting the day-to-day information on pest and beneficial abundance and crop damage that is used to make pest management decisions.

Thresholds provide a rational basis for making decisions and are a means of keeping decisions consistent. Knowing the key beneficial predators and parasitoids for each pest is important for developing confidence in IPM approaches to pest management.

Selecting an insecticide (or miticide) can be a complex decision based on trade offs between preventing pest damage and conserving beneficials, or reducing one pest but risking the outbreak of another.

All pests have survival strategies that allow them to live and breed in cotton farming systems. Understanding how pests can survive, including knowing their **resistance status** and risks, **overwintering habit** and **alternative hosts** can help with good decision making for the long term.

Information in this section links to a number of tables in the Guide.

Registration of a pesticide is not a recommendation for the use of a specific pesticide in a particular situation. Growers must satisfy themselves that the pesticide they choose is the best one for the crop and pest. Growers and users must also carefully study the container label before using any pesticide, so that specific instructions relating to the rate, timing, application and safety are noted.

Growers must also ensure that their insecticide program fits in with the Insecticide Resistance Management Strategy (see pages 59–67). Insecticides can be a costly part of cotton production. Ensure that industry thresholds (pages 39–40) are followed to prevent unnecessary spraying.

Important – avoid spray drift

For legal requirements and best practice information on reducing spray drift, refer to the Spray Application chapter pages 142–158. Carefully follow all label directions.

ABBREVIATIONS USED IN TABLES 1–18

AC = Aqueous concentrate	ME = Microencapsulated
CS = Capsule suspension	OL = Oil miscible liquid
EC = Emulsifiable concentrate	SC = Suspension concentrate
EC/ULV = Dual formulation	SL = Soluble liquid
G = Granule	ULV = Ultra low volume
L = Liquid	WDG = Water dispersible granule
LC = Liquid concentrate	WP = Wettable powder

INSECT PEST	MANAGEMENT AND REGISTERED CHEMICALS
Helicoverpa spp.	Page 10
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IMPORTANT – Use an integrated approach to pest management. For more information on Integrated Pest Management Guidelines for Australian cotton refer to Page 47.

TABLE 1: Seasonal activity plan for IPM

	Overwinter/Planning	Planting – first flower	Flower – first open boll	Open cotton – Harvest
Develop an IPM strategy	Set and communicate IPM Goals Develop and Communicate CHAMP	Good record keeping support CHAMP, regulatory requirements and allows end of season assessment of IPM strategy.		
Know your enemy	Do you have your IPM resources? (ID guides, CPMG, CPM).	Participate in IPM training, field days, or workshops; Contact RDO to join mailing list.		
Take a year around approach	Review the success of last year's approach. Plan ahead to ensure necessary resources and insecticides are available. Monitor winter crops for pests and beneficials – manage carefully to avoid disrupting beneficial populations that may later move to cotton.	Build Beneficials. Check other crops for pests and beneficials. Maintain native vegetation in good condition. Consider planting Lucerne strips. Consider the summer cropping plan and risks of pests moving between crops. Check fallow areas for weeds and pests.	Sample pest and beneficial populations in all crops on the farm. Maintain native vegetation. Begin planning for rotation crops. Check fallow areas for weeds and pests.	Reduce pests / resistance risks for next season by considering which rotation crops will be planted and where. Ensure that native vegetation is maintained. Check fallow areas for weeds and pests.
Think of the farm and surrounding vegetation as a whole system.	Enhance vegetation by: Managing for groundcover and diversity; Prioritise connectivity; Enhance habitat with water ways; and, Weed out pest hosts, especially volunteer cotton. Consider rotation crops (type, location, and potential to host pests and disease). Apply IPM to all crops.	Participate in Area wide Management (AWM). Establish and maintain communication with any apiarist in the region. Use best practice spray application to avoid spray drift. Apply IPM to all crops.	Participate in Area wide Management (AWM). Maintain communication with any apiarist in the region. Use best practice spray application to avoid spray drift. Apply IPM to all crops	Participate in Area wide Management (AWM). Maintain communication with any apiarist in the region. Carefully consider Winter rotation crops (type, location, and potential to host pests and disease). Apply IPM to all crops.
Have good on-farm hygiene.	Zero tolerance to volunteer cotton in rotation crops, fallows and non-field areas. Keep farm weed free over winter. Ensure host free period for pests and diseases. Where practical remove weeds from native vegetation areas.	Keep farm weed free. Zero tolerance to volunteer cotton. Consider pre-irrigation, to allow control of cotton volunteers and other weeds with non-glyphosate control prior to planting. Consider in-crop cultivation where necessary.	Continue to monitor and manage volunteer cotton including adjacent to fields, as well as non-field areas such as fencelines, channels, perennial vegetation and pastures. Consider chipping where necessary.	Conduct effective crop removal to prevent ratoons.
Consider options to escape, avoid or reduce pests.	When planning cotton, consider proximity to sensitive areas, and other host crops relative to prevailing winds, as well as how beneficials move through the landscape. Select a variety that suits the region's season length. Consider okra leaf shape. Plant spring chickpea trap crop. Consider growing a diverse habitat and manage areas of vegetation to encourage beneficials. Plant lucerne (strips or block) in autumn. If planning to release Trichogramma, plan to sow other crops (eg sorghum) that will host Helicoverpa for the wasps to sting and hence maintain populations	Monitor stubble load and assess risk of soil and other pest activity prior to planting, and decide on control options. Good seed bed preparation, optimum soil temps and variety with seedling vigour promote rapid and healthy seedlings that can outgrow damage. Avoid planting to reduce SLW influx risk. Consider summer trap crop. Cultivate chickpea trap crops by 30 September. Build beneficials through use of pest and damage threshold and careful insecticide choice. Consider food sprays or release of beneficial insects.	Optimise crop inputs to avoid particularly rank or stressed crops. Sample for beneficials and parasitism rates. Build beneficials through use of pest and damage threshold relevant to sampling technique, and careful insecticide choice. Food sprays or release of beneficial insects may be considered.	Slash and pupae bust last generation summer trap crop 2-4 weeks after last defoliation. Pupae busting is required following harvest of Bollgard II cotton and is recommended by the industry's IRMS for all cotton. Come Clean Go Clean to prevent spread of pests on, off and around farm.
Sample crops effectively and regularly.	Ensure you can identify key pests, beneficials and types of plant damage.	Sample for pests, beneficials and parasitism rates in cotton. Monitor early season damage. Track pest trends. Use pest thresholds and the predator to pest ratio.	Sample for pests, beneficials and parasitism rates. Track pest trends and incorporate parasitism into spray decisions. Monitor fruit load. Use pest thresholds and the predator to pest ratio.	Sample for pests, beneficials and parasitism rates in cotton as well as last generation trap crop. Monitor fruit load. Use pest thresholds and the predator to pest ratio.

TABLE 1: Seasonal activity plan for IPM (continued)

	Overwinter/Planning	Planting – first flower	Flower – first open boll	Open cotton – Harvest
Grow a healthy crop	Consider the best rotation crop for your situation. Test soil nutrient status to determine fertiliser requirements for cotton crop. Consider potential disease risks.	Good seed bed preparation, optimum soil temps and variety with seedling vigour promote rapid and healthy seedlings that can outgrow damage. Monitor for leaf loss or discoloration; tip damage; development of first squaring position.	Monitor first position retention, fruit retention, nodes above white flower and vegetative growth.	Monitor for leaf damage/ discolouration, fruit retention, nodes above whiteflower, vegetative growth and for honeydew. Manage nutrition and irragtion to avoid or reduce regrowth that may harbor pests.
Evaluate pest abundance against established thresholds	Monitor weeds. Use thresholds and careful spray selection for all crops.	Use pest and damage threshold, relevant to region, timing and sampling method, and consider parasitism and beneficial activity	Use pest and damage threshold, relevant to region, timing and sampling method, and consider parasitism and beneficial activity	Use pest and damage threshold, relevant to region, timing and sampling method, and consider parasitism and beneficial activity. Monitor for honeydew.
Choose insecticides wisely to conserve beneficials	Monitor weeds Use thresholds and careful spray selection for all crops.	Consider insecticide selectivity and impact on beneficials and bees. Avoid early season use of broad-spectrum (eg.OPs) sprays. Consider edge or patch spraying for aphids and mites. Avoid prophylactic sprays.	Consider insecticide selectivity and impact on beneficials and bees.	Defoliation may be a late season alternative to an insecticide.
Apply good resistance management principles.	Complete pupae busting. Zero tolerance of ratoon and volunteer cotton including in rotation crops, fallows and non-field areas.	For Bollgard II, adhere to refuge requirements and planting window. For all cotton crops follow IRMS for every spray. Consider choice of at-planting / seed dressings and implications for later sprays. If a phorate is used at planting instead of a neonicotinoid seed dressing then do not use pirimicarb or dimethoate/ omethoate.	Use thresholds and follow IRMS for every spray. Manage Bollgard refuge for attractiveness.	Pupae busting is required following harvest of Bollgard II cotton and is recommended by the industry's IRMS for all cotton. In CQ slash and pupae bust summer trap crop 2–4 weeks after last defoliation.

TABLE 2: Impact of insecticides at planting or as seed treatments on key beneficial groups in cotton

Insecticides	Rate (g ai/ha)	Main target pest(s)					Persistence[6]	Overall[7]	Beneficial group				
		WW	Mite	Mir.	Aph.	Th[5]			Predatory beetles[1]	Predatory bugs[2]	Spiders	Wasps and Ants	Thrips
At Planting													
Aldicarb	450		▯	▯	▯	▯	medium-long	very low[3]	v. low	v. low	v. low	v. low	v. high
Phorate	600	▯	▯	▯	▯	▯	medium-long	very low[3,4]	No data	No data	No data	No data	v. high
Carbosulfan	750–1000	▯		▯		▯	medium-long	very low[3,4]	No data	No data	No data	No data	v. high
Chlorpyrifos	250–750	▯					medium	very low[4]	No data	No data	No data	No data	No data
Seed Treatments													
Thiodicarb	500 g ai/100 kg seed					▯	short	very low[3]	v. low	v. low	v. low	v. low	high
Thiodicarb + Fipronil	259 + 12 g ai/ 100 kg seed	▯				▯	short-medium	very low[3,4]	No data	No data	No data	No data	high
Imidacloprid	525 g ai/100 kg seed	▯			▯	▯	medium	very low[3]	v. low	v. low	v. low	v. low	v. high
Imidacloprid	700 g ai/100 kg seed	▯			▯	▯	medium	very low[3,4]	v. low	v. low	v. low	v. low	v. high
Thiomethoxam	280 g ai/100 kg seed	▯			▯	▯	medium	very low[3,4]	No data	No data	No data	No data	v. high

1. Predatory beetles – ladybeetles, red and blue beetles, other predatory beetles.
2. Predatory bugs – big-eyed bugs, minute pirate bugs, brown smudge bugs, glossy shield bug, predatory shield bug, damsel bug, assassin bug, apple dimpling bug.
3. Except for effects on thrips which are predators of mites. Note that aldicarb and phorate will also control mites.
4. Based on observations with other soil or seed applied insecticides.
5. WW, wireworm; Mir., mirids; Aph., aphids; Th, thrips.
6. Persistance; short, 2–3 weeks; medium, 3–4 weeks; long, 4–6 weeks.
7. Impact rating (% reduction in beneficials following application); very low, less than 10%; low, 10–20%; moderate, 20–40%; high, 40–60%; very high, > 60%

TABLE 3: Impact of insecticides and miticides on predators, parasitoids and bees in cotton

Insecticides (in increasing rank order of impact on beneficials)	Rate (g ai/ha)	Target pest(s)							Beneficials																Pest resurgence [12]			
										Predatory beetles				Predatory bugs							Hymenoptera							
		Helicoverpa	Mites	Mirids	Aphids	Thrips	Silverleaf whitefly	Persistence [8]	Overall Ranking [10]	Total [1]	Red & Blue beetle	Minute 2-spotted lady beetle	Other lady beetles	Total [2]	Damsel bugs	Big-eyed Bugs	Other Predatory bugs	Apple Dimpling	Lacewing adults	Spiders	Total (wasps)	Eretmocerus [19]	Trichogramma	Ants	Thrips	Mite	Aphid	Helicoverpa	Toxicity to bees [14]
Bt [11]		√						very short	very low	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	—	—	—	VL
NP Virus		√						very short	very low	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	—	—	—	VL
Pirimicarb	250				√			short	very low	VL	VL	VL	VL	L	L	M	VL	VL	VL	VL	VL	M	M	VL	L	—	—	—	VL
PSO (Canopy) [16]	2%	√			√			short	very low	VL	L	L	VL	VL	VL	VL	VL	VL	VL	L	VL	—	VL	H	VL	—	—	—	VL
Methoxyfenozide	400	√						medium-long	very low	L	VL	VL	L	L	L	L	VL	VL	VL	VL	VL	—	VL	VL	VL	—	—	—	VL
Pyriproxyfen	50						√	long	very low	M	—	M	M	VL	—	—	—	—	L	VL	VL	L	VL	VL	VL	—	—	—	L
Etoxazole	38.5		√					short	low	VL	VL	—	L	VL	VL	VL	VL	VL	VL	M	L	—	VL	VL	L	—	—	—	VL
Indoxacarb (low)	60			√				medium	low	L	L	H	M	VL	L	—	L	H	M	VL	VL	—	VL	H	VL	—	+ve	—	—
Indoxacarb (low+salt)	60			√				medium	low	L	L	H	M	VL	L	—	L	H	M	VL	L	—	VL	H	VL	—	—	—	—
Indoxacarb (low+Canopy)	60			√				medium	low	L	L	H	M	VL	L	—	L	H	M	VL	L	—	VL	H	VL	—	+ve	—	—
Rynaxypyr	52.5	√						long	low	L	M	M	L	VL	VL	VL	L	VL	VH	VL	L	—	L	L	VL	—	+ve	—	—
Dicofol [3]	960		√					long	low	L	—	—	—	L	—	—	—	L	—	L	—	M	—	—	VL	—	—	—	VL
Amorphous silica [17]	2500	√						short	low	L	L	—	M	M	—	VL	—	L	L	L	L	—	—	M	VL	—	—	—	—
Spinosad	96	√						medium	low	VL	M	L	VL	M	L	H	VL	L	VL	VL	M	H	H	H	H	+ve	—	—	H [15]
Diafenthiuron	350		√		√		√	medium	low	M	H	VL	M	L	M	VL	L	H	VL	L	L	H	VL	H	L	—	—	+ve	M
Pymetrozine	150				√			short	low	M	M	M	M	L	L	L	VL	H	M	L	L	L	L	M	VL	—	—	—	VL
Fipronil (v. low)	8			√				medium	low	L	L	L	VL	L	M	—	L	M	L	M	L	—	—	VH	L	+ve	—	—	VH
Fipronil (v. low + salt)	8			√				medium	low	L	L	L	VL	L	M	—	L	M	L	M	L	—	—	VH	L	+ve	+ve	+ve	VH
Indoxacarb [13]	127.5	√		√				medium	low	H [14]	L	VH	VH	L	M	L	L	VH	M	VL	L	—	VL	VH	VL	—	+ve	—	H [15]
Spirotetramat	96				√		√	medium	moderate	M	L	H	H	VL	VL	VL	VL	M	VH	M	M	—	M	M	M	—	—	—	—
Abamectin	5.4	√ [6]	√					medium	moderate	L	M	H	VL	M	L	M	M	H	VL	M	M	H	M	H	M	—	—	—	H
Emamectin	8.4	√						medium	moderate	L	VL	M	VL	H	H	H	H	H	L	M	M	—	M	VL	M	—	—	—	H
Dimethoate (low)	80		√ [18]	√	√ [18]	√		short	moderate	M	L	H	H	M	L	—	H	M	M	L	M	—	M	H	M	+ve	+ve	+ve	H
Dimethoate (low + salt)	80		√ [18]	√	√ [18]	√		short	moderate	M	L	H	H	M	L	—	H	M	M	L	M	—	M	H	M	+ve	+ve	+ve	H
Propargite	1500		√					medium	moderate	M	H	H	M	M	H	VL	VL	L	VL	M	M	L	H	H	M	—	+ve	+ve	L

Acetamiprid	22.5				√			medium	moderate	M	M	VH	H	M	M	H	M	VH	L	VL	L	VH	H	VH	VH	—	—	—	M[15]
Clothianidin (low)	25			√				medium	moderate	M	VL	—	H	L	M	VL	VL	H	H	M	M	H	M	VH	VL	—	—	+ve	—
Amitraz	400	√	√[9]		√[9]			medium	moderate	H	M	VH	H	L	—	—	—	H	VL	M	M	H	L	H	M	—	—	—	L
Fipronil (low)	12.5			√		√		medium	moderate	L	L	H	L	L	H	L	L	VH	L	M	M	—	M	VH	VH	+ve	+ve	+ve	VH
Chlorfenapyr (low)	200	√	√					medium	moderate	M	L	VH	VL	M	VL	H	H	VH	L	L	M	—	VH	H	M	—	—	—	H
Thiamethoxam	100				√			medium	moderate	H	H	H	H	M	M	M	H	H	M	VL	M	—	H	VH	H	+ve	—	+ve	H
Fipronil (high)	25			√		√		medium	moderate	L	VL	H	L	M	H	H	L	VH	L	M	M	—	M	VH	VH	+ve	—	+ve	VH
Imidacloprid	49			√	√			medium	moderate	H	L	VH	H	H	M	H	L	VH	L	L	L	VH	M	H	H	+ve	—	+ve	M
Clothianidin (high)	50			√				medium	moderate	H	VL	—	VH	M	M	L	VL	H	H	M	M	VH	H	VH	VL	+ve	—	+ve	—
Methomyl	169	√						very short	high	H	L	VH	VH	M	L	VH	L	VH	M	M	M	VH	H	H	H	+ve	—	—	H[15]
Thiodicarb	750	√						long	high	VH	M	VH	VH	M	M	L	L	VH	VL	M	M	—	M	M	H	+ve	+ve	—	M[15]
Dimethoate (high)	200		√[18]	√	√[18]	√		short	high	M	M	H	H	M	H	—	H	H	VH	M	H	H	H	VH	M	+ve		+ve	H
Chlorfenapyr (high)	400	√	√					medium	high	H	M	VH	L	H	H	H	H	VH	L	M	M	—	VH	VH	M	—	+ve	—	H
OP's[5]		√	√	√	√	√		short-medium	high	H	M	H	H	H	M	H	H	VH	L	M	H	VH	H	VH	H	+ve	—	—	H
Carbaryl[3]								short	high	H	—	—	—	H	—	—	—	—	—	—	—	—	—	—	H	—	—	—	H
Pyrethroids[4]		√	√[7]	√[7]			√[7]	long	very high	VH	—	—	—	VH	—	—	—	VH	VH	VH	VH	VH	VH	VH	VH	+ve	+ve	+ve	H

1. Total predatory beetles – ladybeetles, red and blue beetles, other predatory beetles
2. Total predatory bugs – big-eyed bugs, minute pirate bugs, brown smudge bugs, glossy shield bug, predatory shield bug, damsel bug, assassin bug, apple dimpling bug
3. Information; Citrus pests and their natural enemies, edited by Dan Smith; University of California Statewide IPM project, Cotton, Selectivity and persistence of key cotton insecticides and miticides.
4. Pyrethroids; alpha-cypermethrin, cypermethrin,beta-cyfluthrin, cyfluthrin, bifenthrin, fenvalerate, esfenvalerate, deltamethrin, lambda-cyhalothrin,
5. Organophosphates; omethoate, monocrotophos, profenofos, chlorpyrifos, chlorpyrifos-methyl, azinophos ethyl, methidathion, parathion-methyl, thiometon
6. *Helicoverpa punctigera* only.
7. Bifenthrin is registered for mite and silverleaf whitefly control; alpha-cypermethrin, beta-cyfluthrin, bifenthrin, deltamethrin and lambda-cyhalothrin are registered for control of mirids
8. Persistence of pest control; short, less than 3 days; medium, 3-7 days, long, greater than 10 days.
9. Suppression of mites and aphids only.
10. Impact rating (% reduction in beneficials following application, based on scores for the major beneficial groups); VL (very low), less than 10%; L (low), 10-20%; M (moderate), 20-40%; H (high), 40-60%; VH (very high), > 60%. A '—' indicates no data available for specific local species.
11. *Bacillus thuringiensis*
12. Pest resurgence is +ve if repeated applications of a particular product are likely to increase the risk of pest outbreaks or resurgence. Similarly sequential applications of products with a high pest resurgence rating will increase the risk of outbreaks or resurgence of the particular pest species.
13. Very high impact on minute two-spotted ladybeetle and other ladybeetles for wet spray, moderate impact for dried spray.
14. Data Source: British Crop Protection Council. 2003. The Pesticide Manual: A World Compendium (Thirteenth Edition),. Where LD50 data is not available impacts are based on comments and descriptions. Where LD50 data is available impacts are based on the following scale: very low = LD50 (48h) > 100 ug/bee, low = LD50 (48h) < 100 ug/bee, moderate = LD50 (48h) < 10 ug/bee, high = LD50 (48h) < 1 ug/bee, very high = LD50 (48h) < 0.1 ug/bee. Refer to the Protecting Bees section in this booklet.
15. Wet residue of these products is toxic to bees, however, applying the products in the early evening when bees are not foraging will allow spray to dry, reducing risk to bees the following day.
16. May reduce survival of ladybeetle larvae – rating of moderate for this group.
17. May be detrimental to eggs and early stages of many insects, generally low toxicity to adults and later stages.
18. Will not control organophosphate resistant pests (e.g. mites, some cotton aphid (*Aphis gossypii*) populations
19. Rankings for *Eretmocerus* based on data for *E. mundus* (P. De Barro, CSIRO, unpublished) and for *E. eremicus* (Koppert B.V., The Netherlands (http://side-effects.koppert.nl/#))

DISCLAIMER Information provided is based on the current best information available from research data. Users of these products should check the label for further details of rate, pest spectrum, safe handling and application. Further information on the products can be obtained from the manufacturer.

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