Cotton Aphid

(*Aphis gossypii*)

Version 2.2 20/5/15

Insecticide Resistance Action Committee

Introduction

The cotton aphid (*Aphis gossypii*) is a highly polyphagous pest, which has a host range which includes many commercially grown agricultural and horticultural plant species.

Important crops attacked by the cotton aphid indude; pepper, tomato, eggplant, watermelon, cucumber, squash, pumpkin, citrus, potato and cotton.

The cotton aphid has a short life cycle (5 days to maturity) and is highly fecund, producing around 3 offspring per day. It feeds by inserting its stylet into the plant phloem tissue and damage is caused by either direct sap loss, transmission of a wide range of plant viruses and by encouraging the growth of sooty moulds on the honeydew secreations it produces.

Treatment with insecticides has been the primary control option for growers, with systemic or vapour active insecticides often more favoured. Biological control agents are also an important control method for this pest.

Resistance Mechanisms

Table 2: List of documented *Aphis gossypii* resistance mechanisms for key insecticides.
(Individually resistant aphids may express single or multiple mechanisms of resistance to one or more insecticide groups. Where resistance is known to be restricted to a particular insecticides or chemistry sub-groups this is highlighted).

IRAC Mode of action group	Mode of Action
Group 1: Acetylcholinesterase inhibitors	S431F mutation in *p-acegene* (pirimicarb, triazamate & omethoate)
	A302S mutation in *p-acegene*
	F139L mutation in o-acegene (Organophosphate)
	Elevated levels of an undefined carboxylesterase
	Elevated levels of an undefined P450 monoxygenase
Group 2: GABA gated chloride channel agonists	Elevated levels of an undefined P450 monoxygenase
Group 3: Sodium channel modulators	L1014F mutation in domain II of the *para*-type voltage gated sodium channel gene
	Elevated levels of an undefined carboxylesterase
	Elevated levels of an undefined P450 monoxygenase
Group 4: Nicotinic acetylcholine receptor agonists	R81T mutation in the Beta-1 sub-unit of the nACh receptor
	Undefined metabolic process associated with resistance to some group 4 insecticides. There is some Evidence that some group 4 insecticides are unaffected by this resistance mechanism

Target site resistance mechanism

Metabolic based resistance mechanism

Resistance Status

Insecticide Resistance has been recorded in cotton aphids since the mid-1960's, when organophosphate, carbamate and cyclodiene organochlorines were utilised to control this aphid in a wide range of crops.

Resistance to carbamates and organophosphates have been widely reported in many of the key crops globally and therefore the performance of Group 1 insecticides can not be assured for the control of this pest. As a results the use of Group 1 insecticides should only be considered if the aphids sensitivity has been confirmed.

Resistance to pyrethroids (Group 3) and organochlorine cyclodiene (Group 2) insecticides has also been reported in a number of countries and crops and although their perfomance can not be assured they may still provide a useful tool in pest management. It is recommended that insecticide applicators monitor the performance of these products and consult with local crop advisors on their use for cotton aphid control.

There have been a small number of reports of resistance to nicotinic acetylcholine receptor agonist insecticides (group 4) in cotton (e.g. Australia, China & USA) and cucurbits & vegetables (e.g. Japan & Korea). In regions where group 4 insecticide resistance has been reported then other control options not affected by resistance should be given priority in aphid control programs.

Resistance to flonicamid has only been reported in *Aphis gossypii* samples collected from peppers in Korea and resistance in other regions is not known.

Table 1: Insecticide modes of action which are registered for the control of aphids and known resistance.
(Not all insecticides groups will be registered for use in all regions and crops. Consult with local advisors on product availability)

IRAC Mode of action group	Mode of Action	Insecticide Chemistry	*Known resistance*
Group 1: Acetylcholinesterase inhibitors	1A	Carbamates	XXX
	1B	Organophosphates	XXX
Group 2: GABA gated chloride channel agonists	2A	Cyclodiene organochlorines	XX
	2B	Phenylpyrazoles (Fiproles)	
Group 3: Sodium channel modulators	3A	Pyrethroids	XX
Group 4: Nicotinic acetylcholine receptor agonists	4A	Neonicotinoids	X
	4C	Sulfoxaflor	(x)
	4D	Flupyridifurone	
Group 9: Modulators of chlordotonal organs	9B	Pymetrozine	
	9C	Flonicamid	(x)
Group 12: Inhibitors of ATP synthase	12A	Diafenthiuron	
Group 19: Octopamine agonists	19	Amitraz	
Group 25: Inhibitors of acetyl CoA carboxylase	23	Tetronic & Tetramic acid derivatives	
Group 28: Ryanodine receptor modulators	28	Diamides	

XXX = widespread reports of resistance, XX = resistance reported in several locations, X = isolated instances of resistance, (x) = rare cases of resistance reported.
The information presented in this table is based on peer-reviewed published reports of field collected populations of *Aphis gossypii* being isolated at a specific time and location before being tested for insecticide susceptibility. Insecticide resistance is a dynamic process, and therefore, the information provided does not reflect the current status of insecticide resistance in all countries or locations.

Resistance Management

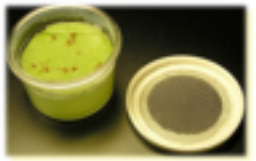
As there is little or no evidence of cross-resistance amongst the groups insecticides used for cotton aphid control, it is recommended that the rotation of effective insecticides with different modes of action are used to provide insect control, whilst at the same time reducing the risk of insecticide resistance from developing. The following should be considered when designing an insect control program for cotton aphid:

- Plan ahead. Determine when in a typical season insecticides applications are likely to be needed and plan for the rotation of insecticides with different modes of action, avoiding the consecutive use of products belonging to the same mode of action group (including seed treatments). Plan for contingencies in case extra applications are needed due to untypical pest infestations. Consider the presence of other insect pests that may occurin the crop and require insecticide treatments.
- Determine which insecticides are most effective for controlling each pest during each application timing. If the presence of other pests which over-lap with cotton aphid, consider using pest specific insecticides rather than broad spectrum insecticides, which may increase unnecessary resistance selection pressure for either or both pests.
- Evaluate the current insecticide resistance situation in the area (consult local crop advisors and experts). Avoid using insecticides already affected by resistance where possible.
- Consider the impact of the insecticides on non-target insects and natural predators, especially during early season applications, where maintaining natural predators can reduce the need for later sprays.
- Consider the use of insect-resistant plant varieties and the use of biological control agents.
- Always follow insecticide label instructions for application timings, volumes and concentrations.

Susceptibility Monitoring

The susceptibility of the cotton aphid and other aphid species can be conducted by using leaf dip assays, as described in the IRAC approved method No. 019.

Further details on this methodology and other susceptibility monitoring methods can be found on the IRAC website: www.irac-online.org



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