IRAC

Insecticide Resistance Action Committee

Cotton Aphid

(*Aphis gossypii*)

Introduction

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

Important crops attacked by the cotton aphid include; 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. Damage is caused by either direct sap loss, transmission of plant viruses or by providing a medium for the growth of sooty moulds in the form of honeydew secretions.

Treatment with insecticides has been the primary control option for growers, with systemic or vapour active insecticides often more favoured. Biological control agents where available should also be considered for cotton aphid control.

Resistance Mechanisms

Table 2: List of documented mechanisms of resistance in *Aphis gossypii* for key insecticide groups.

(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 insecticide or chemistry sub-group this is highlighted in the table below).

IRAC Mode of action group	Mode of Action
Group 1: Acetylcholinesterase inhibitors	S431F mutation in *p-ace gene* (pirimicarb, triazamate & omethoate)
	A302S mutation in *p-ace gene*
	F139L mutation in o-ace gene (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 competitive modulators	R81T mutation in the Beta-1 sub-unit of the nACh receptor
	Undefined metabolic enzymes

Target site resistance mechanism

Metabolic based resistance mechanism

Resistance Status

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

Resistance to carbamates and organophosphates has been widely reported in several key crops globally and therefore the performance of Group 1 insecticides can not be relied upon for the control of this pest. As a result the use of Group 1 insecticides should only be considered if sensitivity to carbamtes and organophosphates has been confirmed.

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

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

Resistance to flonicamid in *Aphis gossypii* has only been reported on peppers in Korea and resistance in other regions is unknown.

Although cross-resistance to insecticides within a mode of action group is common, insecticides within a group may be affected to a greater or lesser degree. In areas where resistance is reported, consult with local experts to determine the impact of resistance on the field performance of individual products.

Table 1: Insecticide modes of action, 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	Resistance reported
Group 1: Acetylcholinesterase inhibitors	1A	Carbamates	Globally widespread
	1B	Organophosphates	Globally widespread
Group 2: GABA gated chloride channel agonists	2A	Cyclodiene organochlorines	Several locations
	2B	Phenylpyrazoles (Fiproles)	No reported cases
Group 3: Sodium channel modulators	3A	Pyrethroids	Globally widespread
Group 4: Nicotinic acetylcholine receptor agonists competitive modulators	4A	Neonicotinoids	Several locations
	4C	Sulfoxamines	Several locations
	4D	Butenolides	Several locations
Group 9: Modulators of chlordotonal organs	9B	Pymetrozine, Pyrifluquinazon	No reported cases
	9D	Afidopyropen	No reported cases
Group 12: Inhibitors of ATP synthase	12A	Diafenthiuron	No reported cases
Group 19: Octopamine agonists	19	Amitraz	No reported cases
Group 23: Inhibitors of acetyl CoA carboxylase	23	Tetronic & Tetramic acid derivatives	No reported cases
Group 28: Ryanodine receptor modulators	28	Diamides	No reported cases
Group 29: Modulators of chlordotonal organs. Target site undefined	29	Flonicamid	Rare cases

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. Although cross-resistance between insecticides within the same mode of action group is common, insecticides within a mode of action group may be affected to a greater or lesser degree. This table does not replace practical use recommendations or reflect levels of control in the field. It is advisable to consult with local experts to determine the impact of resistance on the field performance of individual insecticide products.

Resistance Management

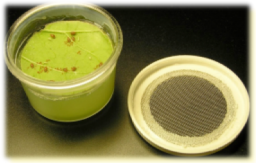
There is little or no evidence of cross-resistance amongst the mode of action groups used for cotton aphid control. It is therefore recommended to rotate between insecticides with different modes of action to provide effective control. This furthermore reduces the risk of insecticide resistance from developing. The following should be considered when designing an insect control program for cotton aphid:

- Plan ahead. Determine when in a typical growing season insecticide applications are likely to be needed and plan a 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 occur in the crop and may require insecticide treatments.
- Determine which insecticides are most effective for controlling each pest during each application timing. In 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.
- 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 predator populations can reduce the need for later insecticide applications.
- Consider the use of insect-resistant plant varieties and the use of biological control agents.
- Always follow insecticide label instructions for application timings, dose rates and water volumes.

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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